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# JOURNAL

of Applied Economic Sciences

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## The Effect of Macroeconomic Environment and Hedonic Market on the Property Pricing Strategy

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### Abstract:

The increase of prices for residential property is going through an annual increase (yoy). In the third quarter of 2017, residential property prices were estimated to grow by 3.99% (yoy), higher than 3.17% (yoy) in the second quarter of 2017. Based on the type of building, the highest increase in house price is expected to occur in small type of building (7,79% yoy). Property investment in West Java also experienced an increase as reflected in the rise of property price index in the third quarter of 2014. The strategy of property pricing is allegedly influenced by macroeconomic environment and hedonic market.

Therefore, this study aims to examine the effect of macroeconomic environment and hedonic market on the property pricing strategy in West Java. The research was conducted by quantitative method. The unit of analysis and observation unit in this research is the customer of the property company in West Java. Observation conducted using time horizon which is cross section / one shoot that means information or data, collected directly at the scene, empirically at one time that is end of year 2017. The population is property companies in West Java, with sample taken as many as 50 respondents. Hypothesis testing is done by use Partial Least Square (PLS). The results show that the macroeconomic environment and hedonic market both influence the pricing strategy. The macroeconomic environment has a more dominant influence than the hedonic market in the formulation of pricing strategy. The results of this study are expected to provide benefits for property management companies in West Java that in the formulation of pricing strategies must consider the macroeconomic environment of population, household income, and interest rates. In addition, the pricing strategy should also consider the hedonic market aspect, especially the environmental and location aspects, physical structure, physical environment, and investment.

**Keywords:** maroeconomic environment; hedonic market; pricing strategy; property

**JEL Classification:** F62; L16

### Introduction

#### Research background

The increase in residential property prices in quarter IV-2016 was higher than the previous quarter. Residential Property Price Index in quarter IV-2016 was at 194.54 or increased by 0.37% (qtq), slightly higher than the previous quarter (0.36%, qtq). Meanwhile, growth in property prices on an annual basis slowed compared to the previous quarter, from 2.75% (yoy) to 2.38% (yoy). The increase in the price of building materials (35.20%) and wages of workers (22.56%) is still the main factor causing the rise in residential property prices in the reporting period.

Annually, residential property prices are expected to rise higher. In quarter III-2017 residential property prices are predicted to grow by 3.99% (yoy), higher than 3.17% (yoy) in Q2/2017. Based on the type of building, the highest increase in house price is expected to occur in small type of building (7,79%, yoy).

The increase in residential property prices experienced an annual increase (yoy). In Q3/2017, residential property prices were estimated to grow by 3.99% (yoy), higher than 3.17% (yoy) in Q2/2017. Based on the type of building, the highest increase in house price is expected to occur in small type of building (7,79%, yoy).

In West Java, various government infrastructure projects are under way in Q3/2014 such as road improvement, road pavement and road pouring. In addition, several districts / cities in West Java are implementing revitalization programs of some traditional markets. Property investment in West Java also experienced an increase as reflected in the rise in property price index in the third quarter of 2014 as residential Property Price Survey.

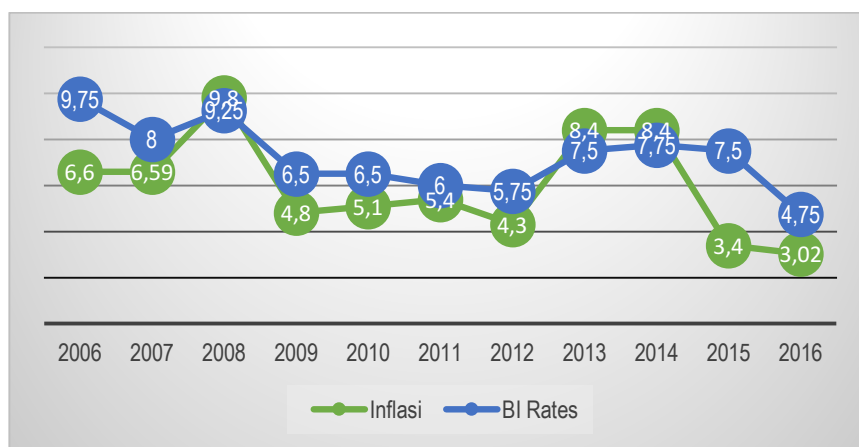
With regard to price determination, the hedonic price method is widely applied in environmental economics studies, since in environmental economics studies many of the prices of goods are not 'real' (implicit) but attached to the goods. To estimate home prices, the method of the hedonic price equation is one of the means of expenditure for housing that can be broken down in price and quantity measured, so rent for each different house or the same house in different locations can be predicted and compared. Simply put, the hedonic equation is a regression of the expenditure (rent or value) of the characteristics of the house. Rosen (1974) defines the hedonic model as a model based on the recognition and treatment of the complexity and heterogeneity of the product.

Shabana (2015) said that the Hedonic Pricing Model managed to estimate house prices in a complex property market where there are different home attributes that affect the value of homes, both positively and negatively. Variables of physical property structure, variable of neighborhood in housing, variable distance from housing to various facilities, housing market price variable and environment physical variable have an effect on the formation of property price.

On the other hand, economic growth is always characterized by inflation, namely the increase in prices of goods and services, including property products. The development of property inflation in West Java indicates a decrease in the first quarter of 2015. Housing costs are slowly increasing. This is confirmed by the residential property price survey of Bank Indonesia, the growth of index in the first quarter of 2015 is lower than the fourth quarter of 2014. The rise in inflation often results in an increase in the SBI rate. This is a normal condition, because one of the most common instruments used by the Government to control the inflation rate in which an increase in the amount of money is to withdraw money in circulation by raising the deposit interest rate.

Changes in the interest rate (SBI) will affect the interest rate of Home Ownership Loan (KPR) which will certainly have an impact on property pricing. The value of SBI rate in March 2008 was 8.00% and for 8 years in the same month in March 2016 the SBI rate was 6.75%, Changes of 1.25%. The highest SBI rate was 9.50% in November 2008, while the lowest SBI rates were 5.75% from February 2012 until May 2013. The relationship between some macroeconomic indicators such as inflation, BI rate, mortgage rates and property prices (residential property price index) can be seen in the graph below:

Figure 1 Inflation movement and BI rates Indonesia period 2006-2015

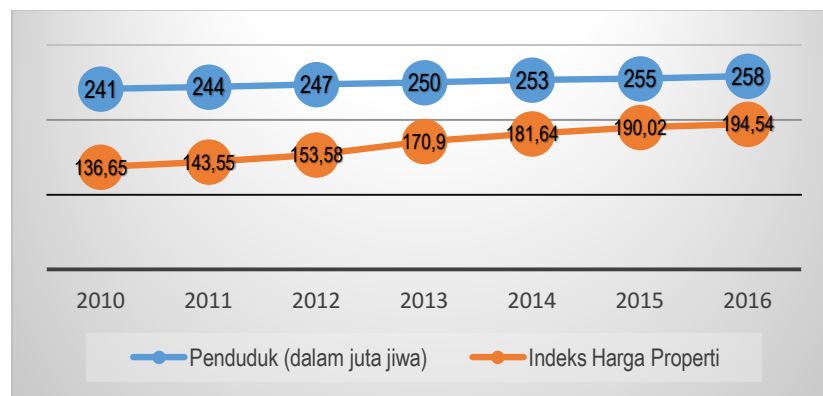


Source: Bank Indonesia and Indonesia Investment.com (processed data)

The increase in SBI interest rates will then raise the mortgage and mortgage rates for construction properties. An increase in mortgage rates and or interest rates on construction loans will lead to an increase in property prices. In the last 5 years the relationship of interest rate hikes with property prices (property price index)

The income of the population will affect consumer demand and purchasing power that can ultimately affect the price of the property. The pattern of consumption or the average expenditure of the population will affect the purchasing power of property products. On the other hand, naturally the need for shelter continues to increase as the population increases. In the last 8 years the relationship between the population and the property price (property price index) can be seen in the following graph:

Figure 2. Population movement and residential property price index Indonesia period 2010-2015



Source: Bank Indonesia and Indonesia Investment.com (data processed)

The growth of the Indonesian population will continue to increase, which provides greater opportunities for the housing needs of the population. Population growth will be accompanied by the development of consumption and behavior patterns and other aspects that have an impact on property pricing.

### Research objectives

Based on this background, this study aims to examine the effect of macroeconomic environment and hedonic market on the property pricing strategy in West Java.

## 1. Literature review

### 1.1. Macroeconomic environment

Some studies discuss the formation of property prices by considering the influence of macroeconomic indicators such as Capozza and Schwan (1989), Mitchell (1993), Potepan (1996) Blight and MacFarlane (2002) and Saphores (2012).

Mitchell (1993) identifies that inflation, real disposable income, interest rates and consumer confidence as economic factors affecting demand for shelter. Based on that, Blight and MacFarlane (2002) considers the relationship of property selling price with variables such as population, interest rate and CPI (Consumer Price Index) using CAPM (Capital Asset Pricing Model) framework or method. Research conducted by Blight and MacFarlane (2002) states that to estimate the current value of future profits it is necessary to apply a discount of interest or interest from the required income. This discount will be a combination of interest-free risk and premium interest rate risk. The process of risk analysis and premium interest will focus on CAPM (Capital Asset Pricing Model) where the independent variable used in the research is the interest rate (bond rate). The higher the interest rate, the lower purchasing power of the property will decrease, because most people buy the house on credit (KPR). High interest rates will make people refrain from buying transactions home, because large installments will affect the ability installments. In addition, higher interest rates result in higher property production costs, and could push home prices higher.

Research conducted by Capozza and Schwan (1989) states that the variable interest rate (interest) is an important variable in addition to population level and population growth that can affect property prices (property price), especially house prices (house price). This is in accordance with research conducted by Potepan (1996) which states that interest variable by using mortgage interest rate with nominal formula of mortgage interest rate minus the annual percentage change in the CPI (Consumer Price Price Index) can affect property price especially house price (house price). Potepan (1996) also stated that income variable including household income by using



median income could influence house price. Saphores (2012) states that the variable per capita income can affect house prices (house price).

Based on the comparative concept, there are three dimensions of the macroeconomic environment related to the pricing strategy, namely: interest rates, average household income, and population.

### 1.2. Hedonic market

Rosen (1974) defines the hedonic model as a model based on the recognition and treatment of the complexity and heterogeneity of the product. This model focuses on the market (market) where commodities can be attached to various types of attributes of its use. The value of the product observed and the amount of special characteristics attached to the product form an implicit price or "hedonic" price. Econometrically, the hedonic price or implicit price is estimated based on regression analysis (product price is sorted by characteristics) in the construction of the hedonic price index.

Thanasi (2015), states that hedonic models have depicted for the first time in the assessment of agricultural land by Haas (1922) and Wallace (1926), but the term "hedonic" was first mentioned by Court (1930), to determine the hedonic price index from the car.

Quoted from Eriksen *et al.* (2016), hedonistic methods are used to understand the demand for heterogeneous goods such as cars, computers, food, housing, and employment (Bajari and Benkard 2005, Hamermesh 1999, Kiesel and Villas-Boas 2007, Raff and Trajtenberg 1995, Sheppard 1999). Eriksen *et al.* (2016) also mentions that the hedonist estimate approach is traditionally known to be refracted when exogenous shocks affect many product attributes, markets for complementary products and replacement products, and aggregate quantity produced.

According to Shabana *et al.* (2015) hedonic models are a good choice to standardize price-pricing protocols for different commodities. Several studies on hedonic pricing have investigated the effect on the value of housing from the distance aspect to the different urban aspects of urban hospitality (Des Rosiers and Thériault 2006, Öner 2013, Thériault, Des Rosiers and Vandersmissen 1999, Youssoufi 2011). Hedonic models have been successfully applied in the last decade for housing assessments in different regions of the world such as Sueol, Republic of South Korea (Jun 2013), Africa (Chitonge and Mfune 2015), Hangzhou, China (Wen, Zhang and Zhang 2014), California, USA (Mueller and Lommi 2014), Lagos, Nigeria (Aliu and Ajala 2014), Wales UK (Tu *et al.* 2014) and Italy (Zoppi, Argiolas and Lai 2015).

Some studies that discuss the Hedonic Model in the formation of property prices are Shabana *et al.* (2015), Zabel (2015), Saphores and Li (2012), Cho, Bowker, Park (2006), and Nazir (2015). Shabana *et al.* (2015) conducted a study designed to establish housing valuation in the city of Faisalabad, Pakistan using the hedonist approach, as well as to estimate the relationship of determinant factors affecting the value of housing in urban communities selected from major cities. Hedonic model successfully estimates house prices in complex property markets (complicated) in Pakistan, especially in Faisalabad.

Shabana *et al.* (2015) argues that housing is one of the basic needs of human life that not only provides protection and tranquility but a primary form of individual health in which structural variable variables affect property price by using hedonic pricing model. In its research, Saphores (2012) mentions that the variable of physical structure (structural variables) considering structure area ( $m^2$ ), numbers of bathrooms, and number of bedrooms' variables can affect property price especially house price. Zabel (2015) in his research also states that physical structural variables (house structures), number of bedrooms, number of bathrooms, number of half baths, total number of rooms, and living area (square feet) affect house prices (house price). The position of the research that will be done by writer in Hedonic Model is by using physical structural variables such as house age, building area ( $m^2$ ), lighting (%), bedroom (unit), bathroom (unit), kitchen (%), garage (%), and page (%) that can affect the property price. Based on the description of the concept, in this study hedonic market is measured by include dimensions: physical structure of the house, life next door, strategic location, investment, and physical environment.

### 1.3. Pricing strategies

According to Kotler and Armstrong (2011, 291) before determining the price, the company must decide the strategy for its product. According to Kotler and Armstrong (2011, 291) the price decision is influenced by internal and external factors of the company. Internal factors include: marketing objectives, marketing mix strategy, costs, organization considerations marketing mix strategy costs. While external factors include: nature of the market and demand, competition, other environmental factors (economy, resellers, government).

According to Stanton (2012), factors related to pricing decisions include:



- the demand for the product, carried out in two steps: to determine whether a particular price is expected by the market and to estimate sales volume on a different price basis;
- target market share; companies can set prices more aggressively at lower prices than other companies who just want to keep their market share. Market share relates to the company's production capacity and ease of entry into market competition;
- competitor's reaction; competition is an important factor in determining the basic price of a product;
- the use of price-setting strategies; can perform filter pricing strategy and penetration pricing strategy;
- product distribution and promotion channels;
- the cost of producing or purchasing products;
- based on the description, the pricing strategy in this study includes two dimensions of price equilibrium and price attractiveness.

### Development of hypotheses

Based on the literature review, the following hypotheses are prepared:

H: The macroeconomic environment and hedonic market affect on the property pricing strategy in West Java.

## 2. Methodology

This research is dominated by Quantitative Research, *i.e* a research design that approaches empirical studies to collect, analyze, and display data in numerical form and tries to accurately measure something (Cooper and Schindler 2006).

The unit of analysis and observation unit in this research is the company's customer of the property company in West Java. With observation using time horizon (time horizon), which is cross section/one shoot, meaning information or data collected directly at the scene empirically at one time that is end of year 2018. Population is a property company in West Java, where in this research sample taken as many as 50 respondents. Hypothesis testing is done by use the Partial Least Square (PLS).

## 3. Result and discussion

### 3.1. Partial Least Square result

#### 3.1.1 Goodness of fit – Outer and Inner model

##### a. Inner Model

Analysis of structural model (inner model) shows the linkage between latent variable in the study. Inner model is evaluated by the use of R square and Prediction relevance (Q square) from Stone-Geisser's with blind folding procedure. Refers to Chin (1998), if the value of R square amounted to 0.67 (strong), 0.33 (moderate) and 0.19 (weak) and Prediction relevance (Q square) 0.02 (minor), 0.15 (moderate) and 0.35 (large).

Table 1 Test of Outer and Inner Model

Variable	R Square	Cronbachs Alpha	Composite Reliability	AVE	Q square
Hedonic Market		0.920	0.929	0.760	0.355
Macroeconomic Environment		0.860	0.914	0.781	0.535
Pricing Strategy	0.620	0.753	0.890	0.802	0.787

Source: Smart PLS 2.0

The table shows that the value of R<sup>2</sup> of pricing strategy as endogenous variable in the moderate criteria (>0.33), and the value of Q square is in the large criteria (>0.350), so it can be concluded that the research model is supported by the empirical condition or the model is fit.

##### b. Outer model

Analysis of measurement model (outer model) shows manifest variables (indicators) with each latent variable. It is used as validity and reliability test to measure latent variable and indicator in measuring dimension that is construct. It can be explained by the value of AVE and Cronbachs Alpha that is to see the reliability of dimension in measuring variables. If the value of Cronbachs Alpha bigger that 0.70 (Nunnaly 1994), it shows that the dimensions and indicators as reliable in measuring variables. Recommended value of AVE is greater than 0.50. Composite reliability and Cronbachs Alpha of variables > 0.70 show that all of variables in the model estimated fulfill the criteria of discriminant validity. Then, it can be concluded that all of variables has a good reliability. Table 2 shows the result of measurement model for each dimension on indicators.

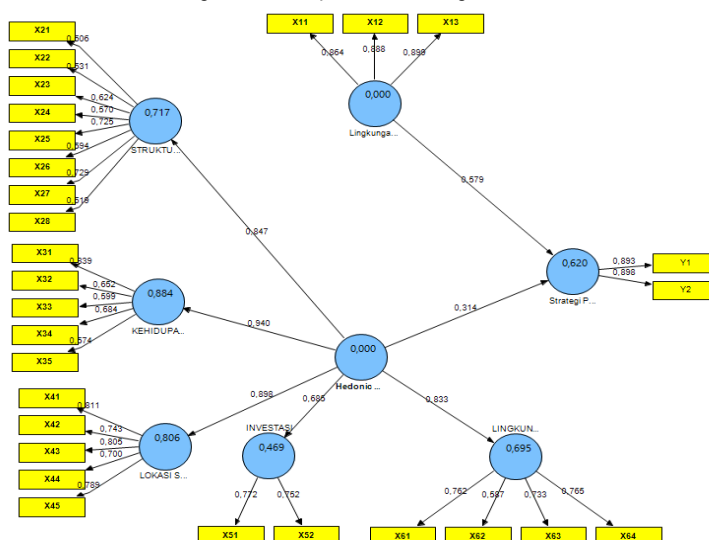
Table 2. Loading factor of latent variable-dimension-indicator

Variable-Dimension	$\lambda$	SE( $\lambda$ )	t-value
X11 <- Macroeconomic environment	0.864*	0.030	29.257
X12 <- Macroeconomic environment	0.888*	0.019	45.842
X13 <- Macroeconomic environment	0.899*	0.026	35.035
X21 <- physical structure of the house	0.606*	0.051	11.991
X22 <- physical structure of the house	0.631*	0.074	8.586
X23 <- physical structure of the house	0.624*	0.056	11.235
X24 <- physical structure of the house	0.570*	0.082	6.942
X25 <- physical structure of the house	0.725*	0.056	13.001
X26 <- physical structure of the house	0.594*	0.074	7.980
X27 <- physical structure of the house	0.729*	0.058	12.612
X28 <- physical structure of the house	0.619*	0.069	8.982
X31 <- life next door	0.839*	0.034	24.630
X31 <- Hedonic Market	0.766*	0.048	16.018
X32 <- life next door	0.652*	0.056	11.635
X32 <- Hedonic Market	0.585*	0.056	10.502
X33 <- life next door	0.599*	0.072	8.306
X33 <- Hedonic Market	0.555*	0.065	8.560
X34 <- life next door	0.684*	0.068	10.057
X35 <- life next door	0.574*	0.095	6.073
X41 <- strategic location	0.811*	0.040	20.447
X42 <- strategic location	0.743*	0.056	13.178
X43 <- strategic location	0.805*	0.040	20.310
X44 <- strategic location	0.700*	0.072	9.712
X45 <- strategic location	0.789*	0.039	20.327
X51 <- investment	0.772*	0.082	9.364
X52 <- investment	0.752*	0.070	10.711
X61 <- physical environment	0.762*	0.054	14.141
X62 <- physical environment	0.587*	0.104	5.630
X63 <- physical environment	0.733*	0.046	15.794
X64 <- physical environment	0.765*	0.043	17.677
Y1 <- Pricing strategy	0.893*	0.021	42.406
Y2 <- Pricing strategy	0.898*	0.017	54.115

Note \*valid for  $\alpha=0.05$

The result of measurement model of dimensions by its indicators show that the indicators are valid which the value of  $t < 2.04$  (t table at  $\alpha = 0.05$ ). The result of measurement model of latent variables on their dimensions shows to what extent the validity of dimensions in measuring latent variables. Following figure shows the complete path diagram:

Figure 3. Complete Path Diagram of research model



3.1.2. Structural model

Based on the research framework, then obtained a structural model as follow:

$$\eta_1 = 0.579\xi_1 + 0.314\xi_2 + \zeta_1 \tag{1}$$

where:  $\eta_1$  = pricing strategy,  $\xi_1$  = macroeconomic environment,  $\xi_2$  = hedonic market,  $\zeta_i$  = residual.

3.1.3. Hypothesis Testing result

Table 3 shows the result of hypothesis testing simultaneously and Table 4 is the result of hypothesis testing for partially.

a. Simultaneous Hypothesis testing

Below is the result of simultaneous testing of hypothesis:

Table 3 - Simultaneous Testing of Hypothesis

Hypothesis	R <sup>2</sup>	F	Conclusion
Macroeconomic environment and Hedonic Market-> Pricing strategy	0.620	38.419*	Hypothesis accepted

Note: \* significant at  $\alpha=0.05$  (F table =3.195)

Based on the table, it is known that within the degree of confidence of 95% ( $\alpha=0.05$ ) simultaneously there is the influence of macroeconomic environment and Hedonic Market to pricing strategy; amounted to 62%, while the rest of 38% is affected by other factor did not examined.

b. Partial Hypothesis testing

Below is the result of partial testing of hypothesis:

Table 4 - Partial Testing of Hypothesis

Hypothesis	$\gamma$	SE	t	R <sup>2</sup>	Conclusion
Macroeconomic environment -> Pricing strategy	0,579	0,080	7,219*	0,429	Hypothesis accepted
Hedonic Market-> Pricing strategy	0,314	0,069	4,530*	0,192	Hypothesis accepted

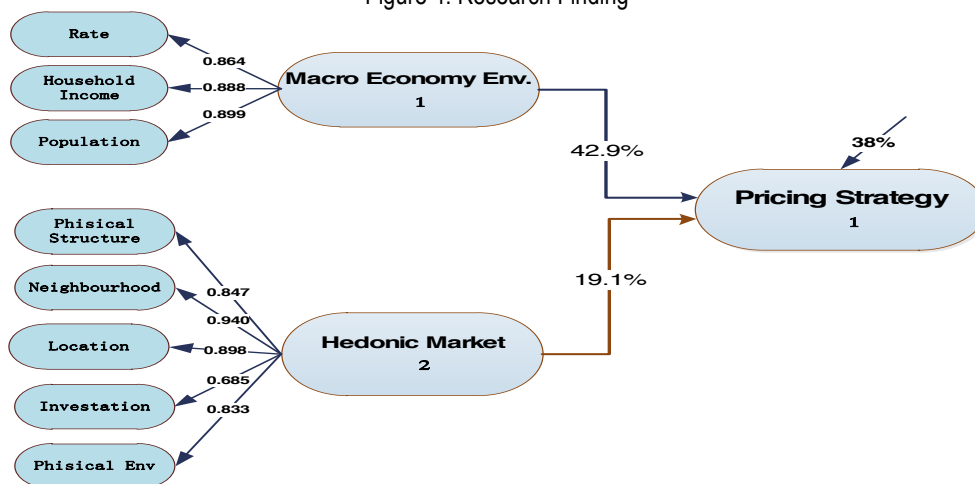
Note: \* significant at  $\alpha=0.05$  (t table =2.01)

The table shows that partially, Macroeconomic environment and Hedonic Market affect significantly to Pricing strategy, which is Macroeconomic environment has a greater influence (42.9%).

3.2. Research finding

Based on hypothesis testing result, will be described the Research Model Finding as follow:

Figure 4. Research Finding



Based on the results of hypothesis testing, appeared that the macroeconomic environment and hedonic market both affect the pricing strategy. The macroeconomic environment is shown to have more dominant influence than the hedonic market in formulating pricing strategies. The results of this study indicate that interest rates, average household income, and population as a macroeconomic environment have a dominant effect on property pricing strategies. Population is the most dominant aspect in terms of macroeconomic environment in formulating pricing strategy compared to household income and interest rate. Meanwhile, in terms of hedonic market, the environment plays a dominant role in pricing strategy compared to location, physical structure, physical environment, and investment aspects.

Thus, the results of this research is beneficial for property companies in West Java in the effort of formulating and implementing pricing strategies that are based on an understanding of macroeconomic environment aspects, especially population growth, and household income and interest rate. The pricing strategy should also consider the hedonic market aspect that includes the neighborhood, location, physical structure, physical environment, and investment. The results of this study are in line with Capozza and Schwan (1989) findings that interest rate variables are important variables other than population level and population growth that can affect property prices, especially house prices. This is in accordance with the findings Potepan (1996) that states that the variable interest can affect property prices (property price), especially house prices (house price).

With regard to the influence of hedonic markets on pricing strategies, the results of this study are also in line with Shabana *et al.* (2015) argues that housing is one of the basic needs of human life that not only provides protection and tranquility but a primary form of individual health in which structural variables affect property price by using hedonic pricing model.

### Conclusions and suggestions

Macroeconomic and hedonic market environments both have an effect on pricing strategies. The macroeconomic environment has a more dominant influence than the hedonic market in the formulation of pricing strategies.

The results of this study are expected to provide benefits for property management companies in West Java that in the formulation of pricing strategies must consider the macroeconomic environment of population, household income, and interest rates. In addition, the pricing strategy should also consider the hedonic market aspect, especially the environmental and location aspects, physical structure, physical environment, and investment.

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## Supply Chain Management as a Source of Competitive Advantage in Wood Clusters

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### Abstract:

The aim of this paper is to demonstrate the influence of the concept of supply chain management on the competitive advantages of business clusters in wood industry by using the methods of theoretical and empirical analysis. The research includes all the wood clusters from the Republic of Croatia and the wood cluster from Styria in Austria. The statistically processed results obtained from data collected through questionnaires have revealed that the factors which constitute supply chain management (IT, Value-Added Process and Relationships with Partners) have statistically significant positive effects on Supply Chain Performance and Competitive Advantage of wood clusters.

**Keywords:** wood clusters; efficiency; effectiveness; supply chain management; competitive advantage

**JEL Classification:** H10; M11; M2

### Introduction

Modern economic trends are moving in the direction of reindustrialization due to high tech and global economic integration. Businesses are operating in an environment characterized by globalization of business, growing competition, accelerated technological development and the increasingly diverse needs of more informed and more demanding consumers. To respond efficiently to dynamic changes from the environment, companies in the wood industry form strategic alliances that may come in different forms. A strategic alliance can be defined as a kind of coalition of business and public entities with a view to achieving common goals. According to the available data, over half of the companies in the world operate in some form of strategic alliances (Tipurić 2013). This can be explained by the fact that small businesses are increasingly struggling with the growing pressure of big business and, in order to survive, smallest businesses are forced to cooperate with each other. Globally dominant are large companies with strong financial, marketing and political involvement in national governments where small businesses cannot compete, although many authors suggest that small and medium-sized businesses create preconditions for economic expansion. For this reason, strategic alliances are imposed as a logical response to challenges facing modern business. Strategic alliances may take various forms, one of which is cluster.

Over the last twenty years, considerable research has been devoted to the phenomenon of business clusters and the analysis of driving forces of their development. Competition is intensifying and trends in business organization are changing, thus reducing the importance of local linking, while increasing the importance of regional and, more recently, global business linking. In the beginning, clusters were defined as geographic concentrations of interrelated entities because they referred to the city or district, but today the geographic aspects do not make very significant influences and the clusters are now spreading geographically even globally. The most famous clusters can be found in banking, pharmaceutical, film or auto industry. The number of clusters in the world is increasing. Clustering provides a great many benefits such as increased innovation capacity, higher specialization and economics of volume.

European Union (EU) has recognized the business cluster as an important model which strengthening

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competitiveness, generating positive synergistic economic outcomes. Accordingly, various measures and policies that support the establishment and operation of the cluster are undertaken (Enterprise Policy, Regional Policy, Research and Innovation Policy). In the EU today clusters exist in almost all economic activities and have different characteristics and structure (horizontal and vertical) depending on the activity, location, partners, management and other.

The aim of this research is to explore how supply chain management strategies affect strengthening of the competitive advantages of wood clusters. In the last two decades, the concept of supply chain management has been recognized globally as a key concept that positively affects competitiveness of complex business systems. It is applied broadly and today it is an indispensable part of multinational corporations' strategies of answering the purpose of space-time transformation of raw materials into finished products.

The objective is to identify and determine supply chain management factors that positively affect competitive advantage of wood clusters. Identification and implementation of factors that constitute supply chain management should lead to a higher level of organization in wood clusters to enable intensifying cooperation among companies, better management, better logistics relationships with suppliers, greater number of innovations, higher productivity, faster information flow, faster product placement, and ultimately manufacturing of final products that will be more price or quality competitive.

## 1. Research background

In the recent years there have been many foreign studies on clusters. Michael Porter conducted the first significant studies on clusters published under the title *The Competitive Advantage of Nations* (1988). Other authors have also contributed significantly to the research: Paul Krugman in *Geography and Trade* (1991), Hayward Jack in *Industrial Enterprise and European Integration* (1995), Hector Rocha in *Entrepreneurship and Development: The role of clusters* (2004) and Martin Perry in *All international perspective* (2007). Many other authors have also discussed the issue on the domestic or international market. The list of previous researches is long, but so far no scientific work has been published that adequately defines and analyses the effects of supply chain management on clusters. It is partly for this reason that cluster is traditionally defined as a group of similar companies that cooperate but also compete. Such a form of cooperation is a feature of horizontal clusters and hence excludes the full implementation of supply chain management process. However, horizontal linkages, though still dominant in some traditional regions (Veneto, Monzano), are being replaced by vertical linkages that are characteristic of capital and knowledge-intensive industries. It is, therefore, important to explore the possibility of implementation of supply chain management factors in traditional industries such as wood.

The first researches related to supply chain management date back to the 80s of the twentieth century. The most recent research is the following: *Strategic Supply Chain Management* by Cohen and Roussel (2005); *Supply Chain Management Best Practices – 2<sup>nd</sup> Edition* by Blanchard (2011), *Essentials of Supply Chain Management – 3<sup>rd</sup> Edition* by Hugos (2011) and *Global Supply Chain Management* (2013) by Matt Drake. After having studied relevant bibliographic units, it can be concluded that only some of the issues about the proposed topic were partially explored and presented to the public, primarily effects of the implementation of supply chain management strategies in wood industry explored by Anderson *et al.* (1999), Hognas (2000), Helstad *et al.* (2001), Juslin and Hansen (2002), Pulkki (2001), Smith (2001), Erlend *et al.* (2004). However, in the studied literature there is no available data on the implementation of supply chain management process in wood clusters as separate organizational entities, and in particular on the identification of supply chain management factors that affect the competitive advantages of enterprises in the cluster.

Several scientific papers have successfully proved that supply chain management solutions will allow businesses to optimize. In their article entitled "The impact of supply chain practices on competitive advantage and organization performance", Li *et al.* (2004) demonstrated that supply chain management strategies positively affect competitiveness of interrelated businesses in various industries and economic activities. The authors included 196 companies in the United States (US) that operate in various industries such as transport, rubber and plastic production, computer manufacturing. Authors tested the impact of selected factors on the theoretical model and proved that there are positive and strong relationships between independent and dependent variables, which represents a significant contribution to the applicability of the concept of supply chain management in vertically linked systems such as wood industry.

In their paper entitled *A quantitative study of the US wood pallet industry based on supply chain management practices* published in 2012, Quesada-Pineda *et al.* demonstrated the applicability of the concept of supply chain management in wood industry, more precisely, in pallet production. The research included 202 companies in the US. Authors tested the concept of supply chain management on the theoretical model as the

ability to optimize supply chains and proved that supply chain management factors such as information technology, value-added process, customer satisfaction and environmental uncertainty can positively affect supply chain performance and competitive advantage. This work is important from the point of view of the application of the concept of supply chain management in wood industry but focuses exclusively on pallet production, where cooperation of a large number of vertically linked businesses is not required.

While seeking to expand the knowledge base on supply chain management in wood industry, numerous research gaps have been found that this research fills in. Although Sureephong *et al.* (2008) and Kaplinsky (2008) proved that the concept of supply chain management has a positive impact on wood clusters, no research has been conducted on the effects of factors in supply chain management such as value-added process, relationships with partners and information technology on competitive advantage. Also, no study has been done yet to explore the mediating role of supply chain performance in achieving competitive advantage. The research offers efforts to disseminate knowledge about the applicability of the concept of supply chain management in wood clusters. By demonstrating the influence of the concept we gain important knowledge about relationships among businesses in cluster, which is a prerequisite required to achieving competitive advantage.

To empirically explore the ability to optimize a cluster by applying the concept of supply chain management, it is necessary to demonstrate the influence of supply chain management factors on selected business indicators, which are most commonly inventory turnover, average cost of warehousing, customer satisfaction, lead time and other. The best is to observe the system over a certain period and then compare business indicators before and after the implementation of the supply chain management concept. Since in this case it is not possible to use the experimental method of proving hypothesis (which is the limitation of the research), the modelling method was used to first define the theoretical model, and then use the standard statistical methods to test the influence of interrelated variables to prove or disprove hypotheses of the model.

Based on literature review and a pilot study and having considered expert information, after having explored the features of wood industry and business clusters, we were able to identify factors that affect supply chain management as variables that will be tested on the theoretical model to prove or disprove the underlying hypothesis posed by the authors. The following factors have been identified: value-added process, information technology (it) and relationships with partners as independent variables, and supply chain performance and competitive advantage as dependent variables. Critical factors affecting supply chain management, which are the basic factors for the research model, are described in the following sections.

### 1.1 Information technology

We are now in the midst of the information revolution and information technology has a major role in supporting businesses and the entire supply chains. The purpose of information technology is to collect and process information from internal and external environments to enable management to make the best decisions possible at a given time. Development of information technology has accelerated the process of supply chain integration (Chizzo 1998), which consequently leads to reduction in transaction costs and accelerating information processing between partner companies (Clark and Lee 2000).

Information technology is a complex system consisting of the following subsystems: communication tools, IT equipment, Integrated Information Systems.

The subsystems are mutually synchronized and cannot function separately, so when implementing a subsystem, managers must consider all aspects of their interactive functioning. The most important investment is IT equipment, which is the information system infrastructure. All supply chain partners should dispose of equipment of the same or similar technological level, as it is a prerequisite required to connect to a single information system. To exchange information within the supply chain that is a prerequisite required to achieve customer satisfaction, modern communication tools that enable real time data transfer are used. All information gathered from the end of the chain is transferred through an integrated information system to its starting point and can be used as input for decision-making. Once the information is collected and processed, managers make decisions that are passed through the information system to the companies in the chain. The rapid progress of technology has resulted in an increased rate of obsolescence, which can be the greatest weakness, but also one of the strengths having in mind numerous benefits of an updated and perfectly functional IT system, which is a prerequisite for development of a supply chain (Tompkins *et al.* 1999).

### 1.2 Value-added process

Value adding activity can be defined as the main strategy of gaining a competitive advantage through supply chain management. The importance of the value-added process for a strategic alliance is great because it affects



customer's perception of companies within the supply chain (Wu and Dunn 1995). It means that each company within the supply chain represents a link that to some extent contributes to creating added value for the customer. The term added value is difficult to define precisely because each customer is unique and therefore has his or her own perception of the value of a product or service he or she receives for his or her money. Customer satisfaction can be used to provide guidelines for effective organization of a supply chain. The term added value should be broken down into more precise factors that describe it. According to the research conducted by Quesada-Pineda (2011) and Zekić and Samaržija (2017), the value-added process is constituted of the following factors: Production Processes and Production Process Quality.

Production processes are critical, particularly in the context of rapid product obsolescence, launching new products and product diversification. As products become more and more sophisticated, considering an increasingly wide range of other ancillary services, which have become the key to the company's gaining and keeping customer loyalty, production process design goes beyond the boundaries and competencies of individual companies and enters the domain of supply chain management. Such an approach to the value-added process requires involvement of as many stakeholders within the supply chain (suppliers, buyers, employees, business partners) as each participant contributes to creating added value (Normann and Ramirez 2000). The responsibility of the management is to create business strategies that will result in total production time cycle compression, avoiding bottlenecks in production and timely allocation of inventory within the supply chain in order to make the production process more efficient.

In SCM, Production Process Quality is defined as a uniquely defined quality level that applies to all companies within the supply chain. Such an approach to quality issue means that all companies in the chain need to have the same or similar business philosophy as in this way only uniform quality can be achieved through the chain ultimately ensuring product or service integrity. Today's approach to quality has changed significantly compared to 20 years ago, where product characteristics and performances were at the forefront, whereas today, the most important are indirect benefits such as lead time, product personalization, ease of use, and the ability to share information, which can to a great extent contribute to Value-Added Process and are much better quality indicators.

### 1.3 Relationships with partners

Relationships with Partners are a term used to define relationships between participants within the strategic alliance. In a strategic alliance, which can have dozens of participants or links, there are only two types of entities that may, from the aspect of their business relationship, be suppliers or buyers. The task of the management is to create strategies that will be used to integrate suppliers and buyers aimed at achieving maximum added value for the end customer.

The importance of customer relations within the supply chain has been witnessed by numerous research papers of Stuart (1997), Noble (1997), Magretta (1998), Day (2000). Customer relations are the main driving force of the entire supply chain. In other words, all members of a strategic alliance are working to meet the needs of the end customer. The key to effective customer relations is to anticipate their future needs and fulfil them. To meet future customer needs, it is first necessary to collect information about customer preferences and, accordingly, define and implement the adequate business strategy.

To create a successful strategy, all suppliers should be involved because they also contribute significantly to creating added value. Managing suppliers implies making strategic decisions and implementing a broad spectrum of activities to define conditions for joining the supply chain, payment terms, financing, warehousing, delivery terms, customer claims management and other. In the last three decades, due to dynamic changes on the market a trend is noticed where long-term contracts are concluded with a few reliable suppliers, which in the long term lead to a closer and long-term cooperation for mutual benefit (Kalwani and Narayandas 1995).

### 1.4 Supply Chain performance

Developing the right key performance indicators will enable organizations to plan and control the changes that occur within the supply chain (Owen and Richmond 1995, Alvarez 1994). According to Garwood (1999), traditional KPIs, which include prime cost, workforce productivity, equipment lifespan and production budget, have been replaced by new indicators that are more customer-orientated such as Supply Chain Performance that is defined as a set of indicators that measure efficiency of the implementation of supply chain management strategies in a strategic alliance. These indicators are needed to measure, control, analyze, and adapt the supply chain plans to market requirements. Strategic alliances that push for excellence continuously introduce new, more accurate indicators to shorten internal processes and avoid bottlenecks in the system. The most commonly

used indicators today are the following: Flexibility, Quality, Integration, Visibility, Availability, and Environmental Awareness.

Considering the low level of development of wood clusters in Croatia and vertically linked clusters in Austria, the following indicators have been chosen as the most adequate: Supply Chain Flexibility, Supply Chain Integration and Partnership Quality.

Supply Chain Flexibility is defined as the organization's ability to adapt efficiently to changes from an external environment (Vickery *et al.* 1999). It means that a supply chain should be timely responsive primarily to customers' demands, then competitors, suppliers and ultimately the government. Flexibility of a supply chain is reflected in its ability to produce demanded products in the right quantity, at the right time, at the right price. In that sense, it can be concluded that flexibility can be measured in terms of production, quantity, price, and time.

Supply Chain Integration defines to what extent all activities within the organization that relate to partners' activities, both suppliers and buyers are integrated (Stock *et al.* 1998, Narasimhan and Jayaram 1998, Wood 1997). Integration can go in two directions: forward - from suppliers to manufacturers and buyers, and backward - from buyers to manufacturers and suppliers.

Partnership Quality is the measure of subjective assessment of the relationships among the participating members along the supply chain. It is often the case that businesses of varied sizes operate within the supply chain, so bigger companies have a greater negotiating power, which puts smaller businesses in inferior position. Although all companies have the same goal, which is satisfaction of customers needs, relationships among the participants are not always harmonious, because sometimes they have different interests (lead time, stock quantity on hand, customer claims management) especially in clusters where companies compete for the same market and for the same geographic area. Sales results and customer service quality are considered as generally accepted indicators of Partnership Quality. To obtain more precise results, organisations should focus on exploring what perception is associated with the relationships along the entire supply chain. Previous research on Partnership Quality focused on satisfaction of all supply chain's participating members with its performance, ethics, integration, the number of those that left the alliance and the number of legal proceedings instituted in a court of law to acquire a benefit from other party in the alliance.

### 1.5 Competitive advantage

A strong and positive impact of supply chain management practices on competitive advantage (in terms of price and quality) has already been proved in several studies (Vokurka *et al.* 2002, Fawcett and Smith 1995, White 1996, Skinner 1985, Roth and Miller 1990). Building and maintaining a competitive edge is the main purpose of the implementation of supply chain management strategies, independent of the industry. Only those supply chains that succeed in achieving competitive advantage will be able to build a successful business in future. Competitive advantage means superior performance relative to other competitors.

In other words, a supply chain has achieved competitive advantage if it is characterised by such abilities or features that are superior to those possessed by other competitors. To achieve competitive advantage, the management must pursue with the strategic implementation of the following factors: IT, Value-Added Process and Relationships with Suppliers, to differ from competitors. Supply Chain Differentiation is reflected in its effective response to customer demands, which will enable companies in the chain to generate higher revenues, gain higher profit, and gain new and retain customers.

## 2. Research model and hypotheses

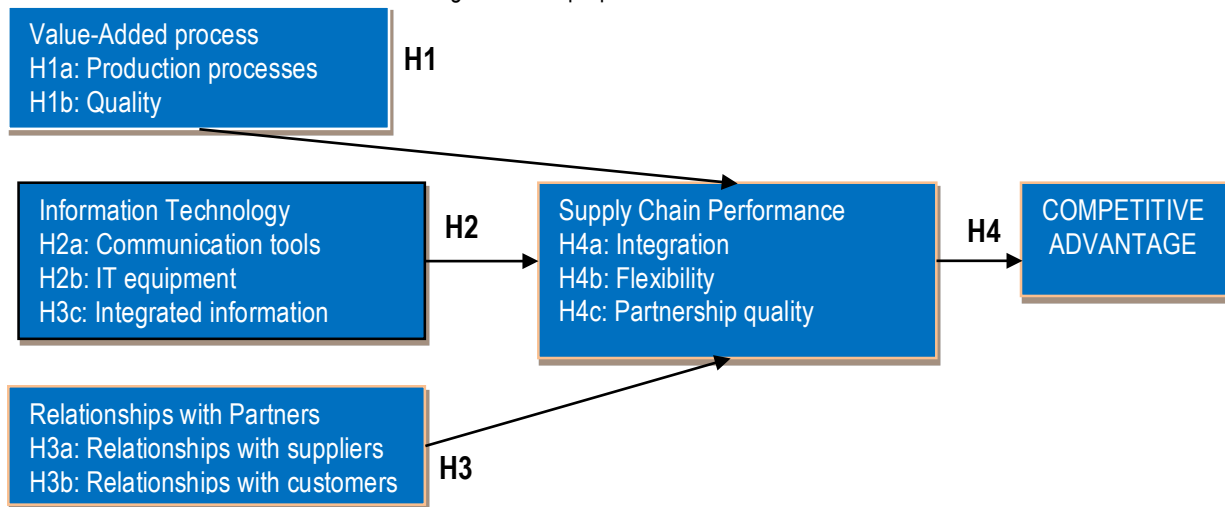
The model seeks to determine the effects of the concept of supply chain management on system's efficiency and effectiveness. To determine efficiency, it is necessary to relate the supply chain management factors (Information Technology, Relationships with Partners and Value-Added Process) to the set of indicators called Supply Chain Performance (Supply Chain Flexibility, Supply Chain Integration and Partnership Quality).

Figure 1 illustrates the model used to establish the relationship between the supply chain management factors (Information Technology, Relationships with Partners and Value-Added Process) and Supply Chain Performance (Efficiency), and the relationship between Supply Chain Performance and Competitive Advantage (Effectiveness). The model is also used to assess the relative contribution of individual factors to determine the impact they have on wood clusters, and the intensity.

The hypotheses (H1, H2, H3 and H4) reveal the relationships that exist between the factors, which may be positive or negative. The model is used to assess statistical contribution of individual factors of supply chain management to supply chain performance (efficiency) and the contribution of supply chain performance to cluster competitiveness (effectiveness) to prove or disprove the hypothesis, which is to establish the existence of a

positive correlation between the concept of supply chain management and the optimization of wood clusters. H1, H2 and H3 are used to measure efficiency of the supply chain, whereas H4 is used to measure its effectiveness.

Figure 1. The proposed research model



Source: Author

### 2.1 The relation between Value-Added Process and Supply Chain Performance

According to Bowersox Closs and Cooper (2010), the value-added process positively affects supply chain performance in terms of increasing market share, product personalization, and achieving economies of scale. This research explores the relation between the value-added process and supply chain performance in wood clusters. As wood industry is characterized by interconnected production, which is manifested through transformation of raw materials into final products, this hypothesis is used to measure how strong a relationship is in wood clusters. To make the result as accurate as possible, contribution of individual production processes to supply chain performance will be tested as well as the contribution of production process quality to supply chain performance. This leads to the hypothesis:

Hypothesis 1 (H1): Value-Added Process positively affects Supply Chain Management Performance

H1a: Production Processes positively affect Supply Chain Management Performance;

H1b: Production Process Quality positively affects Supply Chain Management Performance.

### 2.2 The relation between Information Technology and Supply Chain Performance

It has already been proved by several studies that there is a strong and positive relationship between IT and Supply Chain Performance (Chen and Paulraj 2004, Tompkins *et al.* 1999). This research seeks to explore the relationship between these two factors in wood industry or wood clusters as complex business systems. Supply chains would not be functional without a backbone of information technology. What is needed is to determine how strong the IT impact is on Supply Chain Performance and what is the contribution of individual subfactors: Communication Tools, IT equipment and Integrated Information Systems.

Hypothesis 2 (H2): IT positively affects Supply Chain Management Performance

H2a: Communication Tools positively affect Supply Chain Management Performance;

H2b: IT equipment positively affects Supply Chain Management Performance;

### 2.3 The relation between Relationships with Partners and Supply Chain Performance

Supply chain can be defined as a system of interrelated businesses. All participants (suppliers and buyers) of the supply chain share a common mission to meet customers' needs. It is for this reason that relationships with partners represent the backbone of the concept of supply chain management (Burgess 1998, Hoek 1999). In the context of wood industry and wood clusters, this would mean that suppliers and buyers must work with linked processes to expect production efficiency. Also, to meet customers' needs faster, it is necessary to achieve flexibility in supply chains, as flexibility is quite simple an important competitive advantage.

A relationship with Partners is a key factor to success and represents the backbone of supply chain management (...). Hypothesis 3 (H3) attempts to establish the relationship and strength of the relationship between Relationships with Partners and Supply Chain Performance. For more accurate results, the work seeks to reveal the contribution of individual participants (suppliers and buyers) to Supply Chain Performance. This leads to the hypothesis:

Hypothesis 3 (H3): Relationships with partners positively affects Supply Chain Management Performance

H3a: Relationships with Suppliers positively affects Supply Chain Management Performance;

H3b: Relationships with Customers positively affects Supply Chain Management Performance.

#### 2.4 The relation between Supply Chain Performance and Competitive Advantage

Many relevant researches on supply chain management have investigated the relationships between Supply Chain Performance and Competitive Advantage (Stevens 1990, Ellram 1991, Berry *et al.* 1994, Thomas and Griffin 1996, Lee and Billington 1992). Hypothesis 4 (H4) attempts to demonstrate the influence of supply chain performances on competitiveness but also to identify the supply chain performance factors that can make the most valuable contribution to a company's competitiveness in wood cluster as a business system.

The factor of Supply Chain Performance is composed of the three subfactors: Supply Chain Integration, Supply Chain Flexibility and Partnership Quality. The work seeks to establish the contribution of individual subfactors to cluster competitiveness. This leads to the hypothesis:

Hypothesis 4 (H4): Supply Chain Management Performance positively affects Competitive Advantage

H4a: Supply Chain Integration positively affects Competitive Advantage;

H4b: Supply Chain Flexibility positively affects Competitive Advantage;

H4c: Partnership Quality positively affects Competitive Advantage.

### 3. Research findings

The data processing cycle seeks to evaluate data from psychometric aspects: validity and reliability. Principal component analysis and Exploratory Factor Analysis were used with Oblimin or truncated rotations (on the assumption of the correlated factor system). The validity was determined indirectly by determining the number of factors, and the number of factors was determined by using the Cattell's Scree Test and the Guttman-Kaiser Criterion to reduce the number of principal components (only eigenvalues greater than 1 were used), and factor analysis to measure factor loadings and intercorrelations. Values lower than  $<0,4$  or components having equal loadings on more than one factor were excluded from the survey. Reliability was assessed by the use of internal consistency and the Croanbach's Alpha Coefficient. The criterion of Croanbach's Alpha Coefficient was  $p < 0.5$ .

The following sections discuss factor analysis, which is defined as a set of statistical and mathematical procedures suitable for analyzing data on interrelations between the observed phenomena. Today, it develops as part of modern psychology, and has proved useful in researches where there are many intercorrelated variables and where it is necessary to determine the basic sources of covariance among data. The results of factor analysis indicate that Value- Added Process is composed of two factors: Production Processes and Production Process Quality. Production Processes consist of six components (factor loadings ranging from 0.54 to 0.84), while Production Process Quality has two components (factor loadings ranging from 0.47 to 0.88).

The results indicate that IT is composed of three subfactors: Subfactor 1 (Communication Tools) has got four components (factor loadings ranging from 0.67 to 0.85), Subfactor 2 (IT equipment) has got two components (factor loadings ranging from 0.85 and 0.88), while Subfactor 3 (Integrated Information Systems) has got four components (factor loadings ranging from 0.46 to 0.79). Factor loadings for Relationships with Partners reveal that Subfactor 1 (Relationships with Suppliers) is associated with six components (factor loadings ranging from 0.71 to 0.86), while Subfactor 2 (Relationships with Customers) is associated with five components (factor loadings ranging from 0.62 to 0.78). Supply Chain Performance is composed of three subfactors: Supply Chain Integration, Supply Chain Flexibility, and Partnership Quality. Supply Chain Integration is described by 12 components, with factor loadings ranging from 0.71 to 0.93. Supply Chain Flexibility, as Subfactor 2, is described by three components, with factor loadings ranging from 0.49 to 0.86. Subfactor 3, or Partnership Quality is described by two components, with factor loadings ranging from 0.44 to 0.85. Competitive Advantage is associated with two subfactors: Quality and Price. Based on the results of the analysis it can be concluded that

Quality is described by eleven components (factor loadings ranging from 0.53 to 0.88), while Price is described by three components (factor loadings ranging from 0.48 to 0.77).

The research also involved multiple regression analysis that was used to establish percentage contribution values and the significance of effects of the selected factors, which are Value-Added Process, Information Technology and Relationships with Partners (independent variables) on Supply Chain Performance and Competitive Advantage (dependent variables) in wood clusters. The primary purpose of conducting multiple regression analysis was to evaluate the contribution of supply chain management factors to gaining competitive advantage in wood clusters. The impact was measured by testing correlation ( $r$ ) and factor contribution ( $R^2$ ): Value-Added Process, Information Technology, and Relationships with Partners on Supply Chain Performance and Competitive Advantage.

The results of the analysis have been used to establish the SCM factors that can have statistically strong impact on Supply Chain Performance, thus proving that the concept of supply chain management can positively affect business management efficiency. Also, a relationship that exists between Supply Chain Performance and Competitive Advantage reveals that the concept can be relevant to business management effectiveness.

Table 1. Percentage contribution values

Factor	$\beta$	SE $\beta$	P	$r$	% Contribution Values
Value-added Process	0,216	0,098	0,033*	0,833	18,0
IT	0,191	0,084	0,027*	0,785	15,0
Relationships with Partners	0,525	0,105	<0,001*	0,900	47,2

Source: Author

A statistically significant coefficient of multiple regression  $R = 0.895$ , ( $p < 0.001$ ) and  $R^2 = 0.802$  was determined, which means that the total percentage contribution value of the examined factors to supply chain performance is 80.2%. In other words, these factors might contribute 80.2% to supply chain performance. Percentage contribution value of Value-Added Process to Supply Chain Performance is 18% and is statistically significant ( $p = 0.033$ ). Percentage contribution value of IT is 15% ( $p = 0.027$ ), and the largest percentage contribution value is associated with Relationships with Partners or 47.2% ( $p < 0.001$ ). By conducting the hypothesis test, it has been proved that all factors, which constitute supply chain management, have statistically significant effect ( $p < 0.05$ ) on Supply Chain Performance.

Table 2. Percentage contribution values

Factor	$\beta$	SE $\beta$	P	R	% Contribution Values
Production processes	0,300	0,126	0,021*	0,842	25,3
Quality	0,037	0,059	0,528	0,378	1,4
Communication tools	0,048	0,143	0,738	0,838	4,3
IT equipment	0,224	0,056	0,033*	0,446	10,0
Integrated information systems	0,020	0,061	0,743	0,350	0,7
Relationship with Suppliers	0,440	0,114	<0,001*	0,891	39,2
Relationship with Customers	0,098	0,083	0,239	0,397	3,8

Source: Author

A statistically significant coefficient of multiple regression of  $R = 0.926$ , ( $p < 0.001$ ) and  $R^2 = 0.858$  was determined, which means that the total percentage contribution value of the examined factors to supply chain performance is 85.8%. In other words, these factors might contribute 85.8% to supply chain performance. Significant percentage contribution values were determined for the following factors: Production Processes (25.3%,  $p = 0.021$ ); IT equipment (10%,  $p = 0.033$ ), and Relationships with Suppliers (39.2%,  $p < 0.001$ ). No statistically significant contributions have been established for other factors (residual  $p > 0.05$ ). This leads to a conclusion that the observed wood clusters are most influenced by the following factors: Relationships with Suppliers, IT equipment and Production Processes. A contribution value of  $p > 0.05$  was determined for other factors, which is not statistically significant. Furthermore, the analysis has revealed that Supply Chain Performance can significantly contribute to Competitive Advantage.



Table 3. Percentage contribution values

Factor	$\beta$	SE $\beta$	P	r	% Contribution Values
Supply Chain Integration	0,701	0,097	<0,001*	0,853	59,7
Supply Chain Flexibility	0,041	0,072	0,611	0,124	1,1
Partnership Quality	0,119	0,096	0,270	0,474	5,6

Source: Author

A statistically significant coefficient of multiple regression  $R = 0.815$ , ( $p < 0.001$ ) and  $R^2 = 0.664$  was determined, which means that the total percentage contribution value of the examined factors to competitiveness is 66.4%. In other words, these factors might contribute 66.4% to competitive advantage. The multiple regression analysis has revealed that Supply Chain Performance can significantly contribute ( $p < 0.05$ ) to competitiveness, which means that the concept of supply chain management positively affects Competitive Advantage of wood clusters. The supply chain performance factor analysis has indicated that Supply Chain Integration can significantly contribute to Competitive Advantage or 59.7% ( $p < 0.001$ ), while Supply Chain Flexibility and Partnership Quality do not contribute significantly to Competitive Advantage.

## 4. Discussion

### 4.1 Discussion of results

Interpretation of the results of statistical analysis is important for considering present and creating future management strategies for wood clusters primarily in Central and Eastern Europe but also on a global scale. As no other research has been conducted so far in an attempt to examine implications of applying the concept of supply chain management to business performance in clusters, the acquired knowledge is of great importance. The importance of the acquired knowledge is manifested primarily in the (non) application of supply chain management strategies on supply chain performances, which ultimately reflects its competitive advantages.

The results have revealed the following:

By testing H1 it has been proved that Production Processes have strong positive impact ( $p = 0.021$ ;  $r = 0.842$ ) on supply chain performances, while Production Process Quality does not contribute significantly ( $p = 0.528$ ;  $r = 0.378$ ). The hypothesis implies that businesses had made significant efforts in establishing common production processes (production systems) while no consensus had been reached yet between members about the importance of establishing a quality control system. Successful implementation of production processes is referred to in literature as Lean Management which is defined as an approach to running an organisation that supports the concept of eliminating losses along the supply chain rather than the individual business, creating efficient, continuous processes that require less human factors, less space, less capital, and less time to produce a product or provide a service. Although the application of the concept of lean management in clusters has already been proved (Vrdoljak-Raguž 2012), this work has proved its contribution to wood clusters. This is useful knowledge that can serve managers in wood clusters when analyzing and selecting business strategies.

The contribution of IT to Supply Chain Performance ( $p = 0.027$ ,  $r = 0.785$ ) as well as the contribution of IT equipment ( $p = 0.033$ ,  $r = 0.446$ ) has been proved. This has illustrated that cluster companies dispose of modern equipment that enables continuous operations and daily execution of operating tasks. While it is easy to understand why to invest in IT equipment considering that it can shorten process execution time and serves for control purposes, on the other hand, cluster companies are not investing enough in communication tools and integrated information systems. Not investing in contemporary software concepts can be a fundamental problem in the long run, as other industries are seeing a noticeable trend of increased investment in that business segment. Today, more and more popular programs involve all supply chain participants and are narrowly specialized in some segments of business (Chizzo 1998, Hicks 1997, Tan 2001). Wood clusters do not belong to technology-intensive industries, so it is not realistic to see replacing existing software in short periods or frequent needs for system upgrades. In addition, new software implementation requires significant financial expenditures related to program implementation and employee training. In some cases, it might happen that software maintenance and upgrade cost outweigh the initial cost, which may be discouraging. Considering that wood clusters are composed of several companies at different process stages, wise decisions should be made to ensure uninterrupted integration in the long term, which is not easy taking into account the diversity of business systems.

By testing H3 it has been proved that Relationships with Partners have strong positive impact on Supply Chain Performance ( $p = 0.001$ ,  $r = 0.900$ ), but primarily on the account of Relationships with Suppliers of which contribution is statistically significant ( $p = 0.001$ ,  $r = 0.891$ ) while customer relationship contribution is not. The

bigger influence of Relationships with Suppliers in wood clusters is expected as the production functions of the company are directly dependent on the availability of wood raw materials, so companies need to focus on raw material procurement strategies. The dependence on raw materials is particularly pronounced in Croatian wood industry due to the limited number of supply channels (suppliers) and the dependence on limited natural resources. On the other hand, Customer Relationship is primarily a marketing tool that enables organizations to get as much customer information as possible, which will be used to further develop their sales strategies. Customer relations are supported by software solutions that are developed for classifying data collected in the database. By testing H2 it has been proved that the effects of Communication Tools and Integrated Software Systems are not significant in clusters, and the lack of CRM systems speaks in favour of the fact that the development of business informatization is still inadequate.

By testing H4 it has been proved that Supply Chain Performance positively affects Competitive Advantage and that Supply Chain Integration has the biggest influence on product quality ( $p = 0.001$ ,  $r = 0.853$ ). The applicability of the concept of supply chain management has already been proved in many industries and activities (fruit and vegetable, pallet production, aviation, tourism), and this work has proved that the concept is applicable in wood industry or in wood clusters as well. The acquired knowledge is especially important if we consider broad interpretation of the cluster concept as well as various economic effects generated by clusters, as alliances, on their members. By proving the hypothesis, a significant step was made to the identification of benefits arising from the cluster's functional characteristics, that is to say, the integration positively affects competitive advantages, which is a departure from those papers which imply that the majority of benefits are realized by knowledge spillover, such as Proposed Priority Measures for the Wood Processing Sector, 2013. The importance of integrating the participants within the chain has been further enhanced by prove of the auxiliary hypothesis where it has been established that Supply Chain Integration has the biggest impact on Competitive Advantage. This directly proves that Supply Chain Management, as a concept that integrates and manages all participants in a wood cluster, can optimize business by influencing their efficiency and effectiveness.

#### 4.2 Contribution to theory

The research in several ways contributes to the expansion of existing theoretical knowledge about the possibilities and effects of applying the concept of supply chain management in wood clusters as complex organizational systems.

First, the paper demonstrated the possibilities of applying the concept of supply chain management in wood clusters. It has already been established that in modern business individual companies cannot compete with strategic alliances, encouraging a large number of companies to implement supply chain management strategies to develop efficiency and effectiveness. Although the concept of supply chain management was the subject of research in several scientific papers dealing with the topic in wood industry, the application of the concept has not been tested in wood clusters so far. This research demonstrated the possibilities of the application of SCM concept to contribute to the optimization of wood cluster business.

Secondly, SCM factors which positively affect supply chain competitive advantages in wood clusters of Croatia and Austria have been identified. The identification of the factors is very important because still today there are disagreements among scientists regarding the definition and scope of the concept of supply chain management which in many cases is identified as logistics management (von Hoek 1999, Alvarado, Ursula and Kotzab 2001) or used as a synonym for Relationships with Partners (Lamming 1996, Banfield 1999). It has been demonstrated that supply chain management as a concept positively affects cluster efficiency, by demonstrating the impact of Value-Added Process, Information Technology and Relationships with Partners on Supply Chain Performance and cluster effectiveness resulting from a statistically strong influence of Supply Chain Performance on Competitive Advantage.

Thirdly, the model can serve as a reliable tool for evaluating the achieved degree of supply chain management development within one of the strategic alliances in wood industry and as a benchmarking tool for other organizations according to the criterion of effects of SCM factors on business efficiency and effectiveness. Various business indicators are currently in use that describes implementation of supply chain management in organizations (inventory turnover, inventory cost, average lead time, reliability, shipping lead time etc.), but mainly focus on metrics, the external supply chain or certain SCP factor (Supply Chain Integration, Supply Chain Flexibility, and Partnership Quality). The theoretical model developed for this paper seeks to consider the internal supply chain of wood clusters in which the visible (such as IT equipment) and invisible (Partnership Quality) factors are analyzed, as self-analysis of cluster members that can serve managers when creating future generic business strategies.

### 4.3 Implications for practitioners

The results are practical, so they can serve managers in planning and organizing clusters in wood industry, as well as other alliance managers in the wood sector. Given the current policies, strategies, measures and practices of cluster management in Eastern and Central Europe, the results can serve strategic decision makers as a basis for reflecting on alternative direction of cluster development. Previous practice in Croatia supported horizontal integration, whereas the research demonstrated that vertical integration contributes the most to generating positive economic effects.

### 4.4 Research limitations

The contribution of the research is significant from a theoretical and practical point of view, but there are certain limitations, primarily due to the fact that the concept of supply chain management has not been applied previously in wood clusters in Central and Eastern Europe.

First, the most important limitation is a relatively weak response (21.4%), which means that a relatively small number of companies were ready to complete the survey and participate in the research. Also, the results obtained by testing the model as well as the recommendations for future derives from a model tested on small and medium-sized enterprises (revenue <1.5m euros), while large companies did not participate in the research (revenue > 2.5m euros). The survey included 13 clusters and 58 respondents, meaning that statistical contributions might have been different that more cluster members participated. Future researches need to include more wood clusters where integration is the dominant form of cooperation, to identify more precisely the contribution of individual SCM factors to competitive advantage.

Secondly, a pilot study found that the driving forces of SCM concept, which are Environmental Uncertainty and Top Management Support, are not relevant for wood cluster analysis. Top Management Support was not identified in the pilot study, which was based on factor analysis and expert opinion. This can be explained by the fact that clusters in Croatia have a horizontal structure and that no cluster management personnel were involved in the survey. According to experts, no relevant survey on supply chain management in wood clusters has been made so far, so it was assumed that the respondents were not familiar with the concept, which would influence the outcome of the survey. As no driving force contribution could be measured, it was not possible to measure the contribution of the main driving force of supply chain management in wood clusters, which does not allow for comparison with later research in which the mentioned factor will be explored.

Thirdly, surveyed respondents knew only one business segment within the supply chain (procurement, sales, production, etc.), whereas some questions in the questionnaire implied the entire supply chain (Integrated Information Systems, Production Processes, Supply Chain Performance and similar). If the questionnaire was filled out, for example, by a sales manager then he or she was not competent to evaluate Relationship with Suppliers, or a person from the procurement department could not know how the organization conducted customer relations. Of the total number of surveyed companies, 34.2% have more than ten employees, from which it can be assumed that the questionnaires were not completed by persons responsible for managing the entire supply chain, but only one of its segments contributing to uncertainty of the examined factors.

Fourthly, due to the time constraint of the study itself, the model did not include factors that have been scientifically proven to make it difficult to apply the concept of supply chain management in integrated systems, and it is very certain that they would contribute significantly to wood clusters as cluster as a business system is characterized by competitiveness. The research did not capture important knowledge of the impact of factors (sharing information and quality of information) that affect cluster integration. The information flow is one of three flows within the supply chain, so it is important for members of the alliance to exchange information on a daily basis so that the cluster can function as one entity. Members need to exchange all kinds of information from strategic, operational, logistics and customer information to become accessible to all supply chain participants, thus becoming a significant source of the competitive advantages. Exchange of information is important, but also important is the quality of information that is measured by its accuracy, timeliness, adequacy and credibility. It is known that information is increasingly suffering from distortion and delay as it moves across the supply chain (McAdam and McCormack 2001, Metters 1997, Mason-Jones and Towill 1997) and that there is resistance to share information with partners (Berry *et al.* 1994). Since the survey did not collect data on the importance of information in clusters, it is not possible to make the analysis of their influence on competitive advantages.

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## Brexit and the United Kingdom's Domestic and International Value Chains Second part: Special Focus on Key Global Value Chains

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### Abstract:

UK insertion in global value chains is analysed through the specific angle of inter-industrial relationships and international supply chains. The publication has been divided in two parts. The first one, provided a global network perspective and several synthetic indicators related to the strengths and weaknesses of UK's insertion in global value chains. It identified also the jobs that are directly or indirectly created in the UK through exports. Because a hard Brexit is expected to increase trade costs and affect prices, this second part estimates the impact of additional tariff and non-tariff trade costs on the competitiveness of key sectors: Transport equipment, Chemicals and Electronics. Hopes that a devaluation of the Pound may compensate for higher trade costs must take into consideration that devaluation affects only the domestic share of the value-added, requiring larger exchange rate adjustment. In the case of Transport equipment, the required devaluation is around 30% if all tariff and non-tariff trade costs are passed to the producers.

**Keywords:** Brexit, value chains, global network

**JEL Classification:** C43; C67; F14; F15; O50

### Introduction

The trade dimension of Brexit has been extensively analysed by scholars and international experts. The present essay aims at contributing to this burgeoning literature from the specific angle of domestic and international value chains. To this aim, the analysis uses some recent analytical and statistical developments related to the measure of "trade in value-added". A first part (Escaith 2018) presented a review of the literature related to the analysis of Brexit from a trade perspective and studied UK's insertion in the global economy and its comparative advantages. The analysis of trade from a value-added perspective led to identifying the tasks and jobs embodied in UK's exports of final and intermediate goods and services.

This second part of the article focuses on three sectors, Transport equipment, Electronics and Chemicals, which were selected for their relevance in global value chains. UK's global value chains (GVC) are benchmarked against other countries, in particular the other three European G20 members (France, Germany and Italy) plus China and the USA, the two largest World economies. The mapping of the domestic value chain driven by each selected industry provides the necessary information to estimate of the impacts of Brexit's related trade costs on UK's export competitiveness, as well as the related devaluation of the Sterling Pound that would be required to compensate for the loss in price competitiveness. Most of the analysis is conducted using the trade in value added OECD-WTO *TiVA* database, covering 1995-2011, and its OECD Nowcasts extension to year 2014.

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## 1. Transport equipment

The review of the three sectors (Transport equipment, Electronics and Chemicals) follows a similar protocol, starting with an analysis of UK's specific weight in World trade for this industry. The investigation will look also a market shares before analysing the relevant TiVA indicators from a comparative perspective. Each section closes with an estimate of the impact of Brexit on competitiveness, following the methodology presented in Annex.

### 1.1. Sectoral weight of United Kingdom as trade partner

In a comparison with the other three EU-G20 members, UK sector ranks third after Germany and France due to the relative weakness in its export links. Weighting only the imports, it is second after Germany while its export weight is less than a third of Germany's one. When trade negotiations are concerned, being a large importer provides more weight in the discussion.

Actually, UK as an import market ranks fourth in relative importance after the USA, Germany and China (Table 1). Centrality indicators confirm that UK plays a key role as importer for many countries covered by TiVA.

Table 1. Transport equipment: Network indicators for the Top 10 importers, 2014

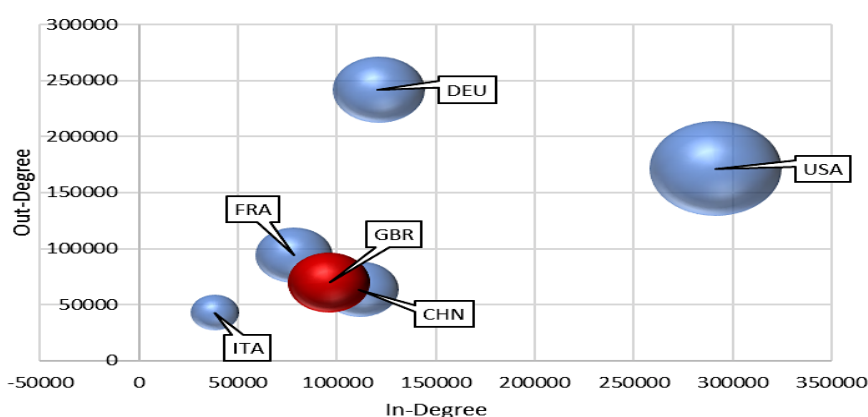
Reporter	In-Degree	Out-Degree	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality <sup>a</sup>	PageRank
USA	291,306	171,154	0.00004	1.00	0.6142	0.0136
DEU	121,365	241,680	0.00003	1.00	0.6056	0.0067
CHN	111,846	63,508	0.00001	1.00	0.5587	0.0046
GBR	96,129	69,767	0.00003	1.00	0.6050	0.0053
CAN	87,553	68,855	0.00003	1.00	0.5987	0.0053
FRA	78,403	93,855	0.00004	1.00	0.6142	0.0046
MEX	58,511	99,505	0.00002	0.97	0.5912	0.0037
RUS	39,545	585	0.00001	0.89	0.5720	0.0017
ITA	38,163	42,935	0.00003	1.00	0.5974	0.0018
ESP	35,922	49,398	0.00003	1.00	0.6076	0.0018

Notes: The reporters are ranked according to their In-degree score. Bilateral flows are weighted by the share of the bilateral flow in total vehicle exports of the reporter; bilateral flows smaller than 1% of reporter's exports were not considered in the calculation of network indicators. a/ Provided for illustration only, see Annex 2 of Escaith (2018).

Source: Author's calculations based on OECD TiVA Nowcasts data.

Indeed, UK, with a PageRank score of 0.00531, ranks third with Canada among all TiVA reporters, after the USA and Germany, but before China and France. One hypothesis for this influential role is that, like Canada, UK benefits from its closer trade relationship with the USA. Another key partner for the UK is Germany (Figure 1), which is particularly export oriented (at the difference of the USA) and maintains close trade relationship with the UK in this sector.

Figure 1. Inter-Industrial World Trade Network in Transport equipment: selected indicators, 2014



Note: The size of the bubble indicates the PageRank score.

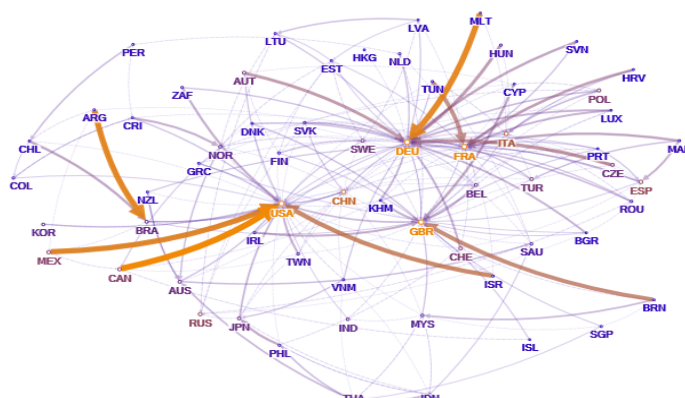
Source: Table 1

## 1.2. Market shares and bilateral trade

In the previous paragraphs, UK's role in the World Trade Network was seen from a global inter-industry perspective, and the inter-industry trade flows were weighted by the monetary value of bilateral trade flows. In such a case, large economies will naturally dominate the results.

But we can also look at the relevance of each import market from the individual perspective of each exporter. In this case, the weight for import markets is given by its relevance to its trade partner, irrespective of the monetary dimension. If an importer absorbs 50% of the exports of a small country, these imports will weigh more than trade from a much larger exporter, if this bilateral flow represents a smaller share of the exporter's total sales. On this basis, UK is an important global player for vehicles and parts (Transport equipment, sector C34T35 of *TiVA*) as far its relevance to exporters is concerned (see Figure 2).

Figure 2. Trade in transport equipment, weighted by share in reporters' exports, 2014



Note: Arcs (exports) are weighted by share of the bilateral flow in total sectoral exports of the reporter; bilateral flows smaller than 1% of reporter's exports were not considered in the calculation of network indicators and exports smaller than 3% are not shown. Nodes (import markets) coloured for their in-degree score from blue (low score) to amber (high score).

Source: Author's calculation based on OECD *TiVA* Nowcasts data.

Among the Top 20 traders (Table 2), non-EU countries represent by far the main destination of UK exports (42.0% compared to 25.5% to EU27 members).

Table 2. Transport equipment: Top20 origins and destinations, 2014

From	To	Percent <sup>a</sup>	From	To	Percent <sup>a</sup>
GBR	USA	21.0	BRN	GBR	53.3
GBR	DEU	10.0	CYP	GBR	29.3
GBR	CHN	7.0	IRL	GBR	26.8
GBR	FRA	6.4	BEL	GBR	26.1
GBR	CAN	2.8	KHM	GBR	25.7
GBR	RUS	2.6	DNK	GBR	16.5
GBR	ESP	1.9	MYS	GBR	14.9
GBR	CHE	1.9	ISL	GBR	12.9
GBR	ITA	1.9	PRT	GBR	12.4
GBR	AUS	1.8	SGP	GBR	12.2
GBR	TUR	1.7	FIN	GBR	12.1
GBR	SWE	1.3	ESP	GBR	11.7
GBR	IRL	1.3	BGR	GBR	11.3
GBR	JPN	1.0	BRA	GBR	10.7
GBR	ZAF	1.0	ITA	GBR	10.3
GBR	BEL	0.8	DEU	GBR	10.0
GBR	HKG	0.8	NLD	GBR	9.7
GBR	SAU	0.8	TUR	GBR	9.6
GBR	KOR	0.8	IND	GBR	9.3
GBR	SGP	0.7	FRA	GBR	8.9

Notes: <sup>a</sup> in percent of total exports of the reporter's sector.

Source: Author's calculations based on OECD *TiVA* Nowcasts.

The picture is more balanced when we look at the importance of UK as an export market: in average, UK represents 18.6% of exports for non-EU members, only slightly more than for EU27 members (15.4%). In particular, UK and Germany respective bilateral market shares are equal (10%) for automotive products, while UK is more important an export market for France and Italy than they are for the UK. Italy exports 10% of its sectoral products to UK while Italy represents less than 2% of UK exports. Trade is also unbalanced with France, which exports 9% of its automotive products to UK while its imports represent only 6.4% of UK exports.

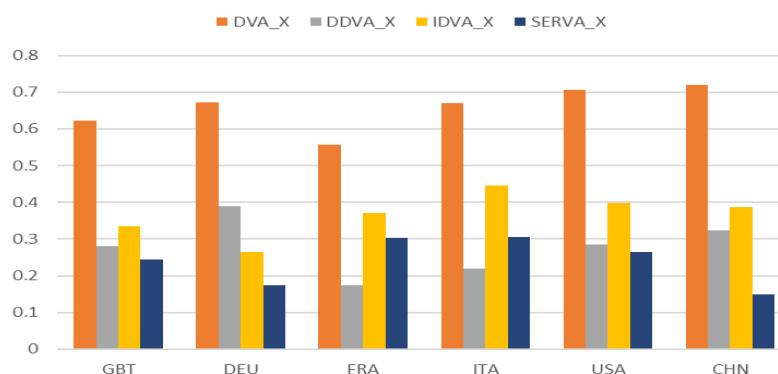
The weight of UK as an export market is particularly high for smaller EU countries such as Cyprus (29%), Ireland (27%), Belgium (26%) or Denmark (17%). Besides Germany, the relative burden of new UK tariffs on the EU imports in the case of a hard Brexit and tit-for-tat UK reciprocity would be particularly high for smaller EU states that have geographical proximity and/or historical ties with the UK (Cappariello 2017).

### 1.3. Sectoral Trade in Value Added (TiVA) indicators: comparative analysis

In this section, we shift our attention to trade in value-added and compare UK's sectoral TiVA indicators with the other EU G20 members (France, Germany and Italy) plus China and the USA. The following graph (Figure 3) pictures the share of domestic value added embodied in sectoral exports (distinguishing direct and indirect sources), and the share of services (domestic and foreign) in total sectoral value.

Among European countries, UK is in an intermediate situation in terms of value-added composition: the share of domestic VA is slightly above 60%, below Germany and Italy but above France. The extent of domestic outsourcing (indirect value-added represent 54% of domestic value added) is larger than in Germany (where most of the domestic value-added comes from the exporting industry itself and only 39% of the tasks are outsourced to other domestic industries) but not as large as France or Italy (67% in both cases). Similarly, the degree of "servicification" of UK's exports lays in-between Germany (low share of services) and France or Italy. Except for a lower contribution of indirect domestic value-added, the UK profile is very similar to the USA' one. Contrary to common perceptions, the imported component of Chinese exports of vehicles and parts is low compared to the other countries.

Figure 3. Transport equipment: Selected TiVA indicators, 2014



Notes: DVA\_X: domestic value added embodied in sectoral exports; DDVA\_X: direct domestic value added from the exporting industry; IDVA\_X: indirect sources of domestic value-added (outsourced to other domestic sectors); SERVA\_X: share of services value-added (domestic and foreign) in total sectoral exports.

Source: Author's calculations based on OECD TiVA Nowcasts.

### 1.4. Impact of Brexit on competitiveness

A hard Brexit is expected to increase EU-UK trade costs due to additional tariffs (EU applies MFN duties to UK products and UK retaliates) but also due to non-tariff trade costs (increased administrative burden and delays at the border). Cappariello (2017) provides estimates of the MFN tariffs in case of hard Brexit. In the case of automobile, the tariff would be about 9%, much higher than the average 4 to 5 percent applied to other goods. In addition, it is expected that the NTM cost will also increase due to additional administrative burden at the border.

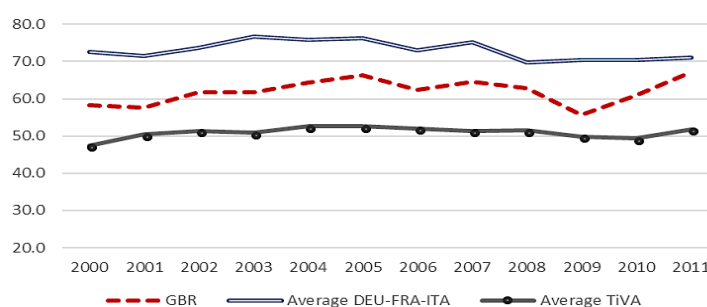
The back-of-envelope simulation sets the monetary impact of these additional costs at 5% ad-valorem for both exports and imports (see Annex 3, 1505). The implication on production cost is based to the reliance of the UK transport industry on EU inputs, which is relatively high (67% of sectoral imported inputs were sourced from EU) and almost similar to what is observed in France, Germany or Italy.

In the Transport equipment case, the direct domestic value-added share is 28% and the indirect one is 33%. The Pound would have to devalue by a margin of 15% to 28% against the Euro in order to nullify the



impact of tariff and non-tariff trade costs under different scenarios (see Annex, Table ). This sector is the most affected of the three industries included in our simulation, due to a combination of factors: high MFN tariffs, high reliance on EU inputs and low coefficient of domestic value-added (62% compared with a UK average of 78%). Moreover, the transport equipment global value chain is based on complex and contractually binding inter-industrial arrangements where participating firms have little freedom on the choice of their inputs. So, there is only a small margin for redirecting imports of inputs to non-EU providers. But, as mentioned in Kee and Nicita (2017), the impact of a change in import tariffs on the demand for UK product depends ultimately of the price elasticity, which is low in the case of Vehicle and Transport equipment.

Figure 4. Imports of intermediate products from EU by Transport Equipment sector (*share of total intermediate imports*)



Notes: Simple averages on France, Germany and Italy, and on all TiVA countries

Source: Author's calculations based on OECD TiVA

## 2. Chemicals

Chemicals (C23T26) is the largest sectoral GVC as far as its weight in world trade is concerned. We apply the same analytical procedure than the one presented previously for Transport equipment.

### 2.1. Sectoral weight of United Kingdom as trade partner

As an importer, UK ranks third after Germany and France when looking at the other three EU-G20 members and 5<sup>th</sup> at world level (Table 3).

Table 3. Inter-Industrial World Trade Network in Chemical: network indicators for the Top 10 importers, 2014

Reporter	In-degree	Out-degree	Weighted Degree	PageRank	Betweenness Centrality	Eigen Centrality
USA	298,304	328,457	626,760	0.0109	0.00001	0.896
CHN	224,879	198,974	423,852	0.0059	0.00001	0.896
DEU	199,384	219,778	419,162	0.0055	0.00001	0.896
FRA	134,557	110,535	245,092	0.0037	0.00000	0.886
GBR	114,647	96,489	211,137	0.0031	0.00001	0.896
JPN	95,327	107,933	203,260	0.0028	0.00001	0.896
MEX	91,003	27,353	118,355	0.0029	0.00000	0.886
ITA	78,247	82,029	160,276	0.0024	0.00000	0.886
CAN	70,291	45,525	115,816	0.0024	0.00001	0.896
ESP	63,824	61,781	125,604	0.0020	0.00001	0.896

Notes: The reporters are ranked according to their In-degree score. Bilateral flows are weighted by the share of the bilateral flow in total vehicle exports of the reporter; bilateral flows smaller than 1% of reporter's exports were not considered in the calculation of network indicators. a/ Provided for illustration only, see Annex 2 of Escaith (2018).

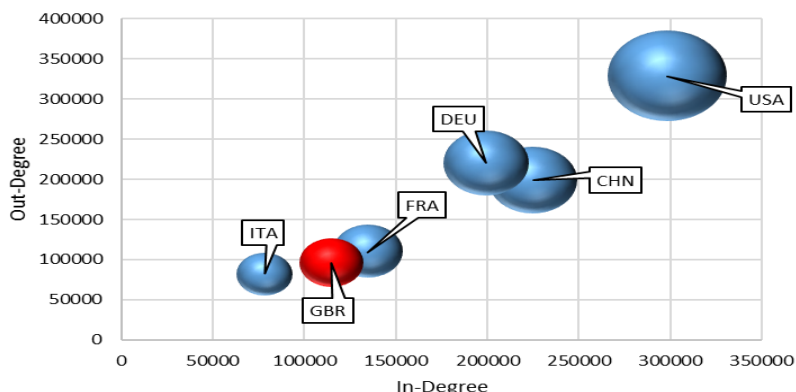
Source: Author's calculations based on OECD TiVA Nowcasts data.

At the difference of transport equipment, UK as a trade node has no other particular strength and its ranking in the Chemical trade reflects basically the sheer volume of trade (weighted degree). Figure 5 shows an almost linear relationship between PageRank, import and export degrees indicators: among the top players, no one benefits from a special network position independently of its economic size for the sector<sup>6</sup>. Indeed, UK's ranking remains high when considering all TiVA reporters. It ranks 5<sup>th</sup> on PageRank with a score of 0.0031, just

<sup>6</sup> As seen below, UK's trade partners are mainly regional ones, with the exception of the USA. Network centrality indicators would have been higher if, for example, the UK had special trade relationship (as an importer or as an exporter) with a key partner outside the region.

before Mexico (0.0029) and Japan (0.0028) and after the USA (0.0109), China (0.0059), Germany (0.0055) and France (0.0037).

Figure 5. Inter-Industrial World Trade Network in Transport equipment: Selected indicators, 201

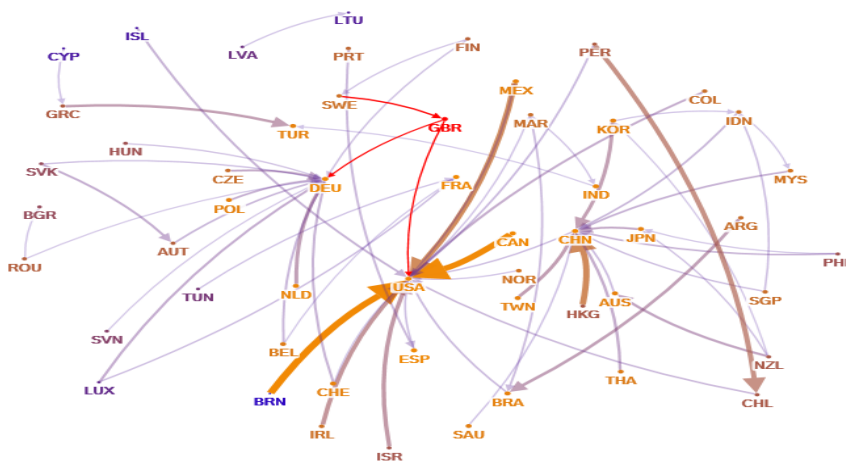


Note: The size of the bubble indicates the PageRank score.  
 Source: Author's calculations based on OECD TiVA Nowcasts data.

### 2.2 Market shares and bilateral trade

Figure 6 shows the trade network graph based on the weight of nodes as export market. The difference in influence (measured as the role as key export markets for other countries) between the three dominant players (USA, China and Germany) and the three next in rank (France, UK and Japan) is obvious in the graph when looking at the number of arcs pointing to these markets (13 for Germany while only 3 for France and 1 for the UK).

Figure 6. Graph of trade in chemical products, weighted by share in reporters' exports, 2014



Note: Arcs (exports) are weighted by the share of the bilateral flow in total sectoral exports of the reporter; bilateral flows smaller than 1% of reporter's exports were not considered in the calculation of network indicators and exports smaller than 3% are not shown. Nodes (import markets) coloured for their in-degree score from blue (low score) to amber (high score).

Source: Author's calculation based on OECD TiVA Nowcasts data. Flows to and from UK highlighted in red.

Table 4 provides more details on the relative importance of trade partners for the UK's Chemical sector. Except for the USA (#1) and China (#9), the Top10 list of UK export markets is populated with European countries. Compared with Transport equipment (Table 2), Europe in general, and EU in particular are much more relevant for UK as market for exports or for imports. And the UK is an important market of export for many European countries: it absorbs about 17% of Sweden sectoral exports and 12% of Belgium's ones. Even for Germany (a key world player in this sector, as we saw), UK weights 8% of its exports, and a similar result is also found for France (in both cases, those EU members are more relevant for the UK as export markets as they are as sources of imports).



Table 4. Chemicals: Top20 origins and destinations, 2014

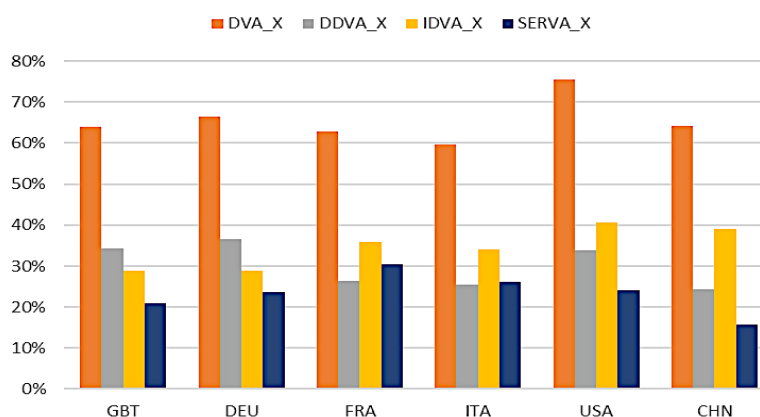
From	To	Percent <sup>a</sup>	From	To	Percent <sup>a</sup>
GBR	USA	13.0	SWE	GBR	16.8
GBR	DEU	12.7	NLD	GBR	11.8
GBR	FRA	9.1	CYP	GBR	11.2
GBR	NLD	8.4	BEL	GBR	11.0
GBR	IRL	5.6	LTU	GBR	10.4
GBR	CHE	4.2	IRL	GBR	10.1
GBR	ESP	3.7	MLT	GBR	9.3
GBR	ITA	3.4	PRT	GBR	9.1
GBR	CHN	3.1	EST	GBR	8.7
GBR	SWE	2.4	FRA	GBR	7.9
GBR	POL	2.4	DEU	GBR	7.8
GBR	CAN	2.0	DNK	GBR	7.3
GBR	BEL	1.9	NOR	GBR	7.2
GBR	JPN	1.8	POL	GBR	6.1
GBR	RUS	1.6	ITA	GBR	5.9
GBR	AUS	1.3	ESP	GBR	5.6
GBR	BRA	1.2	ISR	GBR	5.2
GBR	TUR	1.1	LUX	GBR	5.0
GBR	DNK	1.1	FIN	GBR	5.0
GBR	KOR	1.0	TUR	GBR	4.6

Notes: a\* In percent of total exports of the reporter's sector.

Source: Author's calculations based on OECD *TiVA* Nowcasts.

### 2.3. Sectoral *TiVA* (Trade in Value Added) indicators: comparative analysis

Figure 7 presents UK's sectoral *TiVA* indicators for Chemicals and compares them with the other EU G20 members (France, Germany and Italy) plus China and the USA.

Figure 7. Chemicals: Selected *TiVA* indicators, 2014

Notes: DVA\_X: domestic value added embodied in sectoral exports; DDVA\_X: direct domestic value added from the exporting industry; IDVA\_X: indirect sources of domestic value-added (outsourced to other domestic sectors); SERVA\_X: share of services value-added (domestic and foreign) in total sectoral exports.

Source: Author's calculations based on OECD *TiVA* Nowcasts.

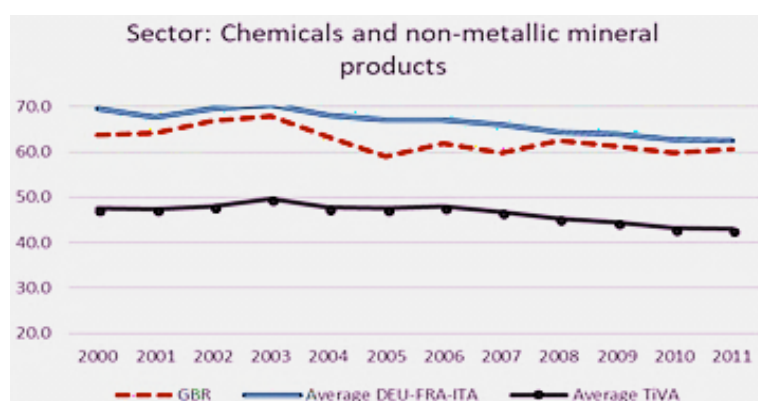
Among European countries, UK is in an intermediate situation in terms of domestic value-added composition: the share of domestic VA is slightly above 60%, below Germany but above France and Italy. UK's *TiVA* profile is similar to Germany's one. Like Germany, the UK chemical sector generates most of the domestic value added (37% and 34%, respectively compared to 26% and 25% for France and Italy). Similarly, UK's sector relies less on domestic outsourcing than France or even Italy. Moreover, the degree of "servicification" of UK's exports (including domestic and foreign sources) is low (only China has a lower value).

## 2.4. Impact of Brexit on competitiveness

Cappariello (2017) estimates that the MFN tariffs faced by UK's exports of chemical products to EU will be low, 2.7%, in case of hard Brexit while EU inputs imported by UK would pay a 2.4% tariff duty. The increase in trade cost is therefore lower than in the case of transport equipment. On the other hand, and as was the case for Transport equipment, the share of domestic value-added is also relatively low (64%) and the reliance on EU inputs is high (Figure 8).

The impact of tariff alone on competitiveness is relatively low (5% in average of the simulations) but in order to nullify the increase in bilateral tariff and non-tariff trade costs with EU27, the Sterling Pound would have to devaluate by 12% to 16% (see Annex Table ). At the difference of transport equipment where parts and components are product specific and not easily substitutable, there is probably a greater flexibility for the UK Chemical industry to reduce its reliance on EU suppliers, at least for the basic and the generic processed inputs.

Figure 8. Imports of intermediate products from EU by UK's Chemical sector (*share of total intermediate imports*)



Notes: Simple averages on France, Germany and Italy, and on all TiVA countries

Source: Author's calculations based on OECD TiVA

## 3. Computer, electronic and optical equipment

After Chemicals and Transport equipment industries, Electronics and Optical equipment is the third largest good-producing sector in terms of total trade flows in 2014.

### 3.1. Sectoral weight of United Kingdom as trade partner

From a global perspective, UK ranks 5<sup>th</sup> in terms of its imports and second in Europe, after Germany. On the export side, UK is not a significant player and is the last one of Table 5 on this criterium. Yet, UK remains overall an important network player in the world of electronic industry and rank 4<sup>th</sup> on the PageRank score.

Table 5. Inter-Industrial World Trade Network in Electronics and optical equipment: selected indicators, 2014

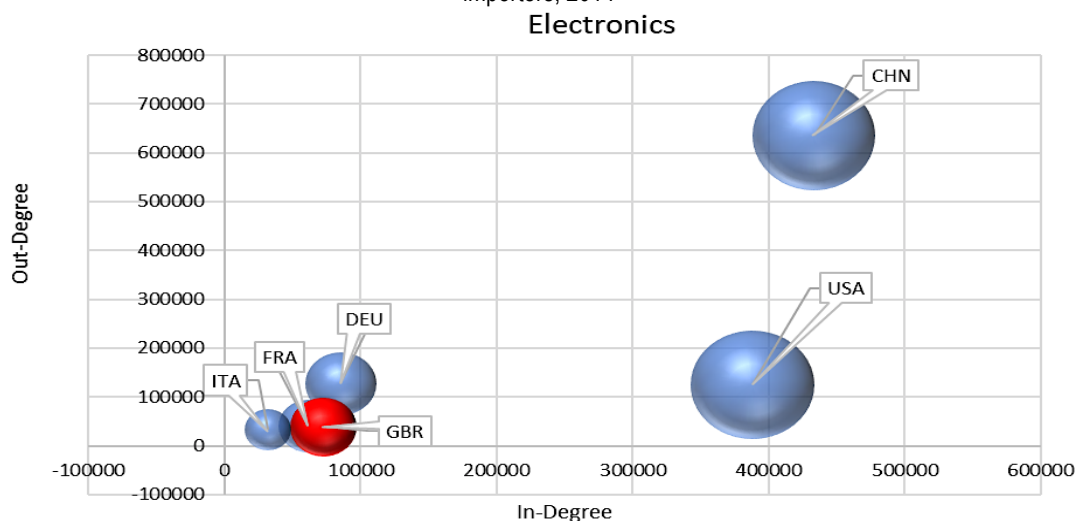
Reporter	In-degree	Out-degree	Weighted Degree	PageRank	Betweenness Centrality	Eigen Centrality
CHN	433 333	635 355	1 068 687	0.0125	0.000013	0.8322
USA	388 509	124 743	513 252	0.0126	0.000013	0.8322
JPN	103 925	133 310	237 235	0.0031	0.000007	0.8098
DEU	85 612	127 086	212 697	0.0042	0.000013	0.8322
GBR	72 832	38 808	111 640	0.0036	0.000013	0.8322
KOR	69 139	125 151	194 289	0.0022	0.000013	0.8197
MEX	63 544	79 853	143 397	0.0029	0.000007	0.8223
FRA	61 465	40 621	102 086	0.0028	0.000007	0.8223
TWN	56 892	131 112	188 004	0.0017	0.000013	0.8197
MYS	48 568	69 790	118 358	0.0018	0.000013	0.8197

Notes: The reporters are ranked according to their In-degree score. Bilateral flows are weighted by the share of the bilateral flow in total vehicle exports of the reporter; bilateral flows smaller than 1% of reporter's exports were not considered in the calculation of network indicators. a/ Provided for illustration only, see Annex 2 of Escaith (2018).

Source: Author's calculations based on OECD TiVA Nowcasts data.

Among the EU G-20, UK's position is very similar to France's one (Figure 9) while Germany – the leading EU trader-- is the only one to have a trade surplus in this sector. China and the USA appear as much larger players in volume, China standing out for its larger exports leading to a trade surplus in this sector.

Figure 9. Inter-Industrial World Trade Network in Electronics and optical equipment: Network indicators for the Top 10 importers, 2014



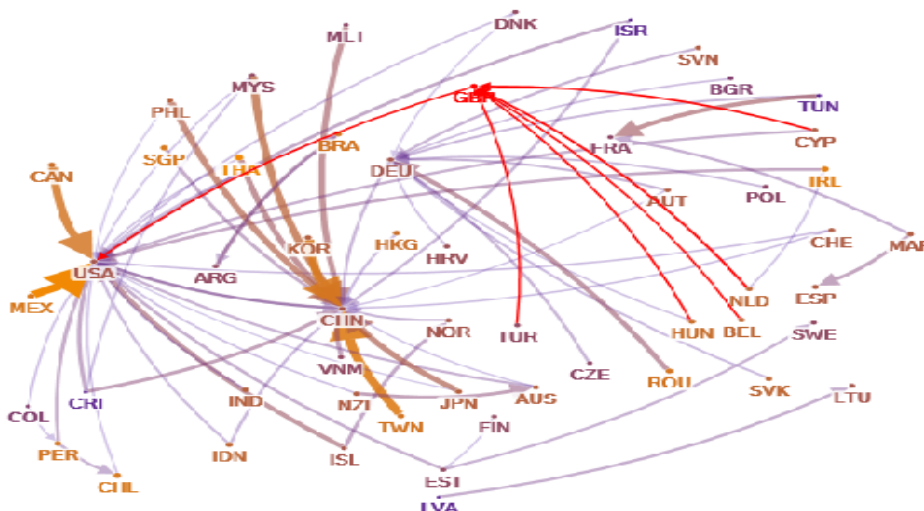
Note: The size of the bubble indicates the PageRank score.  
 Source: Author's calculations based on OECD TiVA Nowcasts data

### 3.2. Market shares and bilateral trade

Compared to France, UK as an importer of electronics appears as a major market for more countries ( ), especially when considering European trade partners.

In the graph, France is a main export market only for two countries, both being in North Africa (Morocco and Tunisia). Among the five countries that count UK as an important market of destination, four are EU members (Belgium, Cyprus, Hungary and the Nederland).

Figure 10. Trade in Electronics and optical equipment, weighted by share in reporters' exports, 2014



Note: Arcs (exports) are weighted by the share of the bilateral flow in total sectoral exports of the reporter; bilateral flows smaller than 1% of reporter's exports were not considered in the calculation of network indicators and exports smaller than 3% are not shown. Nodes (import markets) coloured for their in-degree score from blue (low score) to amber (high score).  
 Source: Author's calculation based on OECD TiVA Nowcasts data. Flows to and from UK highlighted in red.

Table 6 confirms that UK is an important market for EU exporters (only 4 countries are extra-EU in the Top 20 list of exports to UK), especially for smaller countries like Luxembourg (46%) or medium ones like the

Nederland (17%)<sup>7</sup>. EU is not the main market of destination for UK's exports of electronics, as it is also the case of Germany. But while Germany relies principally on China as for its exports, UK is more focused on the USA. On the basis of the Top20 bilateral flows, UK exports to EU members' weight 32% compared to 41% for non-EU destinations. The USA itself absorbs almost 15% of UK's exports of electronics and optical equipment.

Table 6. Electronics and Optical: Top20 origins and destinations, 2014

From	To	Percent <sup>a</sup>	From	To	Percent <sup>a</sup>
GBR	USA	14.8	LUX	GBR	45.8
GBR	CHN	9.5	CYP	GBR	17.5
GBR	DEU	7.5	NLD	GBR	17.1
GBR	FRA	5.4	HUN	GBR	14.7
GBR	IRL	5.3	BEL	GBR	13.8
GBR	ESP	4.0	TUR	GBR	13.6
GBR	ITA	3.9	CZE	GBR	12.2
GBR	RUS	3.7	GRC	GBR	11.1
GBR	JPN	3.1	IRL	GBR	11.0
GBR	SWE	2.2	SVK	GBR	10.6
GBR	AUS	1.7	PRT	GBR	10.4
GBR	KOR	1.7	ESP	GBR	10.3
GBR	MYS	1.6	POL	GBR	10.2
GBR	CHE	1.4	DNK	GBR	9.9
GBR	NOR	1.4	AUS	GBR	8.8
GBR	BEL	1.4	FRA	GBR	8.6
GBR	CAN	1.3	MAR	GBR	7.9
GBR	POL	1.2	NOR	GBR	7.4
GBR	IND	1.1	BRN	GBR	7.3
GBR	BRA	1.0	DEU	GBR	6.8

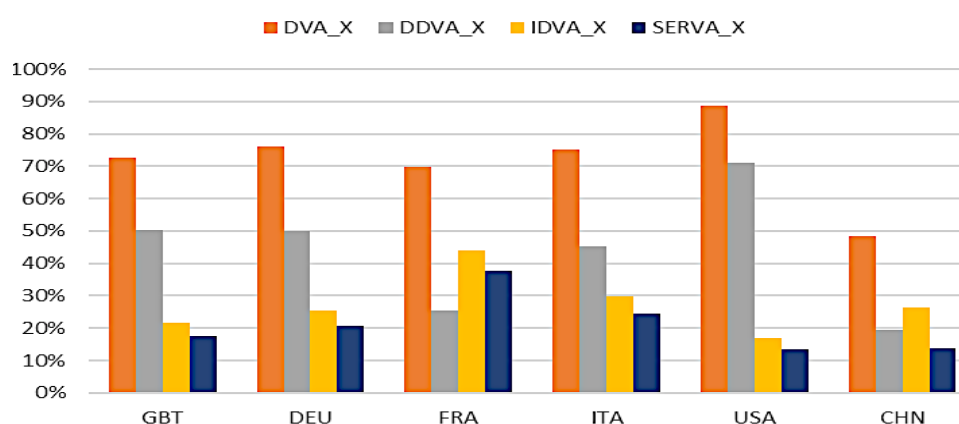
Notes: a\* In percent of total exports of the reporter's sector.

Source: Author's calculations based on OECD TiVA Nowcasts.

### 3.3. Sectoral TiVA indicators: Comparative analysis

As in the case of Transport equipment and Chemicals, UK Electronic sector concentrates most of the exports of domestic value-added on the exporting sector itself, with little domestic outsourcing. Only the US industry is more concentrated. The degree of "servicification" is also low (18%, including both domestic and foreign services) compared to other European countries, in particular France (38%).

Figure 11. Computer, Electronics and Optical equipment: selected TiVA indicators, 2014



Notes: DVA\_X: domestic value added embodied in sectoral exports; DDVA\_X: direct domestic value added from the exporting industry; IDVA\_X: indirect sources of domestic value-added (outsourced to other domestic sectors); SERVA\_X: share of services value-added (domestic and foreign) in total sectoral exports.

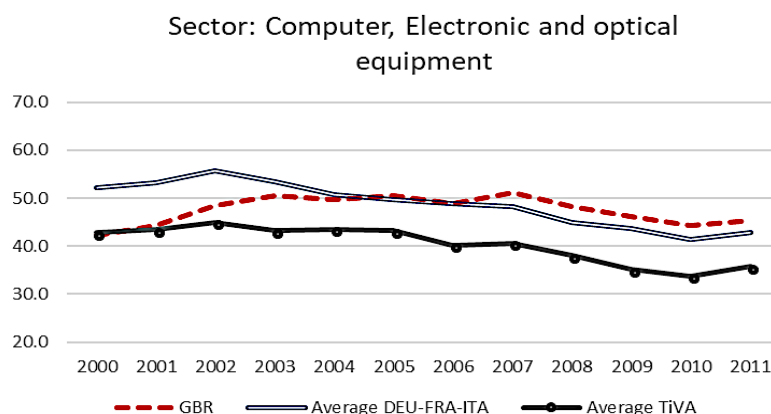
Source: Author's calculations based on OECD TiVA Nowcasts.

<sup>7</sup> Even if statisticians tried their best to filter-out re-exports in the case of countries like the Nederland, there may still remain some over-estimation of the NLD's trade flows due to its central role as a European hub for maritime trade.

### 3.4. Impact of Brexit on competitiveness

The impact of Brexit on tariffs charged by EU27 on UK's exports of electronics and optical equipment is expected to be low. Cappariello (2017) estimates MFN tariffs for the wider group of machinery (except transport equipment) to average 1.9%. Indeed, under WTO's extended IT agreement, a large number of tariff lines in IT are bound to 0. In addition, reliance on EU input is low and decreasing (Figure 12) and the share of domestic value-added (72%) is higher than for Transport and for Chemicals.

Figure 12. Imports of intermediate products from EU by UK's Electronic sector (*share of total intermediate imports*)



Notes: Simple averages on France, Germany and Italy, and on all TiVA countries

Source: Author's calculations based on OECD TiVA

Consequently, Electronics is the less affected of the three sectors analysed in this paper. The Pound would have to devalue by about 3% to cancel the impact of the increase in tariffs, and between 9% and 11% to compensate for the incidence of higher tariff and non-tariff trade costs with the EU (see Annex Table ).

### 4. Sectoral Global Value Chains indices

In GVC trade, firms are organised along a structured production process, with each link performing a specific role and being subject to different challenges. Analysing GVC linkages and position indices delivers some interesting information on the possible impact of export trade barriers on domestic industries (see Box 1). For example, the furthest away from the final market (the longer the length of a GVC and the most upstream an industry is placed within this chain), the less exposed is the domestic industry to a shock (*e.g.*, an increase in tariff) affecting the final product.

#### Global Value Chains production index

One of the most important GVC concepts derived from the international input-output matrices that are behind the OECD-WTO TiVA indicators is the 'length' of a production chain. This 'length' is not measured in geographic terms but as the number of production steps it takes for value added created at the beginning of the production chain to reach final demand, were it is "absorbed" (at the difference of intermediate products, final products are consumed and do not reintegrate the production process as such)<sup>8</sup>.

GVC position index is a relative measure that is based on production length. For a given sector, a country may be located at the beginning of the supply chain (upstream), at the middle or at the end of the production process, closest to final demand (downstream). This relative situation is estimated by computing its GVC position index.

Intuitively, this index is built comparing the number of steps that occur before the sector adds its value-added to the chain, with the number of steps between the industry and the final demand. Following Escaith and Inomata (2016), we use the concept of Average Propagation Length (APL) and define the GVC position index as the ratio of the length of a given country/sector's backward linkage-based APL over its forward linkage one (the distance to final demand). This ratio provides a measure of the relative position of a country in the sectoral global production network: If the ratio is higher (or lower) than 1, the sector is relatively more upstream (or downstream).

<sup>8</sup> This particularly true for consumers' goods. Capital goods (machinery, *etc.*) are used, together with labour, in the production process but not as intermediary inputs. They provide investment services that are remunerated out of the value-added, together with employees' remuneration.

There are other ways of building GVC indices, some based on value-added (as in our case) and other based on production -- see for example Escaith (2017), UIBE (2017) and Wang *et al.* (2017).

Three remarks are called for at this stage. First, there are many different definitions of GVC indexes. Second, because the indicator is the ratio of two indices measuring up and down-steaminess, a change in one direction does not indicate a worsening of the other one, just that it grew less rapidly. Finally, one should not derive normative judgements about the relative position of a given country/sector in the supply chain. Upstreamness may indicate technological dominance in the case of electronics (*e.g.*, production of microchips), as opposed to the downstream final assembly of consumer goods (*e.g.*, TV sets or smartphones), while the opposite may be true for metal products, where upstream firms produce commodities.

Because OECD's ICIO tables had been updated only up to 2011 at the time of collecting our data, this section will use WIOD database, which cover 2000- 2014 in their 2016 revision. Whenever necessary, we estimated 1995 using an extrapolation based on a previous release of WIOD tables. Because the construction of international input-output matrices involves a series of arbitrating between national accounts and trade statistics, the end results may differ from one source to the other one. WIOD 2016 has been compiled following the SNA2008 revision, which may artificially shorten the length of B2B value chains<sup>9</sup>. In addition, both the country coverage and the level of sectoral aggregation differ between *TIVA* and WIOD. WIOD tables distinguish between Motor Vehicles (including trailers) and Other Transport equipment. Similarly, the Chemical sector is disaggregated into Chemical products and Pharmaceutical products. Finally, there are several ways of defining upstream and downstreamness, so the results presented here are partial and indicative only: understanding the actual role of each UK industries in their international supply chain would require a dedicated sectoral analysis.

Table 7. Global Value Chains position indices, 1995-2014

	Level, 2014			Variation 1995-2014 <sup>a</sup>		Variation 2000-2014	
	GVC_APL <sup>b</sup>	APL_f <sup>c</sup>	APL_b <sup>d</sup>	APL_f	APL_b	APL_f	APL_b
<i>Manufacture of chemicals and chemical products</i>							
CHN	1.03	2.61	2.53	13%	10%	12%	12%
DEU	1.13	2.05	1.81	10%	7%	7%	5%
FRA	1.06	1.95	1.85	6%	7%	4%	7%
GBR	1.08	1.93	1.79	4%	9%	3%	9%
ITA	1.07	1.97	1.84	6%	6%	3%	2%
JPN	1.14	2.20	1.93	10%	5%	7%	4%
KOR	1.18	2.28	1.93	8%	2%	6%	2%
USA	1.09	1.88	1.73	1%	1%	3%	0%
<i>Manufacture of basic pharmaceutical products and pharmaceutical preparations</i>							
CHN	0.65	1.42	2.17	-1%	3%	0%	4%
DEU	0.85	1.47	1.73	-4%	6%	-6%	6%
FRA	0.76	1.30	1.72	-3%	10%	-3%	9%
GBR	0.88	1.43	1.62	-5%	3%	-3%	4%
ITA	0.91	1.58	1.73	7%	4%	7%	2%
JPN	0.62	1.14	1.83	-2%	0%	-1%	1%
KOR	0.77	1.48	1.93	20%	6%	17%	5%
USA	0.97	1.68	1.73	-5%	-1%	-1%	0%
<i>Manufacture of computer, electronic and optical products</i>							
CHN	0.96	2.33	2.42	18%	15%	18%	16%
DEU	1.03	1.86	1.80	6%	7%	5%	5%
FRA	0.99	1.80	1.81	4%	12%	5%	12%
GBR	0.95	1.66	1.74	2%	14%	-4%	7%
ITA	1.02	1.86	1.82	6%	11%	3%	6%
JPN	1.05	2.00	1.90	9%	4%	9%	2%
KOR	1.06	2.12	2.00	17%	13%	14%	10%
USA	1.01	1.75	1.73	-3%	7%	-2%	0%
<i>Manufacture of motor vehicles, trailers and semi-trailers</i>							
CHN	0.86	2.11	2.45	3%	9%	3%	8%
DEU	0.93	1.70	1.82	5%	5%	5%	0%

<sup>9</sup> This bias occurs when intermediate goods travel down the GVC without changing ownership.



	Level, 2014			Variation 1995-2014 <sup>a</sup>		Variation 2000-2014	
	GVC_APL <sup>b</sup>	APL_f <sup>c</sup>	APL_b <sup>d</sup>	APL_f	APL_b	APL_f	APL_b
FRA	0.90	1.60	1.77	5%	7%	6%	6%
GBR	0.97	1.69	1.75	3%	6%	5%	5%
ITA	0.95	1.76	1.85	7%	4%	5%	0%
JPN	0.89	1.82	2.05	-6%	-2%	-6%	-5%
KOR	0.88	1.75	2.00	10%	11%	12%	7%
USA	0.87	1.57	1.80	-13%	13%	-3%	0%
<i>Manufacture of other transport equipment</i>							
CHN	0.75	1.79	2.38	5%	8%	4%	7%
DEU	0.92	1.58	1.72	3%	9%	7%	5%
FRA	0.85	1.46	1.72	-1%	10%	0%	9%
GBR	1.02	1.67	1.64	6%	0%	8%	-1%
ITA	0.89	1.66	1.87	7%	8%	5%	3%
JPN	0.80	1.50	1.88	0%	-1%	1%	-2%
KOR	0.92	1.82	1.97	37%	14%	39%	7%
USA	0.88	1.54	1.76	-14%	10%	-1%	2%

Notes: a\* 1995 data based on an extrapolation, the results are presented for completeness only; b/ APL based GVC index equal to the ratio (APL\_f/APL\_b); c/ APL, forward linkages; d/ APL, backward linkages

Source: Based on WIOD data and the UIBE GVC Index developed by the Research Institute for Global Value Chains at University of International Business and Economics (UIBE), China

The GVC\_APL index itself, calculated as the ratio (APL\_f/APL\_b), is of little interest in the present case for inter-country comparison (the same result may come from very different individual values of APL\_f and APL\_b). From the perspective of GVC index and GVC length, UK industries have followed more or less the same trend than the other three large European countries. Actually, the value of APL\_f and its evolution are of more relevance in our case for inferring the vulnerability of UK GVCs to trade restrictions on their EU export market. Intuitively, the shorter is APL\_f, the closer is the industry to final demand and the more directly affected; it is to a change in the importer's trade policy<sup>10</sup>.

Compared with other countries in Table 7, the UK's sector of Computers and electronics industries is closer to final demand and it is getting closer with time. The length of the forward linkages is the smallest of the sample of countries, and it decreased by 4% since 2000. Tariffs are not expected to increase much on this line of products after Brexit, due to the WTO's ITA agreement that binds to zero many related tariff lines. The length of UK's forward linkages is also comparatively short for Manufacture of chemicals and chemical products (the smallest after the USA). The sector moved also forward between 2000 and 2014 on a relative basis: UK's APL\_f increased by only 3% compared to the 5% median value, while the length of backward linkages increased 9%, the second highest score after China<sup>11</sup>. The sector of "Other transport equipment" has consolidated its upstream situation between 2000 and 2014. UK is in an average situation for Pharmaceutical products and for Motor vehicles.

## Conclusions

This article and its first part published in Escaith (2018) aimed at offering background information to researchers interested in performing a sectoral analysis of the implications of Brexit on the UK value chains. Adopting a "general to detailed" comparative approach, the analysis identified in its first part the main characteristics of UK's inter-industrial trade compared to its main trade partners. From a trade perspective, UK's main comparative advantage is in services when looking at both traditional and trade in value-added statistics. Conversely, the UK is not a "special case" when looking at trade in goods. UK's position in the Top5 group of most relevant players in the worldwide network of trade in merchandises is owed more to its economic size than to a particular comparative advantage.

The present article benchmarks UK within "Factory EU" and against other key G-20 countries for three industries that have a particular relevance from a GVC perspective: Transport equipment, Chemicals and

<sup>10</sup> Final goods being, in general, more protected than intermediate ones. Obviously, this is an oversimplification. A proper analysis would need to look at the bilateral GVC length to identify each export market and isolate those that could see a rise in trade barriers as a result of a hard Brexit. Such approach would require a dedicated analysis.

<sup>11</sup> China being an outlier in many cases, the median is a better comparator than the mean.

Electronics. In all cases, the UK value-added decomposition is not very different than other large European countries. Even the degree of “servicification” of the UK industry remains within the regional average, despite the comparative advantage in business services that was shown in Escaith (2018). On a geographical basis, UK exports are usually more diversified than other large EU countries, showing a lower degree of regional integration. UK’s imports highlight its role as market of destination for smaller EU countries. They would suffer a higher burden in the case of new tariffs imposed on EU exports by the UK.

A hard Brexit is expected to increase UK trade costs to and from the EU and affect competitiveness. The Vehicle and Transport equipment UK industry is the sector that is the most affected according to the simulations, due to high MFN tariffs to be applied on bilateral trade with EU and the reliance of the UK transport industry on EU inputs. Hopes that a devaluation of the Pound may compensate for the higher costs must take into consideration that such devaluation will affect only the domestic share of the value-added. The lower is this share, the deeper becomes the required exchange rate adjustment (the so-called “GVC magnification” effect of trade costs). In this case, the Pound would have to devalue by a margin of 15% to 28% against the Euro in order to nullify the impact of tariff and non-tariff trade costs under different scenarios. The extent of exchange rate adjustment is lower for Chemicals (12% to 16%) and for Electronics (9% to 11%).

The simulations show also the role of mitigation policies to preserve the competitiveness of UK industries in the face of higher trade costs with the EU27. Such policies include comprehensive drawback schemes to absorb the increase in tariffs and trade facilitation to reduce the monetary incidence of non-tariff trade costs. Prioritizing trade facilitation is particularly important for the industries that are inserted in international supply chains and need to work on a “just-in-time” basis.

These simulations are rough back-of-envelope calculations and may underestimate the loss of competitiveness if the supply chains are disrupted due to administrative delays and red tape at the border with EU. It is also necessary to end on another note of caution. The review of the literature in Escaith (2018) showed large divergences in outcome when researchers tried to estimate the trade impact of Brexit. We concur with Coutts *et al.* (2018) when they conclude that many in the economic profession will get it wrong on Brexit.

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### Annex: Nominal competitiveness, trade costs and exchange rate simulation

The simulations are based on the national and industrial *TiVA* indicators for 2014 and look at the compensatory devaluation that would be necessary to compensate the loss of UK exports competitiveness to the EU27 due to increased trade costs on inputs imported from EU and output exported to the EU. *TiVA* allows separating the direct domestic value-added (exported by the exporting industry) and the indirect domestic value-added. Therefore, it is possible to disentangle the cross-effects of trade costs, of devaluation of the domestic currency and of differentiated drawbacks on the UK domestic value chain.

This is a back-of-envelope simulation, in the sense that it is merely a simplified accounting exercise simplified. It measures the losses incurred by UK firms due to increased tariff and non-tariffs trade costs on UK output exported to EU and on UK's imports of inputs originating from EU, under three drawback scenarios. Then the simulation defines the devaluation relative to the Euro, which will be necessary to compensate for the increase in trade costs. UK exporters are price takers and have to lower their factory-gate price in Euro in order to compensate for the higher cost of exporting to EU. In addition, they face higher production costs if UK retaliates and imposes MFN tariffs on the inputs they source from EU. A devaluation of the Pound with respect to Euro is expected to compensate both effects, but exchange rate variation will affect only the domestic part of the value-added.

Additional trade costs on output exported to and inputs imported from the EU are the MFN tariffs taken from Cappariello (2017) plus a hypothetical 5% due to the monetary incidence of non-tariff aspects (increased administrative paperwork, delays at the border, etc.). The share of inputs sourced from EU is based on *TiVA* data for year 2014 and includes both goods and services. Indeed, foreign service value-added is often embodied or embedded in tangible inputs (goods) and is also affected by tariffs and other trade costs. The general trend on available 2000-2011 data is for a decrease in the role of EU input suppliers to UK industries, the weight of components sourced from this region has increased markedly for transport equipment and –but to a lesser extent – for electronics and computer (see Table 8 Annex).

Table Annex 8 - Imports of intermediate products imported from EU by sector, UK and selected countries (2000-2011)

Sector/Importers <sup>a</sup>	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
All sectors												
GBR	52.4	52.8	55.1	56.2	54.7	52.4	51.5	52.7	51.0	50.3	49.0	47.9
Average DEU-FRA-ITA <sup>b</sup>	57.7	58.8	60.7	61.3	60.9	58.6	57.3	57.8	55.4	57.0	55.5	54.5
Average <i>TiVA</i> <sup>b</sup>	40.3	40.9	42.0	42.6	43.3	42.0	40.8	41.8	39.7	40.0	39.2	38.9
All Manufacture sectors												
GBR	56.3	57.5	60.8	62.5	61.6	60.6	59.7	60.0	59.8	56.9	56.9	57.8
Average DEU-FRA-ITA <sup>b</sup>	66.6	66.4	68.2	68.5	67.6	66.9	65.6	65.0	63.4	63.3	62.1	62.3
Average <i>TiVA</i> <sup>b</sup>	46.6	46.9	47.1	47.8	47.9	46.9	46.1	45.6	44.3	43.7	42.5	42.9
Chemicals and non-metallic mineral products												
GBR	63.9	64.2	66.8	67.9	63.3	59.0	61.9	59.9	62.5	61.2	59.8	60.7
Average DEU-FRA-ITA <sup>b</sup>	69.5	67.7	69.6	70.4	68.2	67.2	67.1	66.0	64.3	63.9	62.7	62.6
Average <i>TiVA</i> <sup>b</sup>	47.5	47.4	48.0	49.8	47.7	47.5	48.0	46.8	45.3	44.6	43.2	43.0
Computer, Electronic and optical equipment												
GBR	42.3	44.3	48.4	50.5	49.7	50.4	48.9	51.2	48.2	46.2	44.2	45.4
Average DEU-FRA-ITA <sup>b</sup>	52.2	53.2	55.8	53.3	50.7	49.7	48.8	48.2	45.0	43.7	41.4	42.8
Average <i>TiVA</i> <sup>b</sup>	42.8	43.5	44.9	43.2	43.5	43.2	40.2	40.6	38.0	35.1	33.8	35.7
Transport equipment												
GBR	58.3	57.7	61.8	61.8	64.3	66.2	62.3	64.5	62.9	55.7	60.8	67.1
Average DEU-FRA-ITA <sup>b</sup>	72.6	71.6	73.6	76.6	75.9	76.2	73.0	75.2	69.9	70.5	70.3	71.1
Average <i>TiVA</i> <sup>b</sup>	47.5	50.4	51.4	50.9	52.6	52.6	52.0	51.4	51.5	49.9	49.3	51.9

Notes: a\* Share of EU imported intermediate imports in the imported total, percentage; b/ simple average.

Source: Author's calculation based on *TiVA* data

The devaluation of the Pound affects the price of the domestic value added (wages, profits and net indirect taxes) expressed in USD (the *TiVA* accounting unit). Because the domestic share of value-added is always lower than 1, a 1% increase in trade cost will only be compensated by a devaluation larger than 1%. This is an example of the “*magnification effect*” of trade costs in GVC production settings (Escaith 2017). For example, in the case of transport equipment, a 9% increase in EU tariff on UK exports requires a (9%/62%=14.5%) Pound-Euro devaluation to reduce one-to-one the cost of UK primary and intermediate inputs (calculation based on 2014 *TiVA*

coefficients). The lower the domestic share of value-added, the higher the devaluation required compensating higher trade costs. We assume for simplicity that the procurement price of the indirect domestic-value added is derived from a fixed mark-up on the cost of production of first and second tiers domestic suppliers: The cost of sourcing inputs from these suppliers will increase in proportion of the additional import costs they have to pay on the share of Foreign Value-Added sourced from EU<sup>12</sup>.

Three options are considered for drawing-back the additional trade costs (tariffs and non-tariffs) paid on imported inputs when the product is exported. In the first one, additional trade costs on imported inputs can be drawn-back by all domestic producers; in the second one, only the direct exporters can reclaim the additional trade costs: first and second-tiers domestic suppliers cannot benefit from draw-back schemes and reflect the increased trade costs on their imported inputs in their output prices. The third option excludes all possibility of draw-backs. Another way of looking at these options is the following: the full draw-back situation refers to the case where all UK firms contributing to the domestic value chain are able to divert their purchase of inputs to cheaper non-EU suppliers, a situation somewhat similar to the Minford (2016) hypothesis; the second option applies when the UK lead-firm can do it but not its second-tier suppliers (a very improbable situation when trade takes place in a global value chain as participating firms have little choice when picking their key suppliers, see footnote 12); the third option applies when no trade substitution is possible.

The cost-implication of the first case is straightforward: when all additional trade costs on imported inputs are subsidized (reimbursed through a draw-back system) or avoided, the net effect on the market price of the UK export in EU is the additional trade cost on exported output (e.g., additional tariffs imposed by importing countries). When drawbacks are limited to the exporting industry (the general case), the calculation is more complex. If the exporting firm does not have to pay a higher price for its imported inputs, its production costs will nevertheless increase due to the higher procurement cost of EU inputs sourced from first and second tier domestic suppliers (per Table 8 Annex, 48% of foreign inputs are sourced from EU in average of UK sectors). In absence of drawbacks, the additional trade cost is equal to the cost of exporting plus the cost of sourcing all EU inputs required by the exporting industry and its UK suppliers. For example, if no drawback schemes are made available to the exporters of transport equipment and their domestic suppliers, the additional production cost due to higher inputs imported from EU is 1.3% and the required compensatory devaluation is 16.6%  $([9\%+1.3\%]/62\%)$ , see Table 9. The simulation highlights the weight of non-tariff trade costs, which may amplify the devaluation required to compensate additional trade costs up to a factor of 5, as well as the importance of devising administrative and fiscal measures to reduce their impact.

Table 9. Compensatory devaluation required to cancel-out the effect of increased EU27 trade costs

Drawback:	Full		Partial		None	
	Tariff	Tariff and NTM	Tariff	Tariff and NTM	Tariff	Tariff and NTM
Transport equipment	14.5%	22.5%	15.3%	24.1%	16.6%	26.7%
Chemicals and non-metallic mineral products	4.2%	12.1%	4.9%	13.3%	6.0%	15.6%
Computer, electronic and optical equipment	2.6%	9.5%	2.9%	10.1%	3.5%	11.3%

Note: Based on 2011 *TiVA* coefficients, includes additional production and export costs (see text)

Source: Author's calculation based on OECD-WTO *TiVA* database and Cappariello (2017)

This simulation is based on a set of simple accounting relationships and does not pretend to be an economic analysis of the impact of trade costs on production and market prices. A more detailed backward linkage analysis would allow identifying the particular sector supplying specific inputs to each exporting industries and calculate more precisely the additional net cost. Inputting the monetary impact of non-tariff trade costs would be more difficult, albeit some estimates do exist (Escaith 2017). Moreover, the simulation implies a full passthrough on prices of duty taxes and other additional trade costs due to a hard Brexit. This may not be the case when firms "price to market" and adjust accordingly their mark-up margins. Additionally, if demand for intermediate products is price elastic (high Armington elasticity), UK producers may shift to cheaper non-EU suppliers<sup>13</sup>. For complex GVC products, it is probable that the price elasticity within a GVC is low, so little substitution may take place in the short to medium terms. On the other hand, as the market for complex products is often oligopolistic, adjusting mark-up margins to absorb variations in procurement prices is quite plausible.

<sup>12</sup> In other words, there is no trade deviation on inputs after leaving the EU (correcting an EU28 trade diversion effect), a hypothesis which is consistent with most empirical studies (Freund and Ornelas 2010) and would almost certainly apply when B2B input trade takes place within a well-structured international supply chain.

<sup>13</sup> Long-run estimates of Armington elasticities are usually larger than short-run estimates, which means that our simulation applies mainly in the short-run.

## The Effectiveness of Social Media and Press Release Transparency to Detect Indications of Financial Fraud

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### Abstract:

The purpose of this study is to investigate whether the transparency of social media and press releases can detect the financial fraud. This study uses 723 observational samples from 369 companies listed on the Indonesia Stock Exchange from 2015 to 2016. This study shows that social media transparency has negative and significant effects on the indication of financial fraud. However, there is no significant association between press release coverage and an indication of financial fraud. For investors, the results of this study indicate that social media transparency is one determinant that can be used to detect the indications of fraudulent acts on financial statements by the firms.

**Keywords:** financial fraud; social media; press release; media coverage.

**JEL classification:** G39; L82; M10

### Introduction

Prior research indicates that the media promises transparency and openness tools (Mäkinen and Kuira 2008). The media can act as a watchdog that can be used by investors, creditors and governments to oversee the day-to-day actions and activities of companies. Based on Miller's research in the United States, the media has an important role in detecting accounting fraud (Miller 2006). For example, research conducted by Dyck (2008) shows that the media acted as a whistleblower in 17-24% corporate fraud cases in the United States in the period 1996–2004. Literature suggest that social media or Web 2.0 allows the exchange of information in the form of text, images and videos that can generate transparency and is user-friendly (Karakiza 2015). Social media has the potential to accelerate the culture of openness (Bertot *et al.* 2010), while press releases promote sharing information about a company either through press conferences, video broadcasts, press statements or written reports of events, such as commissioners' replacements submitted either through online media or newspapers.

This study examines the effectiveness of social media and press release transparency to detect indications of financial fraud of companies listed on the Indonesia Stock Exchange (IDX) from 2015–2016. With respect to the social media, we predict that company with higher disclosure on social media is a signal that the company do not hide any or substantial information to the market, which indicates that information assymetry is low. Therefore, the fraudulent activities is low which inline with the findings from Gajewski and Li (2015). For the press release, the more news the company has on its press releases, the more likely this is a bad signal about the company (for example norm violation, corruption, *etc.* (Dyck *et al.* 2008).

To investigate this issue, we use a sample of 1124 firm-year observations from 369 listed firms on the IDX from 2015–2016. Indonesia has a developing market with a growing rate of Internet usage, thus it is ideal to examine the effectiveness of social media and press release transparency of companies to detect indications of financial fraud. In our analysis, we use a two-stage regression model by using STATA 14. Our results indicate that social media can be used to predict indications of fraudulent financial statements. This result is consistent



with Bertot (2010) and Gajewski (2015). However, press releases cannot be used as a tool to predict indications of fraudulent financial statements. This is because the nature of press release publishing is seasonal. Companies usually publish news and press releases before approaching initial public offering (IPO) or to apologize after breaking norm. This result is in line with the research undertaken by Dyck (2008).

This study adds new evidence to existing literature in detecting indications of financial fraud. Prior studies examined how media can be a watchdog for accounting fraud (Miller 2006) and minimizing asymmetry information (Gajewski and Li 2015). In this paper, we examine the media transparency of social media and press release coverage as a tool to detect indications of financial fraud. We determine that social media transparency and the indication of financial fraud has a negative relationship, therefore, it can be used as a tool to detect financial fraud. Thus, our result informs and encourages companies to maximize the usage of their websites since these could be useful tool for stakeholders in supervising their operations. The remainder of this paper is structured as follows: Section 2 presents the research hypotheses; Section 3 describes samples and variables; Section 4 presents the results of the study and Section 5 presents the conclusions.

## 1. Literature review and hypotheses

### 1.1 Literature review

The signaling theory is a theory that explains when there are two parties who have different access to information. The sender chooses the way to communicate the information and the receiver interprets it (Connelly *et al.* 2011). Management is the owner and sender of information, while the shareholder is the receiver of the information. This process often leads to information asymmetry. Information asymmetry is the inequality of information that results from the disparity of knowledge in both the context of the organization and the business (Taj 2016). Information asymmetry occurs if one party has more information than the other. Getting accurate information in a business process is crucial because it affects the decision-making process (Connelly *et al.* 2011). Therefore, one of the main aims of the signaling theory is to reduce or eliminate asymmetric information.

The legitimacy theory explains that organizations must continue to ensure that management actions conform to community norms, values, beliefs and expectations (Deegan 2002). Legitimacy can be obtained if there is conformity between the activities of the company with the existing values in society and the environment. If an organization ignores social expectations, its legitimacy is compromised (Black and Quach 2009). Legitimacy is given by external parties outside the company; however, it can also be obtained from internal parties within the company (O'Donovan 2002). Legitimacy management relies on communication between reporting entities and stakeholders (Samkin *et al.* 2010). This communication can be done through press releases.

To reduce asymmetric information, a good corporate governance principle is required; a concept that equates the interests of shareholders with managers to create harmony between the two parties. This principle is necessary to ensure shareholders have confidence in the management and that the management does not steal or embezzle funds for something unfavorable to shareholders. Corporate governance has five basic principles that must be enforced, one of which is transparency (Kaihatu 2006). Information transparency is common practice in companies that can create competitive advantage (Kohut and Segars 1992). The transparency of financial information is achieved through financial statements, while the transparency of non-financial information is communicated using other media tools (Lim *et al.* 2007).

Social media and press releases have become a common communication tool used by companies to disclose non-financial information. Social media or the Web 2.0 platform is an internet-based application that enables the exchange of information in the form of text, images and videos that can create transparency, trust, and strengthen reputation (Karakiza 2015). Information disclosure through the website aims to align the interests of managers and shareholders (Amalia and Laksito 2013). Press releases are a collection of information in the form of news created by the public relations (PR) team of a company to be submitted to the mass media editorial (Ardianto 2011). Press releases convey information about the company to the public, channel public opinion to the company and create a harmonious relationship between the company and the community (Kriyantono 2008). Three types of press releases based on the emphasis of contained information are as follows:

- Basic Publicity Release is the publication of information about a company that covers various news values disseminated through local, regional or international media;
- Product Release is a publication used by a company to market or introduce a new product that is not yet known by the public;
- Financial Release is the publication of financial information within the company to the public (Bivins 1993).



In Statement on Auditing Standard (SAS) number 99, fraud is defined as a deliberate act that results in material misreporting in financial statements (AICPA 2002). Furthermore, there are two types of fraud, based on the perpetrator: the object and the victim (Zimbelman 2014). Fraud based on the perpetrator is divided into two types: fraud committed against the organization and fraud committed on behalf of the organization. Cheating by object is divided into three types, namely: misuse of assets, acts of corruption and fraudulent financial statements. Fraud based on the victim includes fraud within the company or organization as its victim, management fraud, customer fraud and miscellaneous fraud. There are three conditions that lead to the occurrence of fraudulent financial statements: pressure, opportunity and rationalization. These three conditions are commonly called the fraud triangle (Christopher *et al.* 2009).

Early fraud detection is absolutely necessary to reduce and prevent further fraudulent financial statements. Detection of fraudulent financial statements can be achieved using various methods, such as financial statement analysis, manager incentives or compensation, product market competition and pressure. The detection technique of fraud in this research uses the method of company social relationships and analysis of financial reports. Corporate social relationships are evident in how companies convey financial and non-financial information to the public through their social media (website) and press releases. Financial statements analysis detects indications of financial fraud; the Beneish M-Score Model (Beneish *et al.* 2012) is a model of financial statement detection through the analysis of ratios and is presented in Appendix 3.

## 1.2 Hypotheses

Social media is a platform that provides information in real time that can be accessed by the community. Through thorough and real-time information dissemination, transparency will increase so that the company can apply the principles of good corporate governance. With good corporate governance principles exhibited through the transparency of this information, getting real-time information that will affect the decision-making process will also positively impact shareholders. In addition, through social media, shareholders, government and the public can also act as a watchdog or supervisor of actions taken by the company. Through this supervision, the company can no longer hide its fraudulent actions. Previous research supporting this observation were conducted by Bertot *et al.* (2010), and Gajewski and Li (2015).

*Hypothesis 1 (H1): Social media transparency negatively affects the indication of financial fraud*

Non-financial information may also be used to detect fraud. This information could be obtained by the shareholders, government or the public through the news, both in mass media and printed media, such as newspapers. Publicizing through this media, or commonly referred to as a press release, plays an important role in finding indications of fraud committed by the company (Ay (2010), Brazel *et al.* (2009), Dyck *et al.* (2008), and Miller (2006)).

*Hypothesis 2 (H2): Press release transparency positively affects the indication of financial fraud*

## 2. Data and variable measurement

### 2.1 Sample and data source

The initial sample contains all companies listed on the IDX and included in the Orbis database and the Indonesian Capital Market Directory (ICMD) for the period 2015–2016. All financial data are sourced from Orbis, auditor data, as well as company ownership sourced from ICMD. The authors use several sample selection criteria. First, due to the ineffectiveness of the Beneish M-Score to measure indications of fraud in the financial sector, the authors exclude companies in financial industry (Standard Industrial Classification (SIC) code number 6). Second, the company's financial statements ended on December 31 and were audited and published. Third, the company has an official website and can be accessed openly. After applying the above criteria, the authors obtained 723 sample observations from 369 companies.

### 2.2 Measurement of social media transparency

The social media coverage (MEDIACOV) is measured using the Internet Corporate Disclosure Index (ICDI), calculated from the large number of voluntary information disclosures within the companies' web. Web-based questionnaires are used by the authors to measure the voluntary disclosure of information within the companies' web. The web-based questionnaire that the authors use is adapted from the research developed by Garay *et al.* (2013) that contained 32 questions, as shown in Appendix 1. If there is such information on the companies' web, the number 1 was allocated and 0 otherwise.

### 2.3 Measurement of press release coverage

We follow previous research Miller (2006) and Ay (2010) to measure press coverage variable (PRESSCOV). PRESSCOV is measured by the number of news articles related to the company, presented in mass media at a certain time, *i.e.* in 2015 and 2016. The mass media used by the authors is electronic mass media that can be accessed from a collection of news from various newspapers, electronic magazines and Google news. The reason for using this electronic mass media is because access is unlimited to everyone, and it is wider ranged and in real time compared to printed media.

### 2.4 Measurement of indications of fraudulent financial statements

An indication of financial fraud is measured using Beneish M-Score, a financial report detection model. In this method we use several variables to measure the financial fraud. The variables are: Days Sales in Receivables Index (DSRI), Gross Margin Index (GMI), Asset Quality Index (AQI), Sales Growth Index (SGI), Depreciation Index (DEPI), Sales, General and Administrative Expenses Index (SGAI), Leverage Index (LVGI), and the Total Accruals to Total Assets (TATA). The company is categorized to engage in financial manipulation if the M-Score < -2.2 (Beneish 1999, Beneish *et al.* 2012). The equation is presented below:

M-Score with eight variables:

$$M = -4.84 + 0.920 \text{ DSRI} + 0.528 \text{ GMI} + 0.404 \text{ AQI} + 0.892 \text{ SGI} + 0.115 \text{ DEPI} - 0.172 \text{ SGAI} + 4.679 \text{ TATA} - 0.327 \text{ LVGI} \quad (1)$$

M-Score with five variables:

$$M = -6.065 + 0.823 \text{ DSRI} + 0.906 \text{ GMI} + 0.593 \text{ AQI} + 0.717 \text{ SGI} + 0.107 \text{ DEPI} \quad (2)$$

## 3. Empirical analysis

### 3.1 Descriptive statistics

Table 1. Companies' distribution

PANEL A: Companies distribution based on *industry classification*

SIC code	Industry	No of companies	%
0	Agriculture, forestry and fisheries	30	4,14 %
1	Mining and construction	107	14,78 %
2	Manufacturing	192	26,66 %
3	Basic industries and chemicals	133	18,37 %
4	Transportation, communications, electrical, gas and sanitation services	108	14,92 %
5	Wholesale Trade	75	10,36 %
7	Retail Trade	60	8,29 %
8	Services	18	2,49 %
TOTAL		723	100,00 %

Note: Table displays the sample distribution of companies listed on the IDX in 2015-2016 based on the industry classification.

PANEL B: Companies distribution based on year-end

Year	No of companies	%
2015	357	49,31 %
2016	366	50,69 %
TOTAL	723	100,00 %

Note: This table displays the sample distribution of companies listed on the IDX 2015-2016 by year.

To facilitate the reader, we provide the definition of the variables used in this study in Appendix 2. Table 1 shows the distribution of industry and year-based observation samples. Before processing the data to perform descriptive statistics, the authors firstly winsorized the data. Winsorization was done to overcome data containing outliers by pulling the lowest outliers data to 1% level and pulling the highest data outliers to 99% level. The result of statistical analysis performed using STATA after winsorizing the data is shown in Table 2. From Table 2, it is known that the Beneish M-Score Model with eight variables (FINFRAUD1) and five variables (FINFRAUD2) has an average of -2.169 and -2.610, respectively. If the company has an M-Score of more than -2.22, the company is said to be a manipulator (Beneish 1999) and not a manipulator otherwise. This means that by using the eight variable M-Score, the company is said to be a manipulator because it has an M-Score value of more than -2.22,

*i.e.* -2,169. However, different things are shown from the five variable M-Score that indicates the company is not a manipulator, since it has an average M-Score value of less than -2.22, *i.e.* -2.610. The use of the M-Score with five variables is preferred by Beneish (1999) because it is more effective in detecting an indication of financial fraud than the M-Score with eight variables. The average value of MEDIACOV above is 11,014 of the total 32 points of ICDI. This means that the average sample of firms only reveals 34.4% of the overall information on the company's website. The lowest value of MEDIACOV is indicated by the number 0, meaning that the company already has a corporate web, but its content is incomplete.

Table 2. Descriptive statistics

Variable	Mean	Median	Minimum	Maximum
FINFRAUD1	-2.169	-2.407	-5.095	3.755
FINFRAUD2	-2.610	-2.855	-5.935	2.234
MEDIACOV	11.014	13.000	0.000	26.000
PRESSCOV	115.118	8.000	0.000	14,400.000
GROWTH	967.989	1,168.076	-8,913.179	9,688.511
TASSETS	808.673	225.519	1,057.921	2,618.550
TOBINSQ	1.096	0.520	0.020	11.830
BIG4	0.388	0.000	0.000	1.000
NBOM	8.961	8.000	4.000	23.000
BRDIND	0.157	0.167	0.000	0.500
ACIND	0.255	0.333	0.000	1.000
ROA	1.787	1.510	-33.690	32.500
RECSALES	0.011	0.004	-0.353	0.537
FIRMAGE	32.659	31.000	2.000	116.000

Note: This table shows descriptive statistics for all the variables used in this study by displaying the original values.

The average value of PRESSCOV is 115,118. This means that in 2015 and 2016, the average sample companies preached their activities in the mass media with a total of 115 news articles each year. The middle value of PRESSCOV, 8.00, indicates a range of values that is far from average. This shows that some companies have mass media coverage in large numbers, while others do not. The maximum and minimum PRESSCOV is 14400.00 and 0.00. This means there are companies that have the news reach of 7200 news in one year, but on the contrary, there are companies that do not have the news at all whose shares are in the category of sleep stock.

## 3.2 Main analysis

### 3.2.1 Pearson's correlation test

Based on the Pearson correlation test shown in Table 3, the correlation between the MEDIACOV and FINFRAUD1 and FINFRAUD2 variables was 0.065 and 0.072, respectively, meaning that the relationship between MEDIACOV and FINFRAUD1 and FINFRAUD2 was positive with a significance level of 10%. The correlation value between PRESSCOV and FINFRAUD1 variables is positive, while FINFRAUD2 has a negative correlation.

Table 3. Pearson correlation test

Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
[1] FINFRAUD1	1.000													
[2] FINFRAUD2	0.423***	1.000												
	(0.000)													
[3] MEDIACOV	0.065	0.072*	1.000											
	(0.107)	(0.073)												
[4] PRESSCOV	0.011	-0.010	-0.000	1.000										
	(0.789)	(0.803)	(0.997)											
[5] GROWTH	-0.021	0.030	0.059	-0.004	1.000									
	(0.604)	(0.461)	(0.145)	(0.915)										
[6] OCSBLOCK	-0.018	-0.009	0.054	0.012	-0.045	1.000								
	(0.656)	(0.830)	(0.180)	(0.772)	(0.264)									
[7] SIZE	0.036	0.016	0.017	-0.009	0.008	-0.042	1.000							
	(0.376)	(0.699)	(0.674)	(0.821)	(0.836)	(0.293)								
[8] TOBINSQ	0.141***	0.083**	-0.052	0.221***	0.038	-0.041	0.007	1.000						
	(0.000)	(0.038)	(0.199)	(0.000)	(0.346)	(0.311)	(0.854)							
[9] BIG4	-0.033	-0.024	0.090**	0.035	0.123***	-0.095**	0.067*	0.080**	1.000					
	(0.407)	(0.549)	(0.025)	(0.385)	(0.002)	(0.018)	(0.094)	(0.045)						
[10] BSIZE	-0.073*	-0.055	0.062	0.051	0.078*	-0.052	0.065	0.080**	0.170***	1.000				
	(0.071)	(0.169)	(0.123)	(0.206)	(0.053)	(0.192)	(0.107)	(0.046)	(0.000)					
[11] BRDIND	-0.044	-0.061	-0.114***	0.036	-0.009	-0.082**	-0.050	0.106***	-0.048	-0.014	1.000			
	(0.270)	(0.128)	(0.005)	(0.373)	(0.824)	(0.041)	(0.213)	(0.008)	(0.232)	(0.734)				
[12] ACIND	-0.035	-0.080**	-0.068*	0.027	0.029	-0.072*	-0.022	0.014	0.048	0.001	0.616***	1.000		
	(0.380)	(0.046)	(0.092)	(0.508)	(0.467)	(0.072)	(0.576)	(0.732)	(0.233)	(0.990)	(0.000)			
[13] ROA	-0.010	-0.007	0.027	0.119***	0.197***	-0.009	0.023	0.220***	0.158***	0.090**	0.054	0.055	1.000	
	(0.808)	(0.870)	(0.495)	(0.003)	(0.000)	(0.829)	(0.564)	(0.000)	(0.000)	(0.024)	(0.183)	(0.170)		
[14] RECSALES	-0.183***	-0.156***	-0.010	0.005	-0.011	0.069*	-0.033	0.015	-0.105***	-0.021	-0.023	0.019	-0.078*	1.000
	(0.000)	(0.000)	(0.806)	(0.908)	(0.790)	(0.086)	(0.413)	(0.706)	(0.009)	(0.599)	(0.565)	(0.632)	(0.051)	
[15] FIRMAGE	0.007	0.031	-0.020	-0.052	-0.001	-0.055	0.071*	0.057	0.110***	0.076*	-0.002	-0.065	0.056	-0.033
	(0.860)	(0.447)	(0.616)	(0.198)	(0.977)	(0.170)	(0.079)	(0.156)	(0.006)	(0.059)	(0.960)	(0.105)	(0.162)	(0.412)

Note: This table displays the Pearson correlation test results from 723 listed companies in IDX 2015-2016 with \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01, the significance level of 10%, 5% and 1%.

## 3.2.2 Multiple linear regressions test

Table 4 shows the results of multiple linear regression tests between MEDIACOV against FINFRAUD1 and FINFRAUD2 with control variables. Coefficients are marked positive, meaning that the independent variable changes in the direction of the dependent variable changes, and vice versa. We present OLS and robust regression results for each financial fraud variables.

$$\text{FINFRAUD} = \alpha + \beta_1 \text{MEDIACOV} + \beta_2 \text{GROWTH} + \beta_3 \text{OCSBLOCK} + \beta_4 \text{SIZE} + \beta_5 \text{TOBINSQ} + \beta_6 \text{BIG4} + \beta_7 \text{BSIZE} + \beta_8 \text{BRDIND} + \beta_9 \text{ACIND} + \beta_{10} \text{ROA} + \beta_{11} \text{RECSALES} + \beta_{12} \text{FIRMAGE} + \varepsilon \quad (1)$$

Table 4. Regression result of media coverage on financial fraud

VARIABLE	PREDICTED SIGN	FINFRAUD1		FINFRAUD2	
		(1)	(2)	(3)	(4)
MEDIACOV	-	-17.161*	-17.161**	-17.354**	-17.354**
		(-1.88)	(-2.04)	(-2.04)	(-2.27)
GROWTH	+ / -	0.004	0.004	-0.010	-0.010
		(0.32)	(0.30)	(-0.83)	(-0.74)
OCSBLOCK	-	1.363	1.363	0.704	0.704
		(0.30)	(0.25)	(0.16)	(0.14)
SIZE	+	-0.070	-0.070	-0.035	-0.035
		(-0.84)	(-0.79)	(-0.44)	(-0.40)
TOBINSQ	+	-1.233***	-1.233***	-0.667**	-0.667
		(-4.26)	(-2.66)	(-2.46)	(-1.52)
BIG4	-	0.146	0.146	0.113	0.113
		(1.35)	(1.37)	(1.12)	(1.23)
BSIZE	+	0.000**	0.000*	0.000	0.000
		(2.04)	(1.80)	(1.52)	(1.48)
BRDIND	-	1.061	1.061	0.568	0.568
		(1.61)	(1.47)	(0.92)	(0.90)
ACIND	-	-0.694	-0.694	4.083	4.083
		(-0.18)	(-0.18)	(1.16)	(1.11)
ROA	+ / -	5.231	5.231	3.864	3.864
		(0.94)	(0.82)	(0.74)	(0.59)
RECSALES	+	2.354***	2.354***	1.826***	1.826*
		(4.94)	(3.02)	(4.10)	(2.07)
FIRMAGE	-	-0.976	-0.976	-2.308	-2.308
		(-0.33)	(-0.34)	(-0.84)	(-0.76)
Industry dummies		Yes	Yes	Yes	Yes
Year dummies		Yes	Yes	Yes	Yes
R-squared		0.082	0.082	0.064	0.064
N		621	621	621	621

Note: This table shows the results of multiple linear regression of social media transparency and indication of fraudulent financial statements of 621 companies registered on IDX 2015-2016 with \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

In Table 4 specification 1, the coefficient of MEDIACOV is -17.161 and significant in 10% level. In specification 2, robust regression, the significant level is increase to 5% level. These show that media coverage has negative association to financial fraud. This indicates that firms with lower coverage of the media lead to higher probability of financial fraud. These results are also hold when we use the second measure of financial fraud (FINFRAUD2) in the specification 3 and 4. The r-squared is between 6.2 to 8.2%. These findings are in line with the research undertaken by Bertot *et al.* (2010), and Gajewski and Li (2015). The investors or shareholders basically require transparency of information related to the company. Ease of accessing information in real time and the completeness of the information presented will add to the investor's knowledge about the ins and outs of the companies' activities. When this condition occurs, where investors or shareholders and companies' management have the same information, it will create an openness that further increases trust levels. Through this disclosure of information, investors or shareholders can also supervise the course of the company and detect if there is an error or fraud.

$$\text{FINFRAUD} = \alpha + \beta_1 \text{PRESSCOV} + \beta_2 \text{GROWTH} + \beta_3 \text{OCSBLOCK} + \beta_4 \text{SIZE} + \beta_5 \text{TOBINSQ} + \beta_6 \text{BIG4} + \beta_7 \text{BSIZE} + \beta_8 \text{BRDIND} + \beta_9 \text{ACIND} + \beta_{10} \text{ROA} + \beta_{11} \text{RECSALES} + \beta_{12} \text{FIRMAGE} + \varepsilon \quad (2)$$

Table 5. Regression result of press release on financial fraud

Variable	Predicted sign	Finfraud1		Finfraud2	
		(1)	(2)	(3)	(4)
PRESSCOV	+	0.028	0.028	0.039	0.039
		(0.47)	(0.82)	(0.69)	(1.50)
GROWTH	+ / -	0.003	0.003	-0.011	-0.011
		(0.25)	(0.23)	(-0.91)	(-0.81)
OCSBLOCK	-	0.669	0.669	-0.013	-0.013
		(0.15)	(0.12)	(-0.00)	(-0.00)
SIZE	+	-0.071	-0.071	-0.035	-0.035
		(-0.84)	(-0.79)	(-0.45)	(-0.40)
TOBINSQ	+	-1.223***	-1.223**	-0.682**	-0.682
		(-4.18)	(-2.54)	(-2.46)	(-1.50)
BIG4	-	0.132	0.132	0.099	0.099
		(1.22)	(1.23)	(0.98)	(1.07)
BSIZE	+	0.000**	0.000*	0.000	0.000
		(1.94)	(1.72)	(1.40)	(1.36)
BRDIND	-	1.155*	1.155*	0.662	0.662
		(1.75)	(1.74)	(1.07)	(1.04)
ACIND	-	-0.647	-0.647	4.129	4.129
		(-0.17)	(-0.17)	(1.17)	(1.12)
ROA	+ / -	4.742	4.742	3.284	3.284
		(0.84)	(0.73)	(0.62)	(0.05)
RECSALES	+	2.354***	2.354***	1.826***	1.826*
		(4.92)	(3.02)	(4.08)	(2.07)
FIRMAGE	-	-0.882	-0.882	-2.192	-2.192
		(-0.30)	(-0.31)	(-0.80)	(-0.73)
Industry dummies		Yes	Yes	Yes	Yes
Year dummies		Yes	Yes	Yes	Yes
R-squared		0.077	0.077	0.058	0.058
N		621	621	621	621

Note: This table presents the results of multiple linear regressions of transparency press release and indication of fraudulent financial statements from 621 companies registered in IDX 2015-2016 with \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Next, we examine the relationship between press coverage and financial fraud. Table 5 present the results of regression of press release and indication of financial fraud. The results show that *PRESSCOV* is not significantly associated to both *FINFRAUD1* and *FINFRAUD2*. Dyck *et al.* (2008) stated that news coverage, including press releases, is not only driven by the intrinsic appeal of individual information, but also the readers' interests and media coverage is not merely a reflection of reality. But, has an important effect especially on companies that will only be effective if there is a breach of widely accepted norm by the company. Our findings show that, unlike media coverage, press release do not able to detect the indication of firms' financial fraud.

## Conclusion

This study presents that social media transparency is able to detect the indication of firms' financial fraud. Specifically, this study demonstrates that firms' social media coverage is negatively associated with indication of financial fraud. This indicates that firms with higher information coverage on social media, the less indication of fraud activities as social transparency of the media can effectively detect indications of financial fraud. Interestingly, press release transparency has no significant association to indication of firms' financial fraud.



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## APPENDIX 1. Internet Corporate Disclosure Index (ICDI)

No	Question	Description
	"Does this component exist in the company?"	
1.	Statement of Financial Position	Part I: Annual and Periodic Reports on the Internet
2.	Prior Year Statement of Financial Position	
3.	Statement of Profit and Loss	
4.	Prior year Statement of Profit and Loss	
5.	Interim and Periodic Reports	
6.	Notes to Financial Statements	
7.	Cash flow statement	
8.	Prior year Cash Flow Statement	
9.	Social and / or environmental related reports	
10.	Prior year Company report	
11.	Financial data time series	
12.	Selective accounting data	
13.	Financial calendar	
14.	Latest stock market prices	
15.	Organizational structure	
16.	Composition of the board of directors	
17.	External links for investors interest	
18.	Information updated every 24 hours	Part III: Presentation format of information
19.	Links for accounting information	
20.	Annual Report in PDF	
21.	Financial data that can be processed	
22.	Financial data in XBR format	
23.	Web page in more than one language	
24.	Web page has its own search engine	
25.	Web page allows cookies	Part IV: Direct contact with investors
26.	Webpage offers a special email address for the investor	
27.	Shareholder email can be given for company directory	
28.	Have a FAQ section (frequently asked question)	Part V: Option for participation and disclosure with audio or video
29.	Allows investors to request additional information	
30.	Allows real time participation in board meetings	
31.	Offers access to documents (audio or video) from previous meetings	
32.	Offers access to presentations (audio or video) from previous meetings	

## APPENDIX 2. Variable definition

Variable	Definition	Computation	Source
Dependent Variable			
<i>FINFRAUD1</i>	Indication of financial fraud with 8 variables	$M = -4.84 + 0.920 \text{ DSRI} + 0.528 \text{ GMI} + 0.404 \text{ AQI} + 0.892 \text{ SGI} + 0.115 \text{ DEPI} - 0.172 \text{ SGAI} + 4.679 \text{ TATA} - 0.327 \text{ LVGI}$	See Appendix 3
<i>FINFRAUD2</i>	Indication of financial fraud with 5 variables	$M = -6.065 + 0.823 \text{ DSRI} + 0.906 \text{ GMI} + 0.593 \text{ AQI} + 0.717 \text{ SGI} + 0.107 \text{ DEPI}$	See Appendix 3
Independent Variable			
<i>PRESSCOV</i>	Press Release Coverage	Measured by the number of news related to companies on the mass media at certain time, <i>i.e.</i> in 2015, 2016. The mass media used by the authors is electronic mass media that can be accessed from a collection of news from various newspapers and electronic magazines from google news.	Electronic Mass Media
<i>MEDIACOV</i>	Social Media Transparency	Measured using questionnaire based on the Internet Corporate Disclosure Index (ICDI) calculated from the large number of voluntary disclosure information on the company website. It contains 32 questions as shown in Appendix 1. The numbers given in each question are 1 if there is such information in web	Company Website

Variable	Definition	Computation	Source
		company and 0 otherwise.	
Control Variable			
<i>GROWTH</i>	Firm Growth	$(\text{Total Assets}_t - \text{Total Assets}_{t-1}) / \text{Total Assets}_{t-1}$	Orbis Database
<i>OCSBLOCK</i>	Percentage of Shares Owned by Directors (internal ownership)	% Common Stock held by Block holder	ICMD
<i>SIZE</i>	Firm Size	In Total Assets	Orbis Database
<i>TOBINSQ</i>	Firm Performance	$(\text{Market value of common equity} + \text{Book value of total liabilities}) / \text{Book value of total assets}$	Orbis Database
<i>BIG4</i>	Big 4 Accounting Firm (EY, PwC, KPMG, Deloitte)	The dummy variable, valued 1 if the financial statements are audited by the big 4 Public Accounting Firm and 0 otherwise	ICMD
<i>BSIZE</i>	Total Members in Company's Board of Directors	In Number of Board Members	ICMD
<i>BRDIND</i>	Number of Independent Directors in Board of Directors	Proportion of independent directors on the board	ICMD
<i>ACIND</i>	Number of Independent Directors in Audit Committee	Proportion of independent directors in the audit committee	ICMD
<i>ROA</i>	Return on Assets	$\text{EBIT} / \text{Book value of Total Assets}$	Orbis Database
<i>RECSALES</i>	Receivables to Sales Ratio	$\text{Receivable}_t / \text{Sales}_t - \text{Receivable}_{t-1} / \text{Sales}_{t-1}$	Orbis Database
<i>FIRMAGE</i>	Firm Age	Sample year used – Incorporated date	ICMD

APPENDIX 3. Variable definition to calculate the financial fraud measures

Ratio	Description	Computation	Source
DSRI	Days Sales Receivable Index	$(\text{Net Receivables}_t / \text{Sales}_t) / \text{Net Receivables}_{t-1} / \text{Sales}_{t-1}$	Orbis Database
GMI	Gross Margin Index	$[(\text{Sales}_{t-1} - \text{Cost Of Goods Sold}_{t-1}) / \text{Sales}_{t-1}] / [(\text{Sales}_t - \text{Cost Of Goods Sold}_t) / \text{Sales}_t]$	Orbis Database
AQI	Asset Quality Index	$[1 - (\text{Current Assets}_t + \text{Plant, Property \& Equipment}_t + \text{Securities}_t) / \text{Total Assets}_t] / [1 - ((\text{Current Assets}_{t-1} + \text{Plant, Property \& Equipment}_{t-1} + \text{Securities}_{t-1}) / \text{Total Assets}_{t-1})]$	Orbis Database
SGI	Sales Growth Index	$\text{Sales}_t / \text{Sales}_{t-1}$	Orbis Database
DEPI	Depreciation Index	$(\text{Depreciation}_{t-1} / (\text{Plant, Property \& Equipment}_{t-1} + \text{Depreciation}_{t-1})) / (\text{Depreciation}_t / (\text{Plant, Property \& Equipment}_t + \text{Depreciation}_t))$	Orbis Database
SGAI	Sales General & Administration Expense Index	$(\text{Selling General \& Administrative Expense}_t / \text{Sales}_t) / (\text{Selling General \& Administrative Expense}_{t-1} / \text{Sales}_{t-1})$	Orbis Database
LVGI	Leverage Index	$[(\text{Current Liabilities}_t + \text{Total Long Term Debt}_t) / \text{Total Assets}_t] / [(\text{Current Liabilities}_{t-1} + \text{Total Long Term Debt}_{t-1}) / \text{Total Assets}_{t-1}]$	Orbis Database
TATA	Total Accruals to Total Assets	$(\text{Income from Continuing Operations}_t - \text{Cash Flows from Operations}_t) / \text{Total Assets}_t$	Orbis Database

## Russian Practice of State Support and Financial Technologies for Restructuring Mortgage Loans

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### Abstract:

At the end of the year 2008, Russia was exposed to consequences of the global economic crisis. Having assessed the consequences of mass defaults in the USA, the government of Russia assigned the government-owned Agency for Housing Mortgage Lending (AHML) to implement a package of measures designed to provide social protection for its citizens. Systemic research into the way the anti-crisis mortgage rescue scheme designed to support borrowers was implemented between 2008 and 2011 enabled us to work out a series of recommendations for organizing and implementing further mortgage rescue schemes designed to support borrowers in dire financial straits. In 2015 a new state program was formed, based on the experience of 2008-2011.

**Keywords:** mortgage; restructuring schemes; bank; borrower; risk management; loans

**JEL Classification:** G20; G21

### Introduction

Today, development of the economy goes with crises caused by various factors, yet, frequently leading to the same consequences in social area with the increasing number of citizens who find themselves in dire financial straits. The latter fact compels us to generalize and use the experience of providing aid, its principles, and its scope. Increased overdue debt and the increased number of loans always characterize crises in default, including but not limited to mortgages in default (Remy, Lucas and Moore 2011). In this context, a value is put on the generalization of recent Russian experience gained over the period of 2008-2011 when a specialized quasi-governmental institution called the Agency for Restructuring Housing Mortgage Loans (ARHML), a subsidiary of the government-owned Agency for Housing Mortgage Lending (AHML), was set up in order to implement a governmental mortgage rescue scheme designed to support borrowers. (Semenyuk, Tsyganov and Yazykov 2014, Tsyganov and Yazykov 2017)

Initially, creditor banks were expected to restructure residential mortgage loans based on algorithms agreed upon with the AHML, while the AHML was expected to give indispensable guarantees that any losses associated with such transactions shall be limited. Concurrently, the Government of Russia increased AHML's authorized capital by 60 billion rubles. 30 billion out of the sum mentioned had been reserved for implementing the targeted mortgage rescue scheme to support borrowers.

With inexpensive targeted public funding provided by the AHML, on the one hand, and with the increased cost of funding, on the other hand, creditor banks took a categorically strong stand on tools applied in order to restructure residential mortgage loans. All the proposals related to the use of guarantee-based mechanisms were rejected. Bankers demanded liquidity, a possibility not to build reserves for credit losses, and indemnity against possible losses.

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## 1. Restructuring models and schemes in the period 2008 - 2011

The Association of Russian Banks was actively involved in the process of developing AHML restructuring schemes – this discussion platform sped up the process of finding compromise solutions for interaction between the government and the market.

Eventually, three primary restructuring schemes were worked out:

- **Stabilization Loan**, when the ARHML was making payments in the amount of the annuity within 12 months, instead of the borrower. Funds allocated at a preferential rate were recorded as a loan (credit) for the borrower. It was supposed that repayment of such a loan would start on completion of the rescue scheme period and last throughout the whole mortgage loan period. Further use of this method proved that the instrument is highly effective as a tool influencing the market since application of a stabilization loan was not at creditor's discretion.
- **Hybrid Loan Agreement**, which actually implied that a loan would be halved – creditor's part would be reduced by approximately 20% and would still be serviced (with correspondingly reduced payments), whereas the other part would be assigned to the ARHML and be serviced only upon completion of the rescue scheme period. In practice, this restructuring scheme was not in demand due to insufficiently reduced payment load and an arisen obvious defect of a mortgage (two creditors assigned to one mortgage).
- **Stabilization Credit**. An instrument similar to a Stabilization Loan, however, all the procedures are carried out by a mortgagee itself and after such a Stabilization Credit has been fully provided it shall be assigned to the ARHML.

Eventually, a Stabilization Loan turned out to be the most popular mechanism due to the following reasons:

- The creditor did not have any detrimental effect on the process of restructuring. If its borrower was not satisfied with bank's in-house restructuring scheme (they emerged at the beginning of 2010), it could request ARHML's assistance. It was vital since many bankers started off with gloomy forecast in respect of population's employment and rates of regaining their income. Consequently, bankers were determined to carry out mortgage foreclosure as fast as possible.
- In terms of formal matter, any restructured mortgage loan funded with ARHML's payments became "perfect" – overdue debt was repaid, while the loan was regularly serviced, in spite of poor standing of the borrower. A new creditor (the ARHML) was not related to the bank in any way, and the bank may even have been unaware of a new additional loan (*i.e.* formally, there were no signs indicating that the borrower had taken out a loan to pay off the other loan).

It is important to point out that ARHML's scheme had a powerful impact on the market by backing it up "from beneath" – any restructuring scheme implemented by any bank had to be better than ARHML's scheme. Borrowers were given a choice – either they would accept bank's offer or turn to the ARHML for help. The ARHML made all its guidelines (Yazykov and Chepenko 2010, Semenyuk, Tsyganov and Yazykov 2014) and statistics publicly available, which enabled bankers to make their restructuring schemes successful and effective.

The mortgage rescue scheme designed to support borrowers that were experiencing temporary financial difficulties in the wake of the 2008–2009 global economic crisis was based on the following principles:

- *Social Focus*. Government support was offered only to borrowers that were objectively in need of it due to their deteriorated financial standing; the amount of aid was determined in accordance with borrower and its family members' income level; support was given only if accommodation acquired at the cost of borrowed funds was the only accommodation in possession of borrower's family and unless it belonged to the category of elite housing in terms of its cost and floor area;
- *Stimulating Borrower's Responsibility*. Certain restrictions were imposed in terms of the period throughout which support was provided; borrowed funds allocated were given under the following conditions: availability for a fee, urgency, and payback; borrowers were not fully released from loan repayments when they were supported, however, their households were able to make such repayments; offered restructuring mechanisms were not supposed to bring additional economic benefits for any borrowers; creditor's right to foreclose on mortgaged property was undoubted;
- *Availability*. Any bad debt was restructured for borrower's benefit, regardless of standards and terms of lending set by its original creditor and even without its consent. This scheme could be used by any borrowers throughout Russia.



The scheme implemented by the ARHML offered the following main levels of support for borrowers:

- *Level I Support.* Primary mortgage loan restructuring – a loan supported for as long as 12 months at the most (doubled average time needed for finding a job and regaining income) and given to make monthly mortgage repayments, pay off overdue mortgage debt, and pay premiums associated with the insurance contract concluded to secure the mortgage loan – such a stabilization loan allowed any borrower some time to regain its financial solvency. Such loans were given at lower rates than those at the market; it was possible that dutiful borrowers had their interest rate reduced to the level equal to 2/3 of the rate established at the Bank of Russia. At the same time, such loans were insufficiently secured to cover ARHML's risks in situations when the borrower ended up in default again; some creditors did not give their consent to the second mortgage. Any original creditor would reserve its priority right to have its claims settled if the property was sold (foreclosed).

- *Level II Support.* Repeated mortgage loan restructuring – the ARHML bought out mortgage loans taken out from banks by particular individuals that belong to socially vulnerable groups of population and supported the citizens by providing them with repeated restructuring on ARHML's balance sheet without considerably increased payment load imposed on the borrower – thus, the borrower would be given a second chance to recover. In 2010, it was clear that particular socially vulnerable groups of borrowers were not able to regain their financial solvency due to both their financial difficulties and errors made by creditors over the course of restructuring. Such borrowers are the ones “repeated” restructuring tools were developed for. A possibility to undergo “repeated” restructuring was offered to borrowers that met more rigorous social criteria and did not regain their financial solvency within the framework of primary restructuring due to reasons beyond their control. Repeated restructuring was carried out by repurchasing mortgage loans at a discount from creditors at the market, with the original creditor being ready to stop the foreclosure. On average, such discount amounted to approximately 18%. Within the framework of repeated restructuring, the period of support was considerably extended to allow borrowers to regain their income.

## 2. Social criteria

Having analyzed the body of data stored at the AHML and having engaged Russian experts in property market, we have established criteria for selecting borrowers that have to be supported:

- only one accommodation to live in;
- their loan has to be taken out before December 1, 2008;
- their accommodation has to meet the criteria established for economy-class accommodation (cost of 1 sq.m. mustn't exceed average values in the local area by more than 60%. In addition, some restrictions were imposed on the floor area of residential accommodation according to the number of occupants);
- borrower's income dropped dramatically to the level of 2 minimum wages in the local area per each family member.

In order to increase borrowers' responsibility for funds received, the following principles for residential mortgage loan restructuring have been worked out:

- availability for a fee, urgency, and payback of funds allocated;
- disciplined borrowers had their rate reduced to 2/3 of the refinance rate established at the Bank of Russia in order to reduce their payment load;
- maximum period of support mustn't exceed 12 months, while repayments over the stated period mustn't exceed 50% of the size of repayments made before restructuring.

Following the results of implementation of ARHML's Scheme, it should be highlighted that borrowers ended up in default due to the following key reasons:

- dismissal from work;
- reduced salary/ wages primarily due to the fact that the part of their income received off the record had been cancelled or due to so called “concealed unemployment” (a kind of underemployment) of borrowers when the number of their working hours are reduced, or they are given unpaid leave;
- decline in revenues received from entrepreneurial activities;
- a borrower being on maternity/paternity leave;
- borrower's employer went out of business.

It should be pointed out that employees working in such areas as trade, industry, mechanical engineering, cargo transportation, finance, insurance, and construction suffered the most. The core of borrowers in need of support and debt restructuring within the period concerned lived in cities with population of over 100 thousand

people in the following regions: Altai Krai (Altai Territory), the Republic of Bashkortostan, Kemerovo Oblast, Moscow and Moscow Oblast, Novosibirsk Oblast, Omsk Oblast, Perm Krai (Territory), Samara Oblast, Sverdlovsk Oblast, the Republic of Tatarstan, Chelyabinsk Oblast. The Bank of Russia, for one, supported implementation of residential mortgage loan restructuring tools by providing a possibility to keep restructured loans of up to 6 million rubles as part of Portfolios of Homogeneous Loans.

### **3. Risk management**

The ARHML scheme stipulated a ban on evaluating prospects of borrowers regaining their income, as there had normally been only gloomy forecasts thereof under the crisis. However, about 80% borrowers lived through their hard times back to success and scheduled payments to fulfil two of their loan obligations.

Important conclusions that must be made when arranging restructuring schemes should include the following ones:

- it is not allowed to make money out of any restructuring scheme. Borrowers are under a lot of stress and sign terms and conditions of restructuring whatever they are, hoping to find a way to extricate themselves from this situation later. When banks gave borrowers additional loans at high interest rates, in most cases borrowers would “bend” and “fall” under their heavy payment load ending up in default again;
- sufficient time must be allowed for regaining income. Practically, it was proven that the period of support (the period of reduced payments) had to be equal to doubled time needed for finding a job in the local area. Otherwise, borrowers did not have time to get a new steady job and were forced to resort to costly short-term borrowings, whereas their increased payment load made them end up in default again;
- as a rule, borrowers cannot restore their income to its former glory and the income regained is 10-20% lower than it used to be before default (before losing their job). In this context, it is absolutely critical to monitor payment load “carried” by borrowers upon completion of the period of support;
- tools used to stimulate borrower’s repayment discipline have a beneficial effect. For instance, disciplined borrowers had their stabilization loan rate reduced by the ARHML to the level of 2/3 of the refinance rate established at the Bank of Russia;
- it is essential that borrowers make regular repayments (do not forget about their loans). Every subsequent repayment was transferred by the ARHML provided that there was borrower’s report confirming that the funds payable for the previous month had been credited to creditor’s account and interests on sums taken out had been paid. In the absence of any reports and payments, borrowers used to be put on stop lists, which banned them from receiving any further tranches.

### **4. Drawbacks of the scheme**

Drawback of the scheme should include as follows:

- high cost of infrastructure. The average size of any stabilization loan was about 330.000 rubles, which made any follow-up and service transactions quite costly;
- complexity of some processes. The ARHML was not a bank, so it gave loans as opposed to credits. Under Russian law, any loan is considered to have been taken out from the moment the funds have been given to the borrower, which means that the ARHML had to trace the day when the funds had actually been credited to borrower’s account. Accrual of interests had to be calculated from this very day;
- necessity to monitor quality of the network. The ARHML was not a retail structure, so it deployed a vast network of regional agents in order to make sure the Scheme would be accessible. This enabled the Agency to save substantial funds (as there was no need to run a large number of its own offices). However, this also required the ARHML to simplify its procedures and introduce measures of tight control in order to ensure smooth operation of its agent network. Also, between 2010 and 2011, the ARHML had to develop training packages and guidance manuals as well as conduct a series of training workshops for employees working within its agent network, including but not limited to distance-learning courses;
- inadequate statistics. The first version of the Scheme built on AHML portfolio figures resulted in high percentage of rejections to restructure loans based on social criteria. Feedback was constantly analyzed, and the scheme was modified promptly, which made it possible to mitigate the risk of

information sources being inadequate and eventually come to global conclusions (Rusetskaya, Akinin, Rusetsky, Rybina, and Rybin Yu.V. 2017).

In late 2008, the banks had prepared their own restructuring programs and began to produce them, with the benchmark program of the ARHML. The greatest difficulty in the implementation of restructuring programs caused the need to modify it systems. Given the desire to keep the client at home and prevent the appearance of another creditor to the only collateral, the banks launched their own restructuring programs.

The simplest instrument was an additional loan issued to repay the current loan (the so-called stabilization loan). However, in accordance with the requirements of banking regulation, such loans must have increased reserves (loan for repayment of overdue loan). Nevertheless, banks actively used the following options:

- friendly lending (when another Bank lends to borrowers of this Bank and Vice versa);
- issuance of a credit card with automatic cancellation of annuity payment for mortgage loan service;
- a number of banks made serious mistakes in the implementation of such programs, for example:
  - the rate on the stabilization loan could be significant (up to 20-24% per annum) - the borrower under stress signs any terms of restructuring, but subsequently receives an excessive payment, leading to a repeated default of the borrower;
  - the term of repayment of the stabilization loan is short (or one-time repayment in 1-2 years), which did not allow the borrower to find funds to repay a large sum;
  - the period of assistance was extremely short (3-4 months), which did not allow the borrower to find a job with a salary level sufficient to service the loan.

The ARHML actively discussed the activity and studied the best practices of activity of banks. The publication of a large volume of information has allowed lenders to quickly modify your software and to fix errors that occur. An additional advantage was the publication of the ARHML all its documentation in the public domain, which allowed banks to quickly copy and run their own programs of assistance to the borrower.

## 5. Scheme results and conclusions

The most significant result of Scheme implementation was the fact that creditors launched their own restructuring schemes and a theory of borrowers' successful recovery was formulated. The ARHML did not have a mission to restructure all troubled borrowers' loans, however, the fact that some citizens received more reasonable terms from their banks (which helped to save public funds) is a considerable achievement of the technology implemented.

In addition, development of tools for mitigating social consequences associated with borrower's default has started in Russia since 2010. Such tools include but are not limited to as follows:

Development of mortgage insurance as a tool used to compensate for creditor's losses (mortgagee's break-even point shifted from its standard level of LTV<60-62% to the amount of the sum insured) – with mortgage insurance available “a creditor is not afraid to be kind” (Yazykov, Kamyshev and Tsyganov 2014). Federal Law N 353-FZ “On Consumer Loan (Credit)” adopted on December 21, 2013, which formed the foundation of social protection for citizens. A law related to personal bankruptcy adopted and the debt restructuring procedure introduced into a set of personal bankruptcy procedures.

Quantity indicators' show how efficient the scheme has been listed in Tables 1 – 3 below.

Table 1. Primary restructuring indicators

Primary Restructuring Indicators	Total throughout the period of the Scheme implementation
How many times advice has been sought, pcs.	65,397
How many applications for restructuring have been received, pcs.	11,049
Approved, pcs.	8,494
Contracts concluded, pcs.	7,969
Amount of obligations undertaken, million RUR	2,896
Amount of funds provided against restructured residential mortgage loans, million RUR	2,802

Source: ARHML

Table 2. Repeated restructuring indicators

Repeated Restructuring Indicators		Total throughout the period of the Scheme implementation
Creditors' Applications	Number of creditors, pcs.	45.0
	Number of residential mortgage loans offered for buyout, pcs.	8,401.0
	Cost of residential mortgage loans offered for buyout, million RUR	18,119.0
Contracts concluded	Number of contracts concluded with creditors for buying out residential mortgage loans, pcs.	44.0
	Number of residential mortgage loans bought out, pcs.	3,352.0
	Sum spent on buying out residential mortgage loans, million RUR	5,878.5
	Loans given back (which do not comply with the Standard), pcs.	2,161.0
	Sum of loans given back, million RUR	4,077.9
	Number of mortgages accepted to be restructured (which comply with the Standard), pcs.	1,191.0
	Sum of loans accepted to be restructured (which comply with the Standard), million RUR	1,800.6

Table 3. The rate of regaining their financial solvency by borrowers as of January 1, 2013

Primary Restructuring Indicators	Primary Restructuring	Repeated Restructuring
Contracts concluded, pcs.	7,969	3,352
Whereof contracts that comply with the standard for restructuring residential mortgage loans, pcs.	7,969	1,191
Borrowers who regained their financial solvency, number of people	6,239	699
incl. borrowers who fulfilled their obligations, number of people	1,289	90
The proportion of borrowers who regained their financial solvency against the number of contracts concluded or mortgages bought out (mortgages sold back as they did not comply with the standard for residential mortgage loan restructuring were excluded from calculation)	78.3%	58.7%

It ought to be noted that key conclusions include but are not limited to the following:

- there is a need for a monitoring system to control hotbeds of social tension (prompt and accurate collection of statistical data), which will make it possible to deploy prevention tools in due course (Davidson, Sanders, Ching, Wolff 2004);
- over the course of scheme implementation, it was discovered that the level of creditor's loyalty to their borrowers was extremely low and that in cases when the bank would definitely make no losses (with low LTV ratio) the bank went beyond the bounds of cruelty treating its borrowers unfairly (a paradox: the more repayments the borrower had made to pay off its loan, the tougher actions the creditor took, aware of the fact that any creditor enjoys an advantage over borrowers in disputes) (Dagher, Fu 2011);
- it is necessary to make a socially responsible approach to lending an everyday practice, in particular, formalize it through legislation or special regulation;
- ready-to-use tools and procedures for restructuring must be at any creditor's disposal and creditors have to constantly exchange and generalize accumulated experience;
- availability of government- shaped or - backed tools giving direct support to borrowers drastically changes the way creditors treat their customers (as it gives choice);
- it is necessary to introduce market instruments to form the balance of creditors and borrowers' interests. Primarily, such instruments include mortgage insurance, which shifts creditor's break-even point in case of foreclosure.

In 2015 a new program of assistance to certain categories of borrowers on mortgage housing loans (loans), which appeared in a difficult financial situation Russia was adopted and modernized, which is a logical continuation of the technologies of restructuring mortgage housing loans, laid down in 2008 - 2011. First of all, support is provided to citizens with minor children, disabled children or working in priority sectors of the national economy. At the same time, restrictions are set on the size of per capita income, the area and value of the property, its uniqueness in the borrower. That is, the main provisions of the technology of restructuring mortgage lending have been tested by time and application in the conditions of Russia in 2008 - 2011 and 2015 - 2018.

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## Evaluating of the Effectiveness of Public-Private Partnership Projects in the Republic of Kazakhstan with the Analytic Hierarchy Process

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### Abstract:

Evaluation of the effectiveness of public-private partnership (PPP) projects is one of its important aspects. However, it is difficult to accurately evaluate the benefits the state acquires from PPP contracts, to determine the reliability of the declared efficiency and outcome of the projects, and mechanisms for evaluating their effectiveness have not been developed properly; all this necessitates the creation of a methodology for the integrated evaluation of PPP projects that is different from traditional methods. Goal of the research is to develop a new approach to the evaluation of PPP projects based on an integrated indicator that takes into account not only traditional economic factors but also social and socio-political factors, including the multiplicative effect of project implementation, employment, environmental conservation, reduction of social tension and others. To calculate the integral indicator in the evaluation of the projects effectiveness, the authors used the analytic hierarchy process (AHP) which allows to evaluate not only quantitative, but also qualitative information.

The authors developed recommendations for devising a methodology which would enable to evaluate the effectiveness of PPP projects and which makes it possible to determine not only economic but also social effectiveness at the stage of their implementation. The application of the new approach enabled to assess the impact of not only economic factors, but also non-economic, social, political, *etc.*, providing a comprehensive evaluation of the project effectiveness. The authors developed recommendations for creating a methodology that would enable to evaluate the effectiveness of PPP projects, as well as an information system that allows determining their economic and social effectiveness at the stage of project implementation.

**Keywords:** public-private partnership; efficiency; methodology; project; evaluation

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**JEL Classification:** H42; H43; H44; L24; L33

## Introduction

In accordance with the State Program for Industrial and Innovative Development for 2015-2019, Kazakhstan's industrial development is seen as the main condition for the growth of the national economy. Global experience has shown that successful implementation of industrial and innovative development of the country's economy should be based on mutually beneficial and effective partnership between the state and business (The State Program of Industrial and Innovative Development of the Republic of Kazakhstan for 2015-2019 2014).

The USA, Britain, Germany and France take leading positions in the field of public-private partnerships. Talking about European experience, one should mention the work of the EU Commission whose agenda includes a large number of opportunities for financial support of PPPs. The Commission directly promotes the creation of independent organizations aimed at development and implementation of PPP projects. In this regard, we should consider not only the potential of the European Regional Development Fund (ERDF) and the Cohesion Fund, but also the European Investment Bank (EIB) and the European Investment Fund (EIF).

The examples of PPP projects implemented by the EU authorities within the Trans-European transport networks are: in Portugal – the Vasco da Gama Bridge, in Greece – Spata Airport (Athens), the bridge over the Corinth Canal, *etc.*

In addition to the Trans-European transport networks, the EU authorities support PPP projects in other areas, for instance:

- infrastructure projects in the power industry. The Redo and Tapada power plants in Portugal, built as PPP projects, were financially supported by EIB. The LUL Power PFI power station in London was also financed by EIB;
- purchase of rolling stock for public transport in the UK;
- development of the information society at schools (Cuttaree and Mandri-Perrott 2011).

In this regard, it should be noted that EIF, whose main task is to provide guarantees for venture capital for developing small and medium-sized enterprises, actually has a structure of a public-private partnership. At the same time, implementation of public-private partnership mechanisms is associated with some challenges and limitations. It should be noted that when developing approaches for PPP, one should take into account the specifics of PPP projects in the social sphere, which implies including qualitative indicators in quantitative evaluation of such projects. So, this study aims to develop a methodology for evaluating the effectiveness of public-private partnership projects that is based on systematized performance criteria and to propose an integrated indicator to evaluate the effectiveness of PPP projects.

## 1. Literature review

Summarizing the views of modern Russian scientists, we revealed that essential differences in approaches to the evaluation of public-private partnership projects stem from the basic principles that ensure the appropriateness, validity and possibility of PPP organization (Reznichenko 2010, Novikova 2009).

Having studied the traditional approach to the evaluation of PPP project efficiency, we could conclude that it is carried out using the algorithm for evaluating the effectiveness of public-private partnership projects which is focused on studying project's feasibility (Gabdullina 2012, Toxanova and Aitkaliyeva 2017).

Having examined public-private relations, we revealed that they are based on different types of efficiency categories. At the same time, state support ensures a mutually beneficial combination of the interests of various PPP parties. Here, private investors are interested in providing financial resources for socially significant projects.

The issues regarding public-private partnerships, the theory of finance in the investment process, financial analysis and planning are studied in the works of international scientists such as Varnavsky, Klimenko and Korolev (2010), Soloviev (2012), Delmon (2010), Cruz and Marques (2011), Sazonov (2012), Yeskombe (2008), Encinas (2013), Ballingall (2012), Wu, Xu, Li, Wang and Xu (2018), Kumar, Jindal, and Velaga (2018).

The theoretical basis of the issues related to effective state-private partnership was formed by the works of Kazakhstan scientists (Abdymanapov and Abiesova 2013, Abdymanapov *et al.* 2017, Toxanova *et al.* 2017, Mataev 2011), as well as legislative acts regulating the financial interaction of the state and private business in the course of the implementation of investment projects (Khataeva and Tsinir 2008, Government of the Republic of Kazakhstan 2011, Law of the Republic of Kazakhstan "On Public-Private Partnership" of October 31, 2015, Law of the Republic of Kazakhstan of July 7, 2006 No. 167-III "On Concessions", Law of the Republic of Kazakhstan "On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan on Public Administration" of July 02, 2014, Law of the Republic of Kazakhstan "On Amendments and Additions to Certain

Legislative Acts of the Republic of Kazakhstan on Improving Budget Legislation" of December 03, 2013, Law of the Republic of Kazakhstan "On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan Concerning the Introduction of New Types of Public-Private Partnership and Expansion of Their Application" of July 4, 2013, Government of the Republic of Kazakhstan 2008).

Conceptualization of scientific research revealed that the evaluation of PPP projects effectiveness plays an important role in functioning of the institution of public-private partnership. In this regard, the authors of the study compared various methods used to evaluate the effectiveness of PPP projects. The analytic hierarchy process proposed by American mathematician Saaty (1993) allowed the authors to take into account the influence of not only quantitative indicators, but also of such non-formalized indicators as social, psychological, etc. In the context of this study, the analytic hierarchy process was also used to determine priorities and weights of various qualitative factors and political conditions. The analytic network process is a development of the analytic hierarchy process, and it allowed considering mutual influence of the factors on each other.

Despite a large number of PPP studies, including the evaluation of the economic efficiency of projects, we identified the need for developing a new approach to the evaluation of PPP projects; such an approach should be based on an integrated indicator used to evaluate project implementation, and it should consider the impact of not only economic factors, but also non-economic ones – social, political, etc.

## 2. Materials and methods

One of the important conditions for implementing PPP projects is the evaluation of its effectiveness, both by the state and the private sector. In this regard, there is a great difference between traditional approaches and those to evaluating public-private partnership projects, since on the one hand, private sector investments should be evaluated according to the analysis of their financial efficiency, and on the other hand, it is necessary to take into account the interests of the state by analyzing costs and benefits in the public sector and to summarize the mutual benefit of these projects for sustainable growth of the national economy.

The methodology proposed in this study is based on the Analytic hierarchy process that was developed by American scientist Thomas Saaty as a mathematical tool ensuring a systematic approach to decision making. It is, primarily, a method of expert evaluation. In this article we describe the possibilities of applying this evaluation methodology based on the AHP (hereinafter the Methodology) when determining the effectiveness of PPP projects implemented in Kazakhstan.

The evaluation based on the AHP is carried out in stages. At the first stage, we built a qualitative model of the problem in the form of a hierarchy that included the goal, alternative options for achieving the goal and criteria for evaluating the quality of the alternatives.

At the second stage, we identified the priorities of all elements in the hierarchy using the pairwise comparison method. Pairwise comparison of the elements of each level included in the matrix is carried out using T. Saaty's fundamental scale. Also at this stage, we calculated the priority vector in each matrix, the maximum eigenvalue  $\lambda_{\max}$ , the consistency index, and the consistency relation. In accordance with the AHP methodology, the desired weight vector

$$W = (W_1, W_2, W_n)^T \quad (1)$$

is calculated as an eigenvector of the matrix corresponding to the maximum eigenvalue ( $\lambda_{\max}$ ).

The maximum eigenvalue  $\lambda_{\max}$  is calculated using the matrix of pairwise comparisons in the following way. The matrix of comparisons on the right is multiplied by the resulting value of the solution vector, thus giving a new vector. Let us divide the first component of the vector by the first component of the solution vector, and the second component of the new vector by the second component of the solution vector, etc., thus obtaining one more vector. The quotient of the sum of these vector components by the number of the components gives an approximation to the number  $\lambda_{\max}$  – the maximum or the principal eigenvalue.  $\lambda_{\max}$  is used to evaluate the consistency that reflects the proportionality of preferences. The closer  $\lambda_{\max}$  is to  $n$  (the number of objects or types of action in the matrix), the more consistent the result is:

$$\text{Positive inverse symmetric matrix } A = \{a_{ij}\} \quad (i, j = 1, 2, \dots, n) \quad (2)$$

is considered to be consistent if:  $a_{ij} = a_{ik} \cdot a_{kj}$ ; and  $i, j, k = 1, 2, \dots, n$ . Note: if  $A_i = a_{ij} \cdot A_j$ ,  $A_i = a_{ik} \cdot A_k$ , then due to transitivity

$$A_k = a_{kj} \cdot A_j = (a_{ij} / a_{ik}) \cdot A_j \quad (3)$$

$$a_{ij} = a_{ik} \cdot a_{kj}$$

It should be noted that this condition might not be fulfilled when conducting an expert evaluation. A positive inverse symmetric matrix is consistent if and only if  $\lambda_{\max} = n$ , which is proved in the corresponding theorem. Suppose  $C_1, C_2, \dots, C_n$  are a collection of objects (possible actions). Quantitative judgments about pairs of objects ( $C_i, C_j$ ) are represented by a matrix of order  $n \times n$ ,  $A = (a_{ij})$ , ( $i, j = 1, 2, \dots, n$ ). Elements  $a_{ij}$  are estimated by the following rules:

Rule 1. If  $a_{ij} = \alpha$ , then  $a_{ji} = 1/\alpha$ ,  $\alpha \neq 0$ .

Rule 2. If the judgments are such that  $C_i$  has relative importance that is the same as  $C_j$ , then  $a_{ij} = 1$ ,  $a_{ji} = 1$ ; among other factors,  $a_{ii} = 1$  for all  $i$ . Thus, matrix  $A$  is written as:

$$A = \begin{pmatrix} 1 & a_{12} & \dots & a_{1n} \\ a_{12} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{1n} & a_{2n} & \dots & 1 \end{pmatrix} \quad (4)$$

After presenting quantitative judgments about pairs ( $C_i, C_j$ ) in numerical expression as  $a_{ij}$ , the problem is reduced to assigning  $n$  by possible actions  $C_1, C_2, \dots, C_n$  to a set of numerical weights  $\omega_1, \omega_2, \dots, \omega_n$ , that correspond to fixed judgments:

$$(C_i, C_j) = a_{ij} = \omega_i / \omega_j \text{ or } \omega_i = a_{ij} * \omega_j \quad (5)$$

For  $\omega_i = a_{ij} * \omega_j$  let us take the average:  $\omega_i = (1/\lambda_{\max}) \sum_j a_{ij} * \omega_j \Leftrightarrow$  to the problem of finding the maximum eigenvalue and the principal eigenvector  $A\omega = \lambda_{\max}\omega$ .

The third stage includes synthesizing global priorities of alternatives by linear convolution of the priorities of the elements in the hierarchy. At the final stage, a decision is made based on the results obtained.

### 3. Results

#### 3.1. Traditional approach to assessing the effectiveness of a Public-Private Partnership project

Implementation of the project "Reconstruction of the Center-South Corridor (section A)" (hereinafter referred to as "Project A") is envisaged by the Action Plan for the implementation of the National Program "Nurly Zhol" for 2015 - 2019. It includes the construction and reconstruction of the Center-South Corridor, and Section A is one of its elements (Government of the Republic of Kazakhstan 2015). The Project is also considered in the Action Plan for the implementation of the State Program for the Development and Integration of the Infrastructure of the Transport System in the Republic of Kazakhstan up to 2020 (Government of the Republic of Kazakhstan 2014).

Project A implies that after improving (reconstructing) the road, toll collection is to be introduced. The borrower covers expenses for repair and maintenance of the highway using funds raised from tolls, as well as for maintenance of the hardware and software system for charging tolls, organizing paid traffic, purchasing and servicing road equipment for the maintenance of toll roads (sections).

The analysis of the technical condition of the roads of the III-V categories built in the Soviet times showed that they do not meet modern requirements due to the fact that most of the roads have not been reconstructed by present moment. Thus, the main problems of Kazakhstan transport infrastructure are:

- high wear of about a third of all roads;
- low capacity which is due to the increasing number of vehicles;
- the road network is unevenly developed in different regions, which hinders leveling socio-economic development levels.

Due to the mentioned problems, it is possible to provide only 69.3% of settlements with regular traffic service, while about 2,000 rural settlements do not have a year-round transport connection. In addition to social problems, the underdevelopment of transport infrastructure is also hampered by economic development, reducing the volume of freight and passenger turnover, intraregional level of labor mobility, limiting the development of production ties of enterprises. Also, the problems of transport infrastructure development affect the availability of medical, educational, social and cultural infrastructure, safety and the number of road accidents.

Project A is part of the transit corridor "Western Europe - Western China". Thus, it enables to reach the Republic of Uzbekistan, Tajikistan, China and the Russian Federation. The project also aims to facilitate the development of the southern macro region as a whole and to stimulate the export of Kazakhstan goods to the Russian markets by reducing transport costs in production costs by means of the following:

- increasing the average speed;

- reducing travel time;
- connecting macroregions into a single integrated system by high-quality road traffic;
- improving labor migration;
- creating comfortable conditions for the movement of people;
- reducing the operating costs of road users;
- reducing the number of accidents.

In general, considering all the above, the impact of Project A on related industries will manifest itself in increasing the availability of raw materials, the volume of cargo and passenger transportation, the transit potential of Kazakhstan, which would facilitate economic growth, increase the competitiveness of the national economy and the quality of life of the population, as well as improve the efficiency of work and develop the production, business and social spheres.

Having considered the social importance of the Project, let us focus on the economic efficiency of the Project implementation. The main economic effects are:

- receiving income from introducing a toll collection system in the reconstructed section during the operational period – KZT 231.74 billion, including discounted income at 5.5% sectoral inflation – KZT 98.86 billion (direct cash inflows according to calculated indicators of economic efficiency);
- the effect of reducing travel time: for Section A1 of 143 km – KZT 210.19 billion, including discounted effect with 5.5% sectoral inflation – KZT 98.13 billion; along Section A2 of 228 km – KZT 335.12 billion, including the discounted effect with 5.5% sectoral inflation – KZT 156.47 billion.

At the same time, the economic costs of the project also include the risk of increasing sectoral inflation from 5.5% to 10%, and these are:

- for Section A1 – KZT 300.76 billion, including discounted costs with 5.5% sectoral inflation – KZT 152.75 billion;
- for Section A2 – KZT 480.21 billion, including discounted costs at 5.5% sectoral inflation – KZT 244.10 billion.

Thus, the indicator of expected net present value (ENPV) is: for Section A1– KZT 44.38 billion; for Section A2– KZT 11.43 billion. The indicator of the expected internal rate of return (EIRR) is: for Section A1– 12%; for Section A2– 7%. In general, the socio-economic efficiency of the project according to the financial and economic model is as follows (Table 1).

Table 1. Discounted project indicators (taking into account 5.5% sectoral inflation)

Indicator		Units	Section A1	Section A2
Direct benefits	Income from traffic	KZT mln	98,864.20	98,863.88
Indirect benefits	The effect of reducing road accidents	KZT mln	119.26	185.49
	The effect of reducing mortality in road accidents	KZT mln	7.57	12.71
	The effect of reducing the number of animals harmed in road accidents	KZT mln	0.67	1.04
	The effect of reducing travel time	KZT mln	98,134.61	156,466.37
Total economic benefits		KZT mln	197,126.32	255,529.48
Direct costs	Investment costs	KZT mln	-63,091.36	- 101 151.89
Indirect costs	Reconstruction costs	KZT mln	- 39,013.45	- 6,203.27
	Pollution of the environment	KZT mln	- 9,912.28	- 1,504.19
	The risks of increasing sectoral inflation from 5.5% to 10%	KZT mln	- 4,029.54	- 6,439.40
Total economic costs		KZT mln	- 152,746.63	- 244 098.75
Total expected net present value (ENPV)		KZT mln	44,379.69	11,430.73
Expected internal rate of return (EIRR)		KZT mln	12%	7%

Source: compiled by the authors

Taking into account the above-mentioned ENPV and EIRR indicators, the implementation of Project A in the current version is considered positive regarding its socio-economic efficiency. As it was mentioned earlier, it is planned to introduce a toll collection system on the section of the "motor road built within the framework of Project A". The toll is set at the level of existing highways, and in subsequent years the toll is to grow by sectoral inflation of 5.5%. According to the analysis of the project sensitivity at different toll and traffic levels, we can conclude that

there are risks of not achieving a positive result of the NPV project, if the toll and traffic indicators decrease (Tables 2-5).

Table 2. Analysis of the project sensitivity at different toll levels

Deviation	Units	-20%	-10%	0	+10%	+20%
Project NPV	KZT mln	-9 984.2	-3 298.4	2 872.3	8 594.2	13 849.0
Project IRR	%	-	-	5.860%	6.560%	7.191%

Source: compiled by the authors

Table 3. Analysis of the project sensitivity at different traffic levels

Deviation	Units	-20%	-10%	0	+10%	+20%
Project NPV	KZT mln	-8 973.8	-2 847.0	2 872.3	7 924.2	12 634.5
Project IRR	%	-	-	5.860%	6.486%	7.067%

Source: compiled by the authors

Table 4. Results of the aggregate cash flow calculation

Costs	Units	Total
Inflow from operating activities	KZT mln	476,034.24
Sales revenues	KZT mln	231,738.93
Reimbursement from the budget of the Republic through a DDU contract		165,768.38
Reimbursement from the budget of the Republic within Program 091/100		78,526.93
Outflow from operating activities	KZT mln	120,320.06
Current repairs	KZT mln	11,001.64
Maintenance	KZT mln	8,660.63
Medium repairs	KZT mln	26,404.22
Administrative expenses	KZT mln	4,887.07
CIT	KZT mln	27,771.49
VAT payable	KZT mln	21,329.65
Insurance	KZT mln	-
Payment of interest on the loan	KZT mln	19,074.34
Fee for issuing a loan	KZT mln	460.21
Commitment fee	KZT mln	730.83
Fee for state guarantee	KZT mln	-
Operating balance	KZT mln	355,714.17
Inflow from investment activities	KZT mln	-
Outflow from investment activities	KZT mln	123,852.17
Road reconstruction	KZT mln	70,921.05
Overhaul	KZT mln	52,122.71
Balance of investment activity	KZT mln	-123,852.17
Inflow from financial activities	KZT mln	77,580.27
Borrowed funds	KZT mln	68,776.40
Funds from the budget of the Republic	KZT mln	8,510.53
from the budget of the Republic within the program	KZT mln	293.34
Outflow from financing activities	KZT mln	145,503.01
Payment of principal debt of borrowed funds	KZT mln	145,503.01
Balance of financial activities	KZT mln	- 67,922.74
Net cash flow	KZT mln	163,939.26

Source: compiled by the authors

Table 5. Summary of project parameters

Name	Units	Total
Highway	km	143
Category	Units	1B
Number of lanes	lane	4
Construction cost	KZT mln	67,192.74
Other costs	KZT mln	3,728.313
Financing from the budget of the Republic	KZT mln	8,510.53
EBRD non-governmental loan under state guarantee	KZT mln	62,410.53
Project NPV	KZT mln	2,872
Project IRR	%	6



Name	Units	Total
Project NPV	KZT mln	-111,824

Source: compiled by the authors

At the same time, the net discounted income of the project is positive and amounts to KZT 2.872 mln. Thus, in view of the foregoing, the project can be considered commercially effective.

The main criteria for determining the financial viability of the PPP project were:

- positive net present value;
- non-negative annual cash flows;
- the ratio of debt servicing meets the standards;
- the availability of the financial base for senior debt, even in case of the worst scenario (Temeljotov-Salaj and Liyanage 2012, Dufficy 2010, Koltsova and Ryabykh 2007, Vasina 2004, Lobanov and Chugunov 2008, Yang *et al.* 2018, Liu *et al.* 2016, Moore and Wright 2017).

Analyzing the feasibility study for Project A, one can draw the following conclusion:

- the social and economic efficiency of the project implementation is assessed as positive (ENPV – KZT 44 379.69 mln, EIRR –12%);
- the present figure of the project profit (NPV) is positive and amounts to KZT 2.872 mln;
- the NPV of the budget is negative (KZT 111 824 mln); however, it should be noted that the risk the state may be incapable to fulfill the guaranteed state obligations is reduced by concluding a trust management agreement, according to which the expenses for payment of the principal debt, loan servicing and interest payments are reimbursed.

The conducted analysis clearly demonstrates that the investment project proposed for financing from non-governmental loans under the state guarantee of the Republic of Kazakhstan (Project "A") is evaluated positively.

### 3.2. Evaluation of the effectiveness of the project implemented within the framework of public-private partnership using the Analytic Hierarchy Process evaluation methodology

The first specific feature of the analytic hierarchy process (AHP) is that, along with mathematics, it includes psychological aspects.

The second feature of the AHP is its universal and practical nature, which means that it can be applied in any sphere to facilitate decision-making. This includes choosing an alternative or an optimal strategy, allocating resources, future planning, predicting possible scenarios, prioritizing factors when solving complex problems and during strategic planning. These opportunities and advantages over other methods of expert evaluation represent the third feature of the AHP.

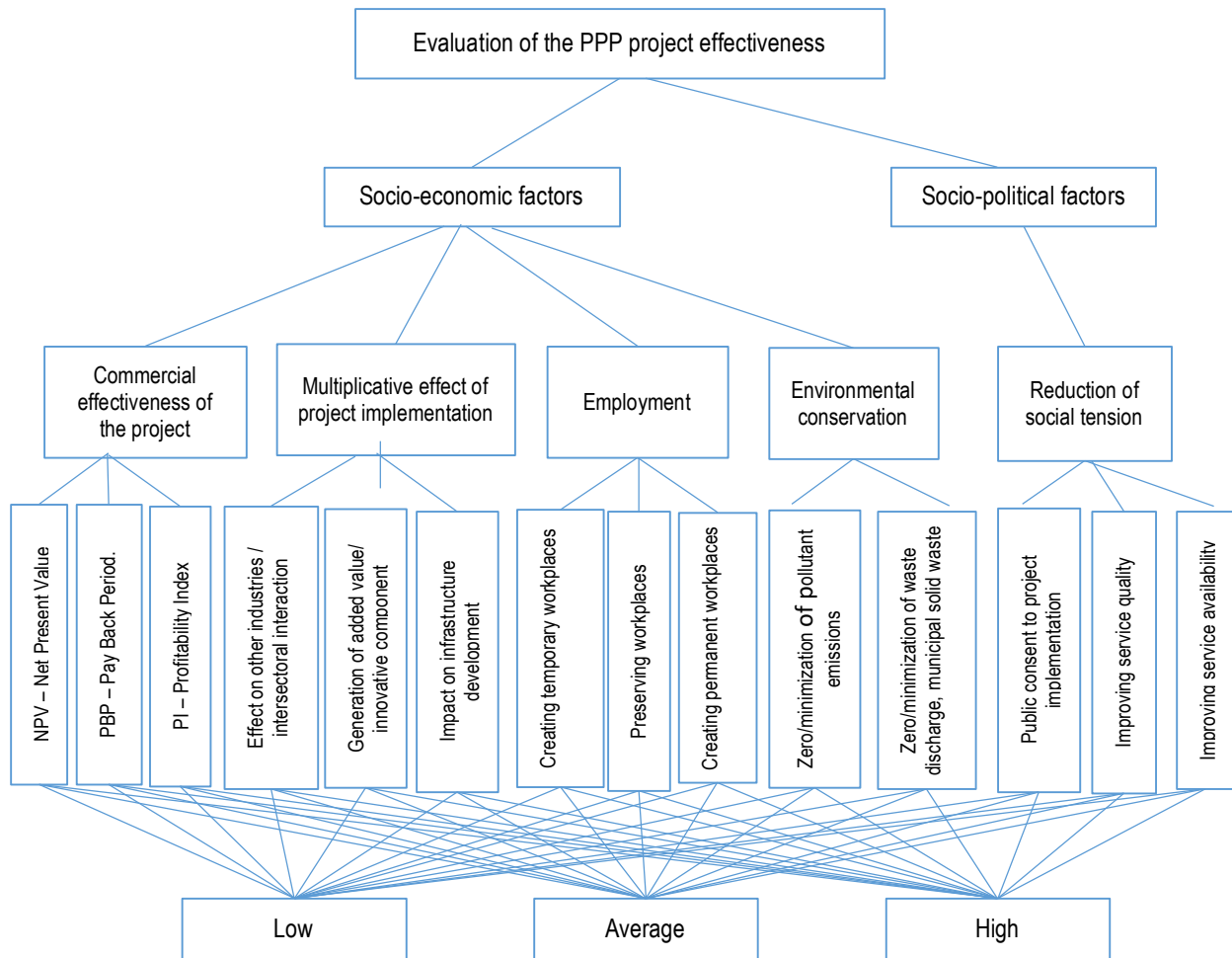
According to the methodology proposed by us, at the first stage we developed a five-level hierarchical model (Figure 1). The first level represents the goal, *i.e.* evaluation of the PPP project effectiveness. The second level contains common factors that determine how effective the PPP project is: socio-economic factors and socio-political factors. By breaking down common factors, we obtained factors representing elements of the third level: the commercial efficiency of the project, the multiplicative effect from the project implementation, employment, environmental conservation (socio-economic factors); reduction of social tension (a socio-political factor). Elements of the third level include several criteria that form the fourth level of the hierarchy. The fifth level is represented by alternatives that are expressed as the efficiency levels of PPP projects: low, average and high.

The proposed hierarchy of project effectiveness criteria allows an expert who has sufficient information about the project to decide on its effectiveness by step-by-step comparison of criteria and alternatives. As a result, the model allows calculating an integrated indicator for each of the alternatives, and the highest value corresponds to the recommended solution, in this case the level of effectiveness of the studied project.

As it was noted above, the consistency indicator reflects the degree of consistency of expert evaluation based on the transitivity of conclusions. Thus, the consistency relation indicates how clearly and accurately the expert represents the object of evaluation and its components. This indicator measures confidence in the final results of the evaluation.



Figure 1. Hierarchical model for evaluating the effectiveness of PPP projects



Source: compiled by the authors

At the second stage, it is necessary to form a pool of experts who will participate in taking a decision on the effectiveness of a PPP project. After evaluating the project, experts give their scores according to the hierarchy described in the Methodology. Expert estimates are the initial data for the AHP algorithm (Table 6).

Table 6. Hierarchy for evaluating the effectiveness of PPP projects

Factor	Factor	Score	
1	Socio-economic factors	Socio-political factors	
1.1.	Socio-economic factors		
	Commercial effectiveness of the project	Multiplicative effect of the project implementation	
	Commercial effectiveness	Employment	
	Commercial effectiveness	Environmental conservation	
	Multiplicative effect of project implementation	Employment	
	Multiplicative effect of project implementation	Environmental conservation	
	Employment	Environmental conservation	
1.1.1.	Commercial effectiveness of the project		
	NPV – Net Present Value	PBP – Pay Back Period	
	NPV – Net Present Value	PI – Profitability Index	
	PBP – Pay Back Period	PI – Profitability Index	
1.1.2.	Multiplicative effect of project implementation		
	Effect on other industries / intersectoral interaction	Generation of added value/ innovative component	

Factor	Factor	Score
Effect on other industries / intersectoral interaction	Impact on infrastructure development	
Generation of added value/ innovative component	Impact on infrastructure development	
1.1.3. Employment		
Creating permanent workplaces	Preserving workplaces	
Creating permanent workplaces	Creating temporary workplaces	
Preserving workplaces	Creating temporary workplaces	
1.1.4. Environmental conservation		
Zero/minimization of waste discharge, municipal solid waste	Zero/minimization of pollutant emissions	
1.2. Socio-political factors		
1.2.1. Reduction of social tension (_O_1024)		
Improving service availability	Improving service quality	
Improving service availability	Public consent to project implementation	
Improving service quality	Public consent to project implementation	

Source: compiled by the authors

After collecting all expert estimates, it is necessary to calculate the project estimate for each expert. For this, let us create comparison matrices:

1) Matrix of comparison of socio-economic factors, social and political factors. To evaluate PPP projects, let us consider a hierarchy consisting of four levels, N = 4:

Level 1 – factors, the number is expressed by M = 2;

Level 2 – criteria, the number is expressed by S<sub>1</sub> =, S<sub>2</sub>=, ..., S<sub>M</sub> = 5;

Level 3 – criteria, the number is expressed by T<sub>1</sub> =, T<sub>2</sub>=, ..., T<sub>S1</sub> =, ..., T<sub>1</sub> =, T<sub>2</sub>=, ..., T<sub>SM</sub> =, ... 14;

Level 4 – alternatives, the number is expressed by P = 3:

1. Introducing the AHP goal that is "to evaluate the efficiency of the PPP project";

2. Introducing N – the number of hierarchy levels;

3. For N = 1 let us introduce "the first level of hierarchy" and M – the number of factors in the first hierarchy: factor 1 – "Socio-economic factors – SEF", factor 2 – "Socio-political factors – SPE", etc.;

These actions allowed us to obtain data to build a comparison matrix of the socio-economic factor and socio-political factor (Table 7).

Table 7. Comparison matrix of the socio-economic factor and socio-political factor

	SEF	SPF	GEOMEAN	EV	PMandEV	PMand EV/EV	Max vector	RI	SI	CE
SEF	1	7.00	2.645751	0.875	1.75	2	2		0	0
SPF	0.142857	1	0.377964	0.125	0.25	2				
			3.023716			4				

Source: compiled by the authors

2) Let us construct a pairwise comparison matrix: for l = 1 up to M - 1 the expert enters one of the numbers of the comparison scale: (9,7,5,3,1, 1/3, 1/5, 1/7, 1/9) (6)

In our case, in the ratio between objects Project N – SEF – SPF, let us enter a value for "Expert evaluation".

A) a<sub>i,1</sub> = 1

B) a<sub>i, l+1</sub> = is the value entered by an expert,

C) a<sub>i+1,1</sub> = 1/ a<sub>i, l+1</sub> the matrix itself should be represented by:

$$\begin{pmatrix} 1 & a_{12} & \dots & a_{1M} \\ a_{21} & 1 & \dots & a_{2M} \\ \dots & \dots & \dots & \dots \\ a_{M1} & a_{M2} & \dots & 1 \end{pmatrix} \tag{7}$$

Next, let us find the geometric mean of the numbers  $a_{i1}, a_{i2}, \dots, a_{iM}$  using the formula:

$$b_i = GEOMEAN = \sqrt[M]{a_{i1} \cdot a_{i2} \cdot \dots \cdot a_{iM}} \quad (8)$$

in the program, one can use formula:

$$b_i = GEOMEAN = e^{\frac{1}{M} \cdot \ln(a_{i1} \cdot a_{i2} \cdot \dots \cdot a_{iM})} \quad (9)$$

At the next step, let us normalize the values obtained  $b_1, b_2, \dots, b_M$ , as follows:

$$1) \ b = b_1 + b_2 + \dots + b_M = \sum_{j=1}^M b_j \quad (10)$$

Next, let us estimate the numbers  $\alpha_1, \alpha_2, \dots, \alpha_M$ , by equalities

$$\alpha_j = \frac{b_j}{b} \quad (j = 1, \dots, M) \quad (11)$$

Thus, we obtain the result – numbers  $\alpha_1, \alpha_2, \dots, \alpha_M$ , which are an eigenvector, i.e. priorities of first-level factors.

3) Let us evaluate the consistency of experts' opinions according to the following algorithm:

- let us find the product of the pairwise comparison matrices and the column of the eigenvector, thus obtaining a new vector:

$$\begin{pmatrix} \beta_1 \\ \beta_2 \\ \dots \\ \beta_M \end{pmatrix} = \begin{pmatrix} 1 & a_{12} & \dots & a_{1M} \\ a_{21} & 1 & \dots & a_{2M} \\ \dots & \dots & \dots & \dots \\ a_{M1} & a_{M2} & \dots & 1 \end{pmatrix} \cdot \begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \dots \\ \alpha_M \end{pmatrix} \quad (12)$$

According to the Methodology, to evaluate the consistency that reflects the proportionality of preferences, let us calculate  $\lambda_{\max}$ . It should be noted that the closer  $\lambda_{\max}$  is to the number of objects or types of actions in the matrix, the more consistent is the result.

$$\lambda_{\max} = \beta_1 + \beta_2 + \dots + \beta_M = \sum_{j=1}^M \beta_j \quad (13)$$

- let us calculate the randomness index by equality:

$$RI = \frac{\lambda_{\max} - M}{M - 1} \quad (14)$$

- next we introduce the randomness index from the International System of Units.
- let us estimate the significance of the consistency of experts' opinions by equality:

$$CE = \frac{IR}{SI} \quad (15)$$

- If the consistency evaluation of the experts opinion falls within  $0 \leq CE \leq 0.1$ , then the opinion of the relevant expert is considered "highly consistent".
- If the consistency evaluation of the experts opinion falls within  $0.1 \leq CE \leq 0.25$ , then the opinion of the relevant expert is considered "relatively consistent".
- If the consistency evaluation of the experts opinion falls within  $CE > 0.25$ , then the opinion of the relevant expert is considered "inconsistent". In this case, the expert's assessment is not taken into account when calculating the effectiveness of the project.

4) Next, we apply the same algorithm to the whole hierarchy. Let us move on to the next level of the hierarchy:

1. For  $N = 2$  we introduce the "second level of the hierarchy", while  $S_1$  represents the number of the second level criteria corresponding to the factor of the first level  $M = 1, \dots, S_M$  is the number of the second level criteria corresponding to the factor of the first level  $M$  of the hierarchy:

- Criterion 1 – "Commercial effectiveness of the project – CEP" (Table 8);
- Criterion 2 – "Multiplicative effect of project implementation – MEPI" (Table 9), etc.;

Table 8. Results of calculations when building a comparison matrix by Criterion 1 – CEP

	NPV	PBP	PI	GEOMEAN	EV	PMandEV	PMandEV/EV	Max vector	RI	SI	CE
NPV	1	7.0	7.0	3.659306	0.753111	2.4813344	3.294779494	3.2947795	0.14739	0.58	0.25412
PBP	0.142857	1	5.0	0.893904	0.183972	0.606146	3.294779494				
PI	0.142857	0.2	1	0.305711	0.062917	0.207299	3.294779494				
				4.85892	1		9.884338483				

Source: compiled by the authors

Table 9. Results of calculations when building a comparison matrix by Criterion 2 – MEPI

	IS Int	In Comp	ImID	GEOMEAN	EV	PMandEV/EV	PMandEV/EV	Max vector	RI	SI	CE
IS Int	1	7.00	7.0	3.659306	0.741864	2.548815	3.435689	3.435689	0.217845	0.58	0.375594
In Comp	0.142857	1	7.0	1	0.202734	0.69653	3.435689				
ImID	0.142857	0.142857	1	0.273276	0.055402	0.190345	3.435689				
				4.932582	1		10.30707				

Source: compiled by the authors

Based on the obtained data, let us build a pairwise comparison matrix.

2. Building a pairwise comparison matrix:

\* for  $l = 1$  up to  $S_1 - 1$  let us enter the numbers from the comparison scale (9, 7, 5, 3, 1, 1/3, 1/5, 1/7, 1/9) (16)

- A)  $a_{i,i} = 1$ ,
- B)  $a_{i,i+1} = 9$ , as entered by an expert,

C)  $a_{i+1,i} = \frac{1}{a_{i,i+1}}$  it is necessary to represent the matrix itself

$$\begin{pmatrix} 1 & a_{12} & \dots & a_{1S_1} \\ a_{21} & 1 & \dots & a_{2S_1} \\ \dots & \dots & \dots & \dots \\ a_{S_11} & a_{S_12} & \dots & 1 \end{pmatrix} \quad (17)$$

Next, let us find the geometric mean of the numbers  $a_{i1}, a_{i2}, \dots, a_{iS_1}$  according to the formula:

$$b_i = GEOMEAN = \sqrt[S_1]{a_{i1} \cdot a_{i2} \cdot \dots \cdot a_{iS_1}} \quad (18)$$

Also, in the program one can use the formula:

$$b_i = GEOMEAN = e^{\frac{1}{S_1} \cdot \ln(a_{i1} \cdot a_{i2} \cdot \dots \cdot a_{iS_1})} \quad (19)$$

Further, we normalize the obtained numbers  $b_1, b_2, \dots, b_{S_1}$  as follows:

$$1. b = b_1 + b_2 + \dots + b_{S_1} = \sum_{j=1}^{S_1} b_j \quad (20)$$

$$2. \text{ let us find numbers } \alpha_1, \alpha_2, \dots, \alpha_{S_1} \text{ by equalities } \alpha_j = \frac{b_j}{b} \quad (j = 1, \dots, S_1) \quad (21)$$

It should be noted that this process is carried out for each  $S_1, S_2, \dots, S_M$ . Thus, we obtain the following

conclusion: numbers  $\begin{pmatrix} \alpha_1^1 \\ \alpha_2^1 \\ \dots \\ \alpha_{S_1}^1 \end{pmatrix}, \begin{pmatrix} \alpha_1^2 \\ \alpha_2^2 \\ \dots \\ \alpha_{S_2}^2 \end{pmatrix}, \dots, \begin{pmatrix} \alpha_1^M \\ \alpha_2^M \\ \dots \\ \alpha_{S_M}^M \end{pmatrix}, \dots$  are eigenvectors, i.e. priorities of the second-level

criteria, in this case:  $\begin{pmatrix} \alpha_1^1 \\ \alpha_2^1 \\ \dots \\ \alpha_{S_1}^1 \end{pmatrix}, \begin{pmatrix} \alpha_1^2 \\ \alpha_2^2 \\ \dots \\ \alpha_{S_2}^2 \end{pmatrix}.$

3. Let us estimate the consistency of experts' opinion by the following algorithm:

- finding the product of the matrices of the pairwise comparison and the column of the eigenvector, we obtain a new vector:

$$\begin{pmatrix} \beta_1 \\ \beta_2 \\ \dots \\ \beta_{S_1} \end{pmatrix} = \begin{pmatrix} 1 & a_{12} & \dots & a_{1S_1} \\ a_{21} & 1 & \dots & a_{2S_1} \\ \dots & \dots & \dots & \dots \\ a_{S_11} & a_{S_12} & \dots & 1 \end{pmatrix} \cdot \begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \dots \\ \alpha_{S_1} \end{pmatrix} \quad (22)$$

Next, let us calculate the consistency estimate, which reflects the proportionality of preferences:

$$\lambda_{\max} = \beta_1 + \beta_2 + \dots + \beta_{S_1} = \sum_{j=1}^{S_1} \beta_j \quad (23)$$

Let us estimate the randomness index by:  $IR = \frac{\lambda_{\max} - S_1}{S_1 - 1}$  (24)

Next, let us enter a randomness index value from the table SI. Let us estimate the consistency of experts' opinion by equality:

$$CE = \frac{RI}{SI} \quad (25)$$

- If the consistency evaluation of the experts' opinion falls within  $0 \leq CE \leq 0.1$ , then the opinion of the relevant expert is considered "highly consistent".
- If the consistency evaluation of the experts' opinion falls within  $0.1 \leq CE \leq 0.25$ , then the opinion of the relevant expert is considered "relatively consistent".
- If the consistency evaluation of the experts' opinion is as follows  $CE > 0.25$ , then the opinion of the relevant expert is considered "inconsistent".

Next, it is necessary to repeat the calculations of the matrices of pairwise comparison and to determine the eigenvectors of the criteria and alternatives. As a result of this stage, we find the eigenvectors for all levels: for factors, for criteria, for alternatives. By the following groups:

1) first level factors

Socio-economic factors	7.00	Socio-political factors
------------------------	------	-------------------------

Eigenvector  $\begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \dots \\ \alpha_M \end{pmatrix}$

2) second level criterion

Socio-economic factors:

Commercial effectiveness of the project	9.00	Multiplicative effect of project implementation
Commercial effectiveness of the project	9.00	Employment
Commercial effectiveness of the project	7.00	Environmental conservation
Multiplicative effect of project implementation	5.00	Employment
Multiplicative effect of project implementation	3.00	Environmental conservation
Employment	1.00	Environmental conservation

Eigenvector  $\begin{pmatrix} \alpha_1^1 \\ \alpha_2^1 \\ \dots \\ \alpha_{S_1}^1 \end{pmatrix}, \begin{pmatrix} \alpha_1^2 \\ \alpha_2^2 \\ \dots \\ \alpha_{S_2}^2 \end{pmatrix}, \dots, \begin{pmatrix} \alpha_1^M \\ \alpha_2^M \\ \dots \\ \alpha_{S_M}^M \end{pmatrix};$

3) third level criterion:

Commercial effectiveness of the project:

NPV – Net Present Value	7.00	PBP – Pay Back Period
NPV – Net Present Value	7.00	PI – Profitability Index
PBP – Pay Back Period	5.00	PI – Profitability Index

$$\text{Eigenvectors } \begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_{T_1}^1 \end{pmatrix}, \begin{pmatrix} \beta_1^2 \\ \beta_2^2 \\ \dots \\ \beta_{T_2}^2 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^{S_1} \\ \beta_2^{S_1} \\ \dots \\ \beta_{T_{S_1}}^{S_1} \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_{T_1}^1 \end{pmatrix}, \begin{pmatrix} \beta_1^2 \\ \beta_2^2 \\ \dots \\ \beta_{T_2}^2 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^{S_M} \\ \beta_2^{S_M} \\ \dots \\ \beta_{T_{S_M}}^{S_M} \end{pmatrix} \text{ etc.}$$

4) fourth level alternatives:

Commercial effectiveness of the project (Table 10):

Table 10. The calculation results after building a matrix for comparing alternatives regarding NPV

	Low	Medium	High	GEOMEAN	EV	PMandEV	PMandEV/EV	Max vector	SI	RI	CE
L	1	7.00	7.00	3.659306	0.741864	2.5488148	3.435689141	3.4356891	0.217845	0.58	0.375594
M	0.142857	1	7.00	1	0.202734	0.6965296	3.435689141				
H	0.142857	0.142857	1	0.273276	0.055402	0.1903447	3.435689141				
				4.932582	1		10.30706742				

Source: compiled by the authors

Next, we obtain the comparison results:

1) Comparison of the alternatives for NPV

Low effectiveness	7	Average effectiveness
Low effectiveness	7	High effectiveness
Average effectiveness	7	High effectiveness

2) Comparison of the second level criteria for PBP

Low effectiveness	3	Average effectiveness
Low effectiveness	3	High effectiveness
Average effectiveness	3	High effectiveness

3) Comparison of the second level criteria for PI

Low effectiveness	9	Average effectiveness
Low effectiveness	9	High effectiveness
Average effectiveness	9	High effectiveness

After the comparison criteria, we obtain eigenvectors:

$$\begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_P^1 \end{pmatrix}, \begin{pmatrix} \beta_1^2 \\ \beta_2^2 \\ \dots \\ \beta_P^2 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^{T_1} \\ \beta_2^{T_1} \\ \dots \\ \beta_P^{T_1} \end{pmatrix}, \begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_P^1 \end{pmatrix}, \begin{pmatrix} \beta_1^2 \\ \beta_2^2 \\ \dots \\ \beta_P^2 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^{T_2} \\ \beta_2^{T_2} \\ \dots \\ \beta_P^{T_2} \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_P^1 \end{pmatrix}, \begin{pmatrix} \beta_1^2 \\ \beta_2^2 \\ \dots \\ \beta_P^2 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^{T_{S_1}} \\ \beta_2^{T_{S_1}} \\ \dots \\ \beta_P^{T_{S_1}} \end{pmatrix}$$

...

$$\begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_P^1 \end{pmatrix}, \begin{pmatrix} \beta_1^2 \\ \beta_2^2 \\ \dots \\ \beta_P^2 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^{T_1} \\ \beta_2^{T_1} \\ \dots \\ \beta_P^{T_1} \end{pmatrix}, \begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_P^1 \end{pmatrix}, \begin{pmatrix} \beta_1^2 \\ \beta_2^2 \\ \dots \\ \beta_P^2 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^{T_2} \\ \beta_2^{T_2} \\ \dots \\ \beta_P^{T_2} \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_P^1 \end{pmatrix}, \begin{pmatrix} \beta_1^2 \\ \beta_2^2 \\ \dots \\ \beta_P^2 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^{T_{S_M}} \\ \beta_2^{T_{S_M}} \\ \dots \\ \beta_P^{T_{S_M}} \end{pmatrix}$$

In the end, we find the product of matrices:



$$\begin{pmatrix} \beta_1^1 & \beta_1^2 & \dots & \beta_1^{T_1} \\ \beta_2^1 & \beta_2^2 & \dots & \beta_2^{T_1} \\ \dots & \dots & \dots & \dots \\ \beta_P^1 & \beta_P^2 & \dots & \beta_P^{T_1} \end{pmatrix} \text{ and } \begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_{T_1}^1 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^1 & \beta_1^2 & \dots & \beta_1^{T_{S_1}} \\ \beta_2^1 & \beta_2^2 & \dots & \beta_2^{T_{S_1}} \\ \dots & \dots & \dots & \dots \\ \beta_P^1 & \beta_P^2 & \dots & \beta_P^{T_{S_1}} \end{pmatrix} \text{ and } \begin{pmatrix} \beta_1^{S_1} \\ \beta_2^{S_1} \\ \dots \\ \beta_{T_{S_1}}^{S_1} \end{pmatrix}, \text{ so that we}$$

obtain the matrix:  $\begin{pmatrix} \gamma_1^1 & \gamma_1^2 & \dots & \gamma_1^{S_1} \\ \gamma_2^1 & \gamma_2^2 & \dots & \gamma_2^{S_1} \\ \dots & \dots & \dots & \dots \\ \gamma_P^1 & \gamma_P^2 & \dots & \gamma_P^{S_1} \end{pmatrix}$ . In this way, we find the product of matrices:

$$\begin{pmatrix} \beta_1^1 & \beta_1^2 & \dots & \beta_1^{T_1} \\ \beta_2^1 & \beta_2^2 & \dots & \beta_2^{T_1} \\ \dots & \dots & \dots & \dots \\ \beta_P^1 & \beta_P^2 & \dots & \beta_P^{T_1} \end{pmatrix} \text{ and } \begin{pmatrix} \beta_1^1 \\ \beta_2^1 \\ \dots \\ \beta_{T_1}^1 \end{pmatrix}, \dots, \begin{pmatrix} \beta_1^1 & \beta_1^2 & \dots & \beta_1^{T_{S_M}} \\ \beta_2^1 & \beta_2^2 & \dots & \beta_2^{T_{S_M}} \\ \dots & \dots & \dots & \dots \\ \beta_P^1 & \beta_P^2 & \dots & \beta_P^{T_{S_M}} \end{pmatrix} \text{ and } \begin{pmatrix} \beta_1^{S_M} \\ \beta_2^{S_M} \\ \dots \\ \beta_{T_{S_M}}^{S_M} \end{pmatrix}, \text{ so that we}$$

obtain the matrix:  $\begin{pmatrix} \gamma_1^1 & \gamma_1^2 & \dots & \gamma_1^{S_M} \\ \gamma_2^1 & \gamma_2^2 & \dots & \gamma_2^{S_M} \\ \dots & \dots & \dots & \dots \\ \gamma_P^1 & \gamma_P^2 & \dots & \gamma_P^{S_M} \end{pmatrix}$ .

Now, let us find the product of matrices:  $\begin{pmatrix} \gamma_1^1 & \gamma_1^2 & \dots & \gamma_1^{S_1} \\ \gamma_2^1 & \gamma_2^2 & \dots & \gamma_2^{S_1} \\ \dots & \dots & \dots & \dots \\ \gamma_P^1 & \gamma_P^2 & \dots & \gamma_P^{S_1} \end{pmatrix}$  and  $\begin{pmatrix} \alpha_1^1 \\ \alpha_2^1 \\ \dots \\ \alpha_{S_1}^1 \end{pmatrix}$ , so we obtain matrix  $\begin{pmatrix} \tau_1^1 \\ \tau_2^1 \\ \dots \\ \tau_P^1 \end{pmatrix}$

In this way, we find the product of matrices:  $\begin{pmatrix} \gamma_1^1 & \gamma_1^2 & \dots & \gamma_1^{S_M} \\ \gamma_2^1 & \gamma_2^2 & \dots & \gamma_2^{S_M} \\ \dots & \dots & \dots & \dots \\ \gamma_P^1 & \gamma_P^2 & \dots & \gamma_P^{S_M} \end{pmatrix}$  and  $\begin{pmatrix} \alpha_1^M \\ \alpha_2^M \\ \dots \\ \alpha_{S_M}^M \end{pmatrix}$ , so we obtain matrix

$\begin{pmatrix} \tau_1^M \\ \tau_2^M \\ \dots \\ \tau_P^M \end{pmatrix}$ . Now let us multiply matrices:  $\begin{pmatrix} \tau_1^1 & \tau_1^2 & \dots & \tau_1^M \\ \tau_2^1 & \tau_2^2 & \dots & \tau_2^M \\ \dots & \dots & \dots & \dots \\ \tau_P^1 & \tau_P^2 & \dots & \tau_P^M \end{pmatrix}$  and  $\begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \dots \\ \alpha_M \end{pmatrix}$ , so we obtain matrix  $\begin{pmatrix} \xi_1 \\ \xi_2 \\ \dots \\ \xi_P \end{pmatrix}$ .

This is how we obtain the desired matrix that can be used to evaluate the effectiveness of a PPP project.

According to the built hierarchy model, the total result is the sum of three components (low effectiveness, average effectiveness, and high effectiveness) that together give 100%. The effectiveness of the project is determined by the maximum value of the components, but if the values are the same, then the effectiveness is estimated downward. Applying the Methodology, we could estimate the high effectiveness of the project, *i.e.* the commercial effectiveness of the NPV project was 7.00, with the discounted profit also amounting to 7.00.

However, taking into account the impact of not only traditional economic factors, but also social and socio-political factors, including such as the multiplicative effect of project implementation, employment, environmental conservation, we discovered that the project is not sufficiently effective. For instance, the multiplicative effect from the project implementation was -5.00, employment -5.00, environmental conservation -3.00. This proves insufficient effectiveness of the project, regarding the impact of social and socio-political factors.

Thus, the application of the new approach to evaluation of PPP projects that included modern methods of priorities assessment such as the AHP method, as well as the analytic network process based on using an integral indicator to evaluate the effectiveness of projects, enabled us to consider the impact of not only economic factors, but also non-economic ones: social, political, *etc.*, and to provide a comprehensive evaluation of the effectiveness of the project.

### Discussion

Due to the fact that partnerships imply mutual benefits that should be specific, understandable to both parties, clear and measurable, evaluation of the effectiveness of public-private partnership projects is an important aspect of PPP. At the same time, each stakeholder may expect an effect of different nature and have different criteria that do not always refer to the area of financial indicators.

Results of the research showed that approaches to the evaluation of PPP projects differ significantly from traditional ones since, on the one hand, it is necessary to assess the investment of the private sector according to the analysis of financial efficiency and, on the other hand, one should take into account the interests of the state by analyzing costs and benefits to the public sector.

Currently, the main problem of implementing projects can be explained by the fact that the market presents information only about two types of efficiency: financial efficiency, reflecting benefits and costs of project implementation from the point of view of private project participants and economic (public) efficiency, generally representing the consequences of the project from the social point of view. Analysis of economic publications also showed that social effectiveness of the project has not been properly investigated.

The social efficiency of the PPP project can be defined as a positive result of the implementation of the investment project for people. It improves the quality of life by increasing the production of goods and services, increases their availability, timeliness and regularity of their supply. We developed a new approach to the evaluation of PPP projects that included modern methods of assessing priorities with an integral indicator applied to evaluate project effectiveness. This allowed us to take into account the impact of not only economic factors, but also non-economic, social, political, *etc.* This methodology allowed us to carry out a comprehensive evaluation of the effectiveness of the PPP project.

### Conclusion

In the course of the study we explored the methodology for evaluating the effectiveness of PPP projects and developed a new approach to evaluate the effectiveness of PPP projects. This approach involved systematization of criteria used to determine projects effectiveness; this enabled us to identify their feasibility and use the integrated indicator of the effectiveness of PPP projects, as well as to build a financial and economic model for evaluating the investment project. The novelty of this approach to evaluating PPP projects is due to the application of an integral indicator that takes into account the impact of not only traditional economic factors, but also social and socio-political factors, including such as the multiplicative effect of the project, employment, environmental conservation, social tension and others, *i.e.* factors that were not considered before. This approach can be applied to evaluate PPP projects implemented in all economic sectors and in the social sphere.

In the course of the research, we developed and tested an information system that enables to determine not only economic but also social efficiency of the project at the stage of PPP projects implementation, which previously was not possible. The hierarchy of project effectiveness criteria developed by us allow the expert who has sufficient information about the project to make a decision about its effectiveness by step-by-step comparison of the criteria and alternatives. As a result, the model estimates an integrated indicator for each of the alternatives, the highest figure corresponds to the recommended solution. In this case it represents the level of effectiveness of the considered project.

Thus, in this research the authors comparatively evaluated how various traditional methods are applied to estimate the effectiveness of PPP projects, as well as evaluated the effectiveness of the project using the AHP methodology. Applying the proposed methodology, the authors could conclude on the high efficiency of the project. However, taking into account the impact of not only traditional economic factors, but also social and socio-political ones, including such as the multiplicative effect of project implementation, employment, environmental conservation, it was revealed that the project is not sufficiently effective.

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## Consumer Preferences and Demand in the Market as Competitive Potential

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### Abstract:

Improving the competitiveness of an enterprise and its products is one of the priority directions of any national economy. In the context of the global market globalization, successful operation of an enterprise largely depends on effective marketing management of its competitive potential. Competitive potential is the basis for improving an enterprise's competitiveness in the long run. Practice shows that especially successful are those marketing-oriented enterprises that have complete and reliable information on the demand and preferences of their consumers. In this case, the results of marketing research become the basis for the company's strategy in the field of providing competitive advantages and improving the effectiveness of its marketing activities. However, enterprises are often not fully aware of the demand and preferences of their consumers. This situation arises due to the lack of an integrated methodology for research on the demand and preferences with respect to a particular product.

Hence, the purpose of this article is the development and testing of a research methodology for demand and consumer preferences in the market of men's suits. The authors of this study used a combination of desk and quantitative (survey) research methods. The research revealed the profile, demand and consumer's preferences in the market of men's suits, as well as the criteria for choosing men's suits in the market of the Republic of Kazakhstan. The proposed research methodology might be used by light industry enterprises in the countries of the Eurasian Economic Union, as well as in other developing countries. From a theoretical point of view, the authors provide their own interpretation of such concepts/definitions as "competitive potential of an enterprise" and "marketing management of competitive potential of an enterprise".

**Keywords:** competitive potential; management; marketing; consumers' demand; preferences; market of men's suits

**JEL Classification:** F10; F19; D91

### Introduction

In the context of the world market globalization, competition in the light industry market of a particular country and the world is becoming more acute. Manufacturers offer to consumers a wide and varied assortment of clothing and shoes that can be bought both domestically and abroad. Online shopping and manufacturers' catalogs are becoming more and more attractive to consumers. Along with this, the use of digital marketing tools increasingly expands the boundaries of the light industry consumer market: from the local market to the global market. In these conditions, it becomes more difficult to maintain competitive positions in the market for domestic light industry enterprises when competing with the global brands. To maintain their competitive positions, light industry enterprises should constantly evaluate their competitive potential based on marketing research. As is known, competitive potential of an enterprise is determined based on evaluation of its internal (marketing, innovation, resource and creative) and external (market) competitive capabilities that could be later converted into its competitive advantages. In this structure of competitive potential, marketing potential should be the starting point for research. That is because the knowledge of the customer's demand and preferences based on benchmarking is the key to success of any enterprise and effective management of the marketing activities of an enterprise. In this regard, the problem of assessing the competitive potential of a light industry enterprise is relevant for any national economy.

The study was conducted in the light industry market of the Republic of Kazakhstan, a member of the Eurasian Economic Union. At the same time, the analysis of the current state of the light industry market in the Republic of Kazakhstan, according to the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan (Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan,

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2013; 2014, 2015, 2016, 2017) shows insufficient development of this branch of economy, as illustrated by the following indicators: a low share of light industry in the structure of manufacturing, which in the period from 2008-2011 was about 0.9%, in 2012-2014 – 1.1%, in 2015 – 1.2%, in 2016 – 1.0%. The parallel figure in Germany, France and the United States is 4%, in Italy – 12%. In developed countries, 20% of the budget falls to the share of light industry, which fills the domestic market with 75-85% of its own production (Mustafina 2015). If one considers the share of light industry in the structure of the country's industrial production, it is even lower, and in 2012-2016 is, on average, as follows: production of textiles and clothing – 0.2%, production of leather and related products – 0.04%.

In the Republic of Kazakhstan, light industry covers only 10% of domestic market needs, of which 8% is in the garment and textile industry and about 2% is in the production of leather and related products. This indicator does not meet the requirements of the country's economic security, since it is 3 times less than the required level and does not reach the threshold of 30%, resulting in the country's high dependence on imports. At the same time, it should be noted that the largest share in the total output of light industry falls on the production of clothing:

- in 2008 – 36.6%, in 2009 – 41.8%, in 2010 – 36.4%, in 2011 – 44.4%, in 2012 – 47.1%, in 2013 – 45.2%, in 2014 – 47%, in 2015 – 50.4%, in 2016 – 44.3%, respectively;
- the number of Kazakhstan enterprises of light industry has decreased by almost two times compared to the period of 1980-1990 with approximately 1000 economic entities. Thus, the number of light industry enterprises in recent years amounted to 581 units in 2008, 570 units in 2009, 565 units in 2010, 536 units in 2011, 543 in 2012, 554 units in 2013, 455 units in 2014, 463 units in 2015 and 452 units in 2016, respectively. At the same time, the share of clothing production enterprises in the total volume of light industry enterprises was 64.5% in 2008, 64.2% in 2009, 61.2% in 2010, 58.6% in 2011, 59.1% in 2012, 58.5% in 2013, 58% in 2014, 56.8% in 2015 and 58.4% in 2016, respectively;
- for the period under review, the light industry employed about 7.1 thousand people in the production of textiles; about 5 thousand people – in the garment industry; about 1 thousand people – in the production of leather and related products. Their share in the total employment in the manufacturing industry is about 4.3%, and in general, in the total volume of industrial production – about 2%;
- the profitability in the light industry in 2016 amounted to: 8.9% in textile production, 10.2% in the garment industry and 37.2% in production of leather and related products. At the same time, it should be noted that the profitability of production growth was achieved as a result of the return on investment in fixed assets;
- the structure of exports and imports in the light industry shows a decrease in exports by 3.3 times in 2016 (\$206.6 million) compared to 2008 (\$686.3 million) and an increase in imports by 2.2 times in 2016 (\$1019.5 million) compared to 2008 (\$457.6 million). These indicators characterize the low export potential of light industry enterprises in the Republic of Kazakhstan.

The main reasons for the current situation in the light industry market of the Republic of Kazakhstan are the dependence of the branch's enterprises on the import of raw materials and incomplete production load, which is basically below 35%. Other problems hampering the development of light industry of the Republic of Kazakhstan are the following:

- technical and technological backwardness of the light industry enterprises' equipment, considerable physical and moral wear of fixed assets up to 80%;
- investment unattractiveness due to low profitability of light industry enterprises and a long payback period;
- insufficient working capital in light industry enterprises;
- dependence of the load of textile enterprises on agricultural producers, which are the main suppliers of raw materials;
- low labor productivity of the industry (compared with the foreign leaders of light industry) due to high labor input;
- lack of highly qualified personnel due to unattractive working conditions and wages, as well as the lack of modern educational programs for training specialists in textile, clothing and footwear production;
- noncompetitiveness of finished goods in terms of price due to the high percentage of import dependence on raw materials, components and accessories, and also due to insufficient awareness of producers of the demand and preferences of the target segment;
  - high spending on product promotion (high rents in shopping centers and other marketing costs);



- low export share of finished products;
- low consumer awareness of domestic products.

To solve these problems, along with further state support for Kazakhstan's light industry, industry enterprises should effectively manage their competitive potential through the primary consideration of demands and preferences of the target segment. In this regard, it seems relevant to address the complex and poorly structured problem of managing the competitive potential of light industry enterprises based on the study of consumers' demand and preferences.

The features of the marketing activities of light industry enterprises are as follows:

- light industry enterprises carry out both primary processing of raw materials and production of finished products;
- the products of light industry enterprises belong to the category of the first necessity, since clothes and footwear provide physiological needs of a person and influence his/her state of health;
- the demand for products of light industry is seasonal and depends on changes in the fashion industry;
- high mobility of production and technological capabilities of light industry enterprises, allowing rapid changes in the range of products under market changes associated with seasonal changes in demand and fashion, without reducing output and, consequently, sales volumes, and without reducing tax deductions.

## 1. Literature review

Scientists study the management problems of competitive potential from various positions: marketing, innovations, resources (financial, production, organizational, human resources) and creativity. At the same time, depending on the type of enterprise activity, researchers identify the relevant factors that form competitive potential and indicators that characterize its competitiveness. The founder of the modern theory of competitive potential, competitive advantages and competitiveness is Michael Porter, whose scientific works served as the basis for further development of theory and practice in relation to different branches of the economy.

In this paper, the authors examine the problems of managing competitive marketing potential of an enterprise, since it is the starting point for ensuring competitive advantages and competitiveness of any enterprise. The problems of marketing management of a company's competitive potential are analyzed in the studies of several foreign and domestic economists and marketers. Among them, one can single out the following scientific works of Western economists – Porter (2005, 2010, 2013), Lambin (2011, 2013), Aaker (2007), Kotler and Keller (2014), O'Shaughnessy (2002) and others; Russian marketers–Fatkhutdinov (2006), Nosova (2009), Salikhova (2011), Kiseleva, *et al.* (2007), Dudin, *et al.* (2018), Kuzmin, *et al.* (2017) and others; Kazakhstani economists – Sabden *et al.* (2007), Esimzhanova (Mustafina 2015), and others. Marketing research of consumers is the central element in the management of competitive potential. In this connection, the methodological basis for conducting marketing research were the works by Malhotra (2008), Churchill (2010), Golubkov (2008), Belyaevskii (2008), Bozhuk, and Kovalik (2008), Dyusembekova (2013), Karmanov, *et al.* (2017), Rusetskaya, *et al.* (2017) and others. In developing the research methodology, the conceptual framework outlined in the works of these scientists was taken into account in order to improve the quality and representativeness of the study.

At the same time, the analysis of scientific publications showed that the existing theoretical regulations for managing the competitive potential of enterprises are not exhaustive, due to inadequacy of studies on the light industry enterprises; therefore, some aspects remained outside the field of scientific interests. In this regard, the study attempts to examine the problems through the prism of marketing activity of the light industry enterprises, specializing in the production of men's suits.

## 2. Materials and methods

The following methods were used in the study:

- desk method – for the analysis of the current state of the light industry market, according to the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan; as well as the collection and analysis of secondary information on enterprises that manufacture men's suits;

- quantitative method (survey) – to provide initial information on the demand and consumer preferences for men's suits in the market of the Republic of Kazakhstan, the authors conducted a market research by means of a questionnaire.

Marketing research process included the following steps: development of the research concept, development of the research plan, collection of information, preparation and analysis of information, preparation of a report and its presentation. Let us reveal further the content of these stages:

1. Development of the research concept:

- the problem of marketing research – low sales volumes of men's suits of the "QLP" – domestic trademark of a relatively young shoe and clothing factory "Kazlegprom-Almaty" LLP, operating in the light industry market of the Republic of Kazakhstan since 2011. This problem is due to the alleged reasons: low consumer awareness of the factory products, lack of information on the demand and consumers' preferences for men's suits;
- planning the research methodology – the authors of this study chose the quantitative survey method by means of an e-questionnaire;
- construction of an analytical verbal model. It was based on the process of consumer decision-making on the choice of a particular men's suit brand. A consumer buys a suit based on his experience, personal preferences and needs, awareness of the brand and its fame, expectations of a certain quality expressed in perceived consumer value. When the expected and perceived values coincide during the process of wearing a men's suit, a consumer becomes a loyal customer of the garment and shoe factory of LLP "Kazlegprom-Almaty".
- the object of study – consumers of men's suits in the market of the Republic of Kazakhstan;
- the subject of study – consumers' demand and preferences for men's suits, their degree of awareness of the national brand "QLP";
- objective of the study – descriptive: to reveal consumers' demand and preferences in the market for men's suits in the Republic of Kazakhstan to improve management of the marketing competitive potential of the light industry enterprise;
- development of working hypothesis – in the present study, the authors propose the following hypotheses:
  - H1: An increase in consumers' awareness of domestic products (men's suits) will lead to the increase in its demand and consumption, as well as to the increase in consumers' loyalty;
  - H2: Expansion and updated range of men's suits will lead to the increase in consumer demand;
  - H3: Effective management of the competitive potential of light industry enterprises based on accounting for consumers' preferences and demand for men's suits will lead to import substitution in the country;
  - H4: Effective management of competitive potential of light industry enterprises will lead to development of its export potential (export growth).
- problem statement – the present study has solved the following problems:
  - to identify the structure of factors influencing the decision to purchase a men's suit;
  - to identify the frequency and preferred place to shop for men's suit;
  - to calculate the share of "mind" and "heart" in relation to men's suits;
  - to identify consumers' preferences when buying a men's suit;
  - to range by importance, the criteria influencing the choice when buying a men's suit;
  - to determine consumer preferences in selection of sources of information, to inquire about the new points of sale of men's suit; country-manufacturer of men's suits; the optimal price to purchase a men's suit; as well as the price of a men's suit;
  - to determine the degree of awareness of the national Kazakhstan's brand "QLP";
  - to receive proposals from consumers to increase awareness of men's suits of Kazakhstan domestic manufacturers;
  - to determine the consumer's profile of Kazakhstan "QLP" men's suit brand;
  - to develop recommendations to improve the marketing management of competitive potential for enterprises in the production of men's suits based on the results of the study.

2. Formation of the research plan:

- development of the research plan — the authors chose a descriptive type of marketing research and a quantitative survey method, in particular, an electronic survey;

- determination of measurement and scaling procedures – an incomparable scaling method was used;
- development of a questionnaire and conducting a pilot survey—the questionnaire developed in accordance with the requirements for its compilation classically consists of three parts: introductory, basic and requisite (passport). The introduction includes the purpose of the present study, the importance of respondent's participating in the survey, guarantees of anonymity. The main part of the questionnaire contains the initial question (1), questions for obtaining basic information about consumers' demand and preferences (2-8, 11-12), complex questions (9-10); it also includes control questions for assessing the degree of reliability of the respondents' answers. When developing the questionnaire, a strategy of the funnel-like (tunnel) approach was used, with the transition from general to specific issues;
- the respondents were asked questions about their demand and preferences in choosing a men's suit, the level of awareness of foreign and domestic brands of men's suits, the criteria for choosing men's suits and the acceptable price for purchase. The requisite part of the questionnaire included classification questions about social-demographic characteristics of the respondents. Then, based on the replicated questionnaire, a pilot survey was conducted – testing the questionnaire on a small sample of respondents (30 people) in order to improve it by identifying and eliminating potential problems. Based on the results of the pilot survey, the last adjustment of the questionnaire was made with a subsequent replication. The questionnaire was reproduced in the platform testograf.ru for the purpose of conducting a field electronic survey.
- sampling planning – development of a sampling plan and determination of the sample size consisted of the following stages: defining the general population, sampling framework, defining method and sample size:
  - definition of the general population – men of the Republic of Kazakhstan at the age of 18 years and older;
  - sampling framework – directories of enterprises and government bodies of Kazakhstan, in which their e-mail addresses are available; sample unit – a man who has a men's suit in his wardrobe;
  - selection of the sampling method – probabilistic (random); type of sampling method – a simple random selection in which each element of the general population has a known and equal probability to be selected independently of each other element, and the sampling itself is formed by random selection of elements from the sampling frame;
  - selecting the sample size – a study of the demand and preferences for men's suits by its type refers to the testing of goods. According to the minimum and typical size tables for marketing research by Malhotra (2008), when testing the product in order to solve the problem, the minimum range should be 200 people, the typical range is 300-500 people. The authors also attempted to calculate the sample with the use of the statistical method based on the country's population (Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan 2017):

The population of the Republic of Kazakhstan is 17.9 million people, of which: men, in total – 8.7 million people (48.4% of the total population of the Republic of Kazakhstan); men aged 18 years and over – 5.9 million people (68.5% of the total number of men in the Republic of Kazakhstan) – the nominal general population (N).

Knowing the nominal number of the general population, one cannot accurately determine the real general population. This is due to the fact that one cannot accurately determine how many people wear a men's suit. Thus, some men do not need to have a men's suit in their wardrobe. In this regard, one cannot determine the real general population. Moreover, the value of the most nominal population is quite large. In this case, statistical re sampling can be calculated with an unknown general population, but with a known normalized deviation and allowable error (Bozhuk, Kovalik 2008):

$$n = \frac{z^2 \times p \times q}{e^2} \quad (1)$$

where:  $n$  is the sample size;  $z$  is the normalized deviation, determined based on the chosen level of confidence, this indicator characterizes the possibility, the probability of achieving answers in a special confidence interval;  $p$  is the variation of the general population for the sample, in percentage or fractions;  $q = (100 - p)$ ;  $e$  is the acceptable error.

The maximum sample error ( $e$ ) and the trust ratio ( $z$ ) are normally established depending on the required accuracy and reliability of the study. In this study, let us determine the normalized deviation ( $z$ ) based on 95% confidence level, in that case  $z=1.96$ , and the maximum sample error will be  $e=0.05$ . The variation in the present study is the degree of awareness or ignorance of the target audience about the men's suits of the domestic Kazakhstan trademark "QLP". As is known, the largest range of variation ( $\sigma^2$ ) is observed with  $p=q$ , which

accounts for  $\sigma^2 = 0.5 \times 0.5 = 0.25$ . The maximum dispersion value (0.25) can be used to calculate the required random sample size without a pilot study.

In the present study, let us assume that 50% of men have men's suits in their wardrobe and wear them constantly ( $p=0.5$ ), while 50% of men do not have men's suit in the wardrobe and do not wear it often, since there is no need for that ( $q=0.5$ ).

Substituting these values in the sampling formula and calculating it, one can get:

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = 384 \text{ people} \quad (2)$$

As one can see, the size of the sample is 384 people, let us round it up to 500 people.

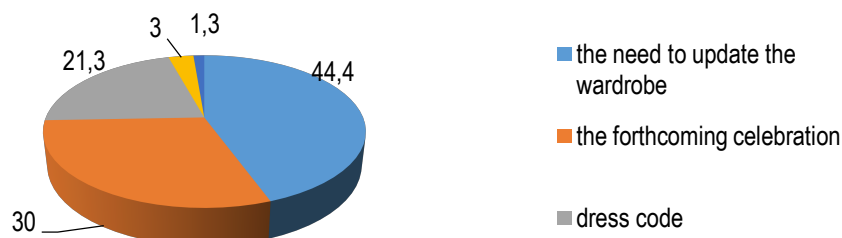
1. *Collection of information* – research field were conducted by a doctoral candidate; the questionnaire reproduced in the testograf.ru platform was sent to the electronic addresses of enterprises and government authorities of Kazakhstan with a cover letter requesting to participate in the electronic survey and to assist in distributing the questionnaire among the company's employees by internal local mail. The questionnaire included the first filtering question "Please indicate your gender" (male/female) so that only the target audience (men) could participate in the survey. An electronic survey method was chosen in order to reach a wide range of men, given that they are normally at their workplaces in the daytime and since they can be rarely seen in the points of sale of men's suits in the evenings and weekends. Fieldwork was conducted from September to December 2017.
2. *Preparation and analysis of information* – since the questionnaire was reproduced on the testograf.ru platform, minimal time was spent for editing data, processing and analyzing information. The statistics showed 230 disqualifications, *i.e.* women who followed the link to answer the questionnaire, but the system moved them to the end of the questionnaire with the following message displayed at the monitor "We apologize, but another target audience (men) is required for this survey. Thank you for your willingness to participate in the survey!"
3. All the respondents – the target audience, *i.e.* the men who participated in the survey, answered the questionnaire till the very end; there were no respondents who had left the survey. The average time spent by a respondent for the survey was 12.72 minutes.
4. *Preparation of the report and its presentation* – based on the results of a study of the demand and preferences for men's suits in the market of the Republic of Kazakhstan, a report was prepared and its presentation was conducted based on the enterprise for which the study was conducted. The key results of the study are presented in the next section of this work.

### 3. Results

In a study of demand and consumer preferences for men's suits in the market of the Republic of Kazakhstan, the following results have been obtained:

1. A men's suit is purchased by respondents for the following cases (several variants of answers were allowed): the need to update the wardrobe – 44.4%, the forthcoming celebration – 30%, dress code – 21.3%, the emergence of new models – 3%, had difficulty in answering – 1.3% (Figure 1).

Figure 1. Distribution of respondents' answers to the question "What factors influence your decision to purchase a men's suit?" in %



The ranking of the factors shown in Figure 1 by age group is presented in Table 1.

Table 1. Factors influencing the respondents' decision to purchase a men's suit in %

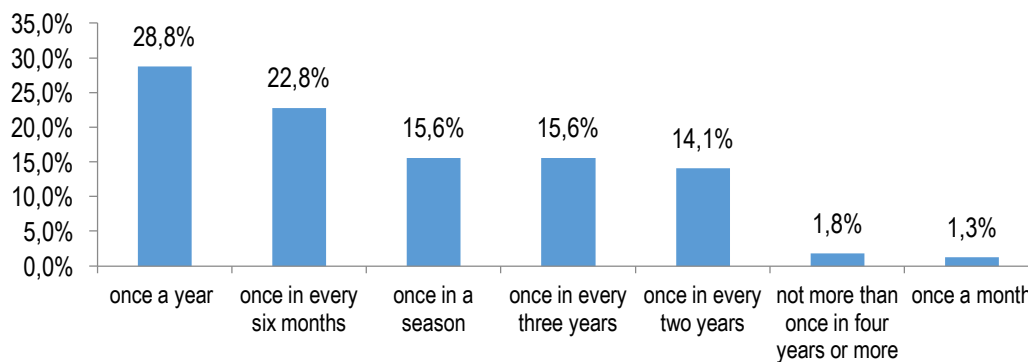
No.	Factors influencing the decision to purchase a men's suit	Age groups						
		below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	The need to update the wardrobe	50	31.9	40.6	52.2	55.2	70	50
2	Forthcoming celebration	25	52.8	26.3	23.8	24.1	20	50
3	Dress code	25	11.1	27.5	21.3	20.7	10	-
4	The emergence of new models	-	2.8	3.1	2.7	-	-	-
5	Not sure	-	1.4	2.5	-	-	-	-
Total		100	100	100	100	100	100	100

Note: compiled by the authors on the basis of the marketing research results

As can be seen from the data in Table 1, against the background of the analyzed factors, it can be noted that with increasing age, the respondents update their wardrobe more often; also the segment at the age of 18-45 years stands out – those respondents prefer new models of men's suits.

2. The following answers were received to the question "How often do you buy a men's suit?": once a year – 28.8%, once in every six months – 22.8%, once in a season – 15.6%, once in every three years – 15.6%, once in every two years – 14.1%, not more than once in four years or more – 1.8%, once a month – 1.3% (Figure 2).

Figure 2. Distribution of respondents' answers to the question: "How often do you buy a men's suit?"



In terms of age groups of respondents, the frequency of purchasing men's suits in the Kazakhstan market is presented in Table 2.

Table 2. Frequency of purchasing men's suits in the Kazakhstan market in percentage

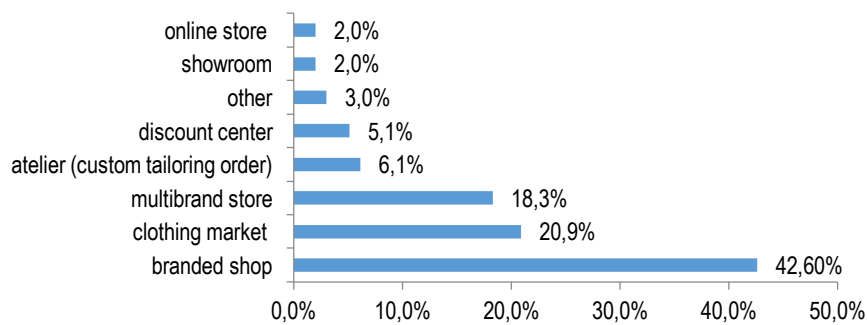
No.	Factors influencing the decision to purchase a men's suit	Age groups						
		below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	once a year	-	34.7	30	29.2	13.8	20	-
2	once in every six months	50	23.6	26.3	19.5	13.8	20	-
3	once in a season	50	9.7	13.1	22.1	10.3	20	50
4	once in every three years	-	15.3	14.4	16.8	24.1	10	-
5	once in every two years	-	15.3	11.3	11.5	34.5	20	50
6	once a month	-	1.4	3	-	-	-	-
7	not more than once in four years or more	-	-	1.9	0.9	3.4	10	-
Total		100	100	100	100	100	100	100

Note: compiled by the authors on the basis of the marketing research results

The data in Table 2 show that the highest frequency of purchasing men's suits falls on the age group from 18 to 45 years, since 45 years the share of consumers buying suits not often than once in four or more years increases.

3. The respondents' answers to the question "Where do you usually buy a men's suit?" were ranked as follows (several options were allowed): branded shop – 42.6%, clothing market – 20.9%, multibrand store – 18.3%, atelier (custom tailoring order) – 6.1%, discount center – 5.1%, other (in boutiques, always different, where it will be) – 3%, showroom – 2%, online store – 2%. As the answers to this question show, a Kazakh consumer basically buys a men's suit in the domestic market (Figure 3).

Figure 3. Preferred places to buy a men's suit



Let us consider the preferred places for purchasing a men's suit by age segments (Table 3).

Table 3. Preferred places to buy a men's suit in the market of Kazakhstan in percentage

No.	Places to buy a men's suit	Age groups						
		below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	Branded shop	50	34.4	42.5	48.1	38.7	50.0	66.7
2	Clothing market	-	28.1	20.3	17.8	17.8	16.7	-
3	Multibrand store	25	18.8	21.2	14.8	14.8	16.7	33.3
4	Atelier(custom tailoring order)	-	5.2	5.7	6.7	9.7	-	-
5	Discount center	25	5.2	5.2	3.7	6.5	8.3	-
6	Showroom	-	2.1	2.4	2.2	-	-	-
7	Online store	-	4.2	1.4	1.5	3.2	-	-
8	Other	-	2.1	1.3	5.2	9.3	8.3	-
Total		100	100	100	100	100	100	100

Note: compiled by the authors on the basis of the marketing research results

As one can see from Table 3, the most preferred place to buy a men's suit in all age segments is a branded store; then comes a clothing market, but segments less than 18 years and older than 65 years do not visit it; the third popular are multibrand stores, visited by all age groups. In a discount center, the greatest share in the purchase of men's suits falls on consumers aged less than 18 years – 25%; and the consumers aged 55-65 years – 8.3%. Consumers over the age of 65 buy men's suits only in two places: a branded store (66.7%) and a multibrand store (33.3%). Services of an online store and individual tailoring are popular among the customers aged 18 to 55 years.

4. The following two questions were asked in order to determine the respondents' "share of mind" ("Please indicate which brand of men's suit first comes to your mind") and "share of heart" ("A men's suit of which brand did you purchase last time?") in relation to men's suits. Among the trademarks of men's suits, that first came to their mind the respondents named a wide range of brands; their ranking is presented in Table 4.

Table 4. The share of mind and heart of consumers of men's suits in the market of Kazakhstan

SHARE OF MIND			SHARE OF HEART	
"Please indicate which brand of men's suit first comes to your mind"			"Men's suit of which brand did you purchase last time?"	
Place	Trademark name	Answers, in %	Trademark name	Answers, in %
1	GLASMAN (KZ)	11.5	GLASMAN (KZ)	9.7
2	Hugo Boss (Germany)	6.9	QLP (KZ)	5.6
3	Brioni (Italy)	5.1	Zara (Spain)	4.1
4	Giorgio Armani (Italy)	4.6	Hugo Boss (Germany)	3.6
			Suvari (Turkey)	3.6
5	QLP (KZ)	3.3	Giorgio Armani (Italy)	3.3
6	Kanzler (Russia)	3.1	Kanzler (Russia)	2.1
			Massimo Dutti (Spain)	2.1
			Altyn Adam (KZ)	2.1
7	Zara (Spain)	2.8	Enrico Marinelli (Italy)	1.3
8	AltynAdam (KZ)	2.1	Canali (Italy)	0.8



SHARE OF MIND			SHARE OF HEART	
"Please indicate which brand of men's suit first comes to your mind"			"Men's suit of which brand did you purchase last time?"	
9	Canali (Italy)	1.8	Brioni (Italy)	0.5
	Suvari (Turkey)	1.8	Tom Ford (USA)	0.5
			Romano Botta (Turkey)	0.5
			Pierre Cardin (France)	0.5
			Angelcher (KZ)	0.5
10	Pierre Cardin (France)	1.5	Roberto Cavalli (Italy)	0.3
	Enrico Marinelli (Italy)	1.3	Gucci (Italy)	0.3
	Massimo Dutti (Spain)	1.0	Imperial Tailoring (South Africa)	0.3
11	Roberto Cavalli (Italy)	0.8	<i>Total</i>	41.7
	Angelcher (KZ)	0.8	<i>Other trademarks, the share of each is less than 0.3%</i>	58.3
12	Gucci (Italy)	0.5		
	Romano Botta (Turkey)	0.5		
	Imperial Tailoring (South Africa)	0.5		
13	Tom Ford (USA)	0.3		
	Zegna (Italy)	0.3		
14	<i>Total</i>	50.5		
15	<i>Other trademarks, the share of each is less than 0.3%</i>	49.5		

Note: compiled by the authors on the basis of the marketing research results

As the data in Table 4 show, the first foreign brands to come to mind (the share of mind) were: "Hugo Boss" – 6.9%; "Brioni" – 5.1%; "Giorgio Armani" – 4.6%, "Kanzler" – 3.1%; Zara – 2.8%; "Canali" and "Suvari" – 1.8% each; "Pierre Cardin" – 1.5%, "Enrico Marinelli" – 1.3%, "Massimo Dutti" – 1%; among the domestic Kazakhstan brands: Glasman – 11.5%, QLP – 3.3%, Altyn Adam – 2.1%, Angelcher – 0.8%. It should also be noted that 49.5% of respondents named other brands, but the share of each of them was less than 0.3%.

The percentage of respondents' share of heart (brands of men's suits purchased last time) was distributed as follows: among the foreign brands "Zara" – 4.1%; "Hugo Boss", "Suvari" – 3.6%; "Giorgio Armani" – 3.3%; "Massimo Dutti", "Kanzler", "Altyn Adam" – 2.1% each; "Enrico Marinelli" – 1.3%, "Canali" – 0.8%, "Brioni" – 0.5%; among the domestic brands: Glasman – 9.7%, QLP – 5.6% and Angelcher – 0.5%. Men's suits of other brands were purchased by 58.3% of respondents, though each of them was also less than 0.3%.

Analysis of the share of mind and heart among the domestic Kazakhstan producers shows that the trademark number 1 is GLASMAN – 11.5:9.7% (awareness of it is higher than the share of purchases), number 2 – "QLP" 3.3:5.6% (despite the fact that the name of the trademark does not come to the memory immediately, its share of purchases is higher), number 3 – "Altyn Adam" 2.1:2.1% (the proportion of mind and heart coincide, which indicates the presence of adherents to this brand); number 4 – "Angelcher" 0.8:0.5% (with low values of the share of mind and heart). Let us consider below indicators of the share of mind and heart by trademarks of men's suits in terms of age segments (Table 5).

Table 5. The share of mind (SM) and heart (SH) of consumers of men's suits in the market of the Republic of Kazakhstan in terms of age segments in percentage

No.	Trademark name	Age groups													
		below 18		18-25		26-35		36-45		46-55		56-65		over 65	
		SM	SH	SM	SH	SM	SH	SM	SH	SM	SH	SM	SH	SM	SH
1	GLASMAN	2	3	18	24	38	29	36	34	4	8	2	3	-	-
2	Hugo Boss	-	-	15	21	37	43	30	21	15	7	4	7	-	-
3	Brioni	-	-	15	50	55	-	30	50	-	-	-	-	-	-
4	G.Armani	-	-	33	31	33	38	22	23	6	-	6	8	-	-
5	QLP	-	-	15	-	23	32	38	55	15	9	8	5	-	-
6	Kanzler	-	-	17	-	50	38	33	50	-	12	-	-	-	-
7	Zara	-	-	18	38	55	38	9	19	18	6	-	-	-	-
8	Altyn Adam	-	-	38	38	63	50	-	12	-	-	-	-	-	-
9	Canali	14	-	14	-	14	67	43	33	14	-	-	-	-	-
10	Suvari	-	-	-	21	71	43	29	21	-	14	-	-	-	-
11	Pierre Cardin	-	-	-	-	67	-	17	100	17	-	-	-	-	-

No.	Trademark name	Age groups													
		below 18		18-25		26-35		36-45		46-55		56-65		over 65	
		SM	SH	SM	SH	SM	SH	SM	SH	SM	SH	SM	SH	SM	SH
12	E.Marinelli	-	-	-	-	80	100	20	-	-	-	-	-	-	-
13	M. Dutti	-	12	50	25	-	38	25	25	25	-	-	-	-	
14	R. Cavalli	-	-	-	100	33	-	67	-	-	-	-	-	-	
15	Angelcher	-	-	-	-	-	-	67	100	33	-	-	-	-	
16	Gucci	50	100	50	-	-	-	-	-	-	-	-	-	-	
17	Romano Botta	-	-	-	50	-	50	100	-	-	-	-	-	-	
18	Imperial Tailoring	-	-	-	50	-	-	-	50	100	-	-	-	-	
TOTAL		100		100		100		100		100		100		100	

Note: compiled by the authors on the basis of the marketing research results, where SM is the share of mind and SH is the share of heart

Based on the data in Table 5, let us determine the target segments of domestic Kazakh men's suits producers as their share decreases:

- "GLASMAN" – the target segment is aged 36-45 years – 34%, the followers are aged from 26 to 35 years – 29%, and from 18 to 25 years – 24%;
- "QLP" – the target segment is aged 36-45 years – 55%, the followers are aged from 26 to 35 years – 32%;
- "Altyn Adam" – the target segment is aged 26-35 years – 50%, the followers are aged from 18 to 25 – 38%, and from 36 to 45 years – 12% (in this case the segment will lose its activity with increasing age);
- "Angelcher" – the target segment is aged 36-45 years – 100%.

As one can see, the trademarks "GLASMAN", "QLP", "Angelcher" occupy a niche in the age segment of 36-45 years; "Altyn Adam" – in the age segment of 26-35 years (50%). At the same time, the weakest position in the market is with the "Angelcher" trademark, as its consumers belong to one age segment. The "GLASMAN" trademark has a more stable position; the purchase of men's suits is distributed more or less evenly throughout the consumers' age groups. It should be noted that the men's "QLP" suits do not have buyers aged less than 18 years, from 18 to 25 years and over 65 years, which is probably due to low awareness of the trademark or the lack of suitable models for these categories of consumers.

5. As a follow-up to the previous question, the respondents were asked, "Why did they buy this particular brand of a men's suit?" (Multiple answers were allowed). The criteria for choosing a men's suit were as follows: perfect fit – 22.8%, design of the model – 19.9%, perfect fabric – 14.9%, satisfying price – 13.7%, good color – 11.1%, fine inner processing of the suit – 9.5%, trust in the company-manufacturer – 6.5%, were not sure – 1.2%, other (prefer this brand; perfect height of a suit; to support the domestic manufacturer) – 0.5%. Ranking of these factors by age segment is presented in Table 6.

Table 6. Factors that influenced the choice of the brand of a men's suit, purchased by the respondents last time in %

No.	Why did they buy this particular suit last time?	Age segments						
		below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	Perfect fit	25	22.8	22.0	26.6	15.9	27.3	-
2	Design of the model	-	22.3	22.8	12.8	20.8	22.7	28.6
3	Perfect fabric	25	13.3	16.8	12.8	14.7	9.1	28.5
4	Satisfying price	25	12.7	11.0	19.0	13.4	13.6	-
5	Good color	25	13.9	11.0	8.9	13.4	4.6	14.3
6	Fine inner processing of the suit	-	6.0	11.0	8.8	12.2	13.6	14.3
7	Trust to the company-manufacturer	-	7.2	4.8	8.4	6.1	9.1	14.3
8	Not sure	-	1.8	-	2.2	2.5	-	-
9	Other	-	-	0.6	0.5	1.2	-	-
Total		100	100	100	100	100	100	100

Note: compiled by the authors on the basis of the marketing research results

The analysis of factors that influenced the choice of a men's suit, most recently purchased by respondents according to Table 6, shows the following:

- the age group below 18 years prefers only two trademarks "Massimo Dutti" and "Gucci" pays attention only to four factors: ideal fit, price, material and color of the suit;

- the age group from 18 to 25 years repeats the general dynamics of factors described above;
  - the age group from 26 to 35 years pays attention to the fabrics of a men's suit, which takes the third place after ideal fit and price;
  - for the age group from 36 to 45 years the price of a men's suit is the second significant factor after an ideal fit;
  - the respondents from 46 to 55 years are very sensitive to the price of a men's suit, it ranks first among the factors that influence their choice;
  - the men aged 56-65 years mind the inner processing of a men's suit along with the price;
  - the respondents over the age of 65 years pay attention to the design of a men's suit and the fabrics, perfect fit and price are not that important to them.
6. To reveal the degree of awareness of the existing brands of men's suits, the respondents were asked a question with a clue "Please indicate what other brands of men's suits do you know? (Please list the names of the brands you know)". The respondents listed TOP-10 trademarks of men's suits: these included the world famous and popular brands in 2017, as well as domestic Kazakhstan brands. Among the 10 most common answers, the following brands were named: Glasman – 10.8%, Giorgio Armani – 10.1%, Hugo Boss – 9.8%, Zara – 9%, Roberto Cavalli – 8.1%, Brioni – 7.7%, Gucci – 5.4%, Massimo Dutti – 5.9%, KANZLER – 5.1%, Canali – 4.7%, Zegna – 3.8%, Tom Ford – 3.6%, Altyn Adam – 2.9%, Angelcher – 2.4%, QLP – 2.1%, Romano Botta – 2.2%, Imperial Tailoring – 1.8% (see Table 7).

Table 7. The respondents' answers to the question "Please indicate what other brands of men's suits you know?" (by age segments) in %

No.	Awareness of the trademarks of men's suits	Total	Of them by age groups						
			below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	GLASMAN (KZ)	10.8	12.5	11.8	10	10.6	9.9	2.6	-
2	GiorgioArmani (Italy)	10.1	12.5	12.8	9.6	8.4	10.6	15.4	7.7
3	Hugo Boss (Germany)	9.8	12.5	8.9	9.0	11.6	10.6	10.3	15.4
4	Zara (Spain)	9.0	-	11.8	9.7	6.3	7.8	7.7	7.7
5	RobertoCavalli (Italy)	8.1	-	8.1	7.8	8.6	7.8	12.8	-
6	Brioni (Italy)	7.7	12.5	7.6	7.2	8.6	8.5	7.7	7.7
7	Massimo Dutti (Spain)	5.9	-	7.3	6.3	4.5	4.3	7.7	7.7
8	Gucci (Italy)	5.4	25	1.3	6.0	6.0	6.4	10.3	15.4
9	KANZLER (Russia)	5.1	12.5	5.0	5.4	5.2	3.5	2.6	-
10	Canali (Italy)	4.7	-	3.4	5.2	4.7	5.0	-	15.4
11	Zegna (Italy)	3.8	-	3.4	3.9	4.5	2.8	2.6	-
12	TomFord (USA)	3.6	-	3.9	4.0	3.0	2.8	5.1	-
13	Altyn Adam (KZ)	2.9	-	4.2	2.8	2.6	1.4	5.1	-
	Marks&Spencer (Great Britain)	2.4	-	0.8	2.9	2.2	3.5	2.6	7.7
14	Angelcher (KZ)	2.4	-	1.8	2.1	3.0	5.0	-	-
15	QLP (KZ)	2.1	12.5	2.4	1.5	3.0	2.8	-	-
16	Romano Botta (Turkey)	2.2	-	1.6	2.3	2.4	1.4	5.1	-
17	Imperial Tailoring (SA)	1.8	-	0.5	1.9	2.4	2.1	-	7.7
18	Ravazzollo (Italy)	1.1	-	1.0	1.1	1.5	0.7	-	-
19	LoroPiana (Italy)	0.9	-	1.6	0.8	0.4	2.1	2.6	-
20	Others	0.5	-	0.8	0.4	0.6	0.7	-	-

Note: compiled by the authors on the basis of the marketing research results

Analysis of the respondents' awareness about domestic Kazakhstan brands of men's suits as shown by the data in Table 8 indicates that "GLASMAN" is the leading brand. "Altyn Adam" is the 13th most popular in the segment of 18-65 years, "Angelcher" is No.14 in terms of awareness among the respondents aged 18-55 years, "QLP" is the 15th most popular brand among men in the age of 18-55.

7. The respondents learn about new points of sales of men's suits from the following sources of information (multiple answers were allowed): recommendations of friends/colleagues/relatives – 32.9%, social networks – 29.3%, producers' websites/outlets – 21.4%, TV (6.2%), fashion magazines –

3.6%, other (SMS messages, window shopping) – 3.4%, fashion shows – 1.7%, radio – 1.5%. The ranking of these sources of information by age segment is presented in Table 8.

Table 8. Preferred sources of information on new sales locations for men's suits in percentage

No.	Sources of information on new sales locations for men's suits	Age groups						
		below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	Recommendations of friends/colleagues/relatives	16.7	36.6	13.5	53.7	42.9	53.8	-
2	Social networks	-	34.8	44.4	9.9	16.7	-	-
3	Producers' websites/outlets	33.3	16.1	25.1	26.4	11.9	7.7	-
4	TV	33.3	3.6	8.2	2.5	7.1	15.4	50
5	Fashion magazines	-	3.6	2.9	2.5	7.1	15.4	-
6	Radio	16.7	-	2.9	-	2.4	-	-
7	Fashion shows	-	0.9	2.3	0.8	2.4	7.7	-
8	Other	-	4.4	0.7	4.2	9.5	-	50
Total		100	100	100	100	100	100	100

Note: compiled by the authors on the basis of the marketing research results

As can be seen from the data in Table 8, the respondents' preferences in choosing sources of information about new sales locations for men's suits are distributed in terms of the largest specific weight as follows:

- recommendations of friends/colleagues/relatives – men aged 35-65;
- social networks – men aged 18-35;
- producers' websites/ outlets – men aged below 18-55;
- television – the men aged below 18 and from 56 to 65 years;
- radio – the respondents below 18 years old;
- fashion shows might only interest men from 56 to 65 years;
- a high proportion of "other" responses (SMS messages, window shopping) corresponds to the segment of 46-55 years, 18-25 years and 36-45 years.

8. The key question of the questionnaire was "Please rate the importance of each factor influencing your choice of a men's suit, where 1 is "absolutely unimportant" and 5 is "very important". Respondents were asked to estimate and rank their preferences (Table 9):

Table 9. Rankings of respondents' answers to the question "Please rate the importance of each factor influencing your choice of a men's suit, where 1 is "absolutely unimportant" and 5 is "very important" in percentage

No.	Criteria for choosing a men's suit	Rating				
		1	2	3	4	5
1	Brand recognition	24.9	10.3	29.2	12.6	23.1
2	Price	5.1	3.6	26.4	18.7	46.2
3	Perfect fit	5.1	0.5	3.3	9.2	81.8
4	Fabrics	6.2	2.3	11.3	26.4	53.8
5	Special promotions/discounts, availability of a discount card	12.8	6.4	28.7	15.1	36.9
6	Advertising	40.8	12.1	22.8	9.0	15.4
7	Recommendations of friends and relatives, reviews on the Internet	19.5	10	26.7	17.7	26.7
8	Place of sale	21.0	9.5	25.9	16.2	27.4
9	Customer service, consultant's advice	13.8	8.2	19.5	19.0	39.5
10	Assortment renewability	12.8	8.2	23.8	15.6	39.5
11	Practicality / compatibility with the existing wardrobe and accessories	10.5	4.9	17.7	21.8	45.1
12	Compatibility with fashion trends	13.1	7.9	21.3	23.6	34.1
13	Country of origin	18.7	6.2	25.9	18.7	30.5

Note: compiled by the authors on the basis of the marketing research results

Based on the data from Table 9, let us rank the importance criteria in choosing a men's suit by decreasing order: 1) ideal fit – 81.8%, 2) fabrics – 53.8%, 3) price – 46.2%, 4) practicality/compatibility with the existing wardrobe and accessories – 45.1%, 5-6) assortment renewability and customer service – 39.5% each, 7) special promotions/discounts, discount card – 36.9%, 8) country of origin – 30.5%, 9) compatibility of the suit with fashion trends – 34.1%, 10) place of sale – 27.4%, 11) recommendations of friends and relatives, reviews on the Internet

– 26.7%, 12) brand recognition – 23.1%, 13) advertising – 15.4%. These criteria should be considered by light industry enterprises when building a marketing policy.

In terms of age segments, these criteria are presented in Table 10; their analysis shows the following distinctive characteristics:

- respondents below the age of 18 most value the following criteria: place of sale, customer service, consultant's advice, country of origin and the compatibility of the suit with fashion trends, to which they pay attention after a perfect fit, fabrics and price;
- the respondents aged 18-25 when choosing a men's suit, aside from the fabric composition, pay attention to the practicality of the suit, its compatibility with the existing wardrobe and accessories, country of origin and the brand recognition;
- the respondents aged 26-45 when choosing a men's suit, in general repeat the overall dynamics of preferences as described above;
- the respondents aged 46-55 pay attention to special promotions, discounts and discount cards – this criterion is the third most important after the ideal fit and the composition of the fabric;
- the respondents aged 56-65 are most sensitive to the price of a men's suit, 70% of them consider this criterion as the most important;
- the respondents who are older than 65 are more categorical when choosing a men's suit: they consider the place of sale and a perfect fit; they do not pay attention to recommendations of their friends, relatives, acquaintances and reviews on the Internet.

Table 10. Rankings of respondents' answers to the question "Please rate the importance of each factor that influences your choice of buying a men's suit" by age segments, where 1 is "absolutely unimportant", 5 is "very important" in percentage

N o.	Age groups																																			
	below 18					18-25					26-35					36-45					46-55					56-65					over 65					
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
1	<i>Perfect fit</i>																																			
2				7					1	7	5	1	3	9	8	5	1	4	5	8	7	-	3	3	8	1	-		2	7	-	-	-	-	10	
5	-	-	-	5	3	-	3	7	7						2					5								0	0					0		
2	<i>Fabrics composition</i>																																			
2				7		1	3	4	6	3	1	3	4	8	1	1	1	6	7	7	-	1	7	1	-		2	7	-	-	5	5	-			
5	-	-	-	5	1	3	9	5	2			1	4	6		0	9	2									0	0					0	0	-	
3	<i>Price</i>																																			
2			2	5			2	2	3	3	3	2	1	4	6	3	2	1	4	7	3	2	2	4	1	1	1	-	7	-	-	-	5	50		
5	-	-	5	0	7	6	6	5	6			9	7	8			6	8	7					4	1	5	0	0	0					0	0	
4	<i>Practicality/compatibility with the existing wardrobe and accessories</i>																																			
2			5	2	1	2	1	4	9	7	1	2	4	1	4	1	1	5	3	-	2	2	5	1	-	1	3	5	5	-	5	-	-			
5	-	-	0	5	4	4	4	5	3			6	7	1	1		6	8	1								0	0	0	0					0	0
5	<i>Assortment renewability</i>																																			
-			5	2	2	1	1	2	1	3	1	1	2	1	4	1	4	2	1	4	1	1	1	1	3	1	1	2	2	4	-	-	5	-	50	
-	-	-	0	5	5	4	0	8	8	0	1	0	3	4	2	4		4	5	3	7	0	7	7	9	0	0	0	0					0	0	
6	<i>Customer service, consultant's advice</i>																																			
-			5	5	1	1	2	1	3	1	8	1	2	4	1	5	2	1	4	1	3	3	1	3	1	1	2	1	5	5	5	-	-	-	-	
-	-	-	0	0	4	7	2	4	3	4			6	2	0	4		9	2	7																
7	<i>Special promotions/discounts, availability of a discount card</i>																																			
5		2		2	2	1	2	1	2	9	8	3	1	3	1	4	2	1	4	7	-	3	1	4	1	-	2	2	5	-	-	5	-	50		
0	-	5	-	5	1	3	9	1	6			1	8	4	3		5	4	4																	
8	<i>Country of origin</i>																																			
2			2	5	1	3	1	2	2	6	2	2	2	1	6	2	1	3	3	7	1	1	3	3	-	2	1	4	-	-	-	-	5	50		
5	-	-	5	0	3	8	5	9	5	0			3	3	8	7		9	3	5	1															
9	<i>Suit's compatibility with fashion trends</i>																																			
-	2		2	5	1	1	2	2	2	1	9	2	2	3	1	6	2	2	4	1	3	1	2	4	1	-	1	3	5	5	-	-	-	-	50	
-	5	-	5	0	3	0	5	7	5	2			4	4	1	4		0	0	0	7															
10	<i>Place of sales</i>																																			
2			2	5	2	3	1	2	1	1	2	1	2	2	8	2	1	2	1	1	1	2	3	4	-	-	3	3	-	-	-	-	-	10		
5	-	-	5	0	4	8	1	5	2	8	0	9	4	9	5		4	7	6	4	7	7	1	1	0											
11	<i>Recommendations of friends, relatives, reviews on the Internet</i>																																			
2	-	5	-	2	1	1	3	2	2	1	9	3	1	2	2	9	2	1	2	1	1	1	1	3	2	-	2	2	4	5	5	-	-	-	-	

N o.	Age groups																																		
	below 18					18-25					26-35					36-45					46-55					56-65					over 65				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	5		0		5	3	1	0	2	4	9		0	6	6	6		1	8	6	4	7	7	7	5	0		0	0	0	0	0			
1	<i>Brand recognition</i>																																		
2	2		2	2	2	2		3	1	2	2	1	3	1	2	2	1	3	1	2	2	1	2	1	2	2	2	1	2	3	-	-	-	5	50
	5	-	5	5	5	7	1	1	6	4	0	1	3	2	7	2	1	0	0	1	4	1	7	7	0	0	0	0	0	0	0	0			
1	<i>Advertising</i>																																		
3	2		5		2	4	1	1	1	1	3	1	2	9	1	4	1	1	8	1	4	1	3	3	1	2	2	1	-	5	5	-	-	5	-
	5	-	0	-	5	6	3	7	3	1	7	1	8		5	6	2	7		7	1	4	2		0	0	0	0	0	0	0	0			

Note: compiled by the authors on the basis of the marketing research results

9. The following question allowed to reveal preferences of respondents in relation to the country of origin when choosing a men's suit (they were allowed to choose several answers): Italy – 33.5%, Turkey – 22.7%, Germany – 14.7%, Kazakhstan – 13.8%, the country of origin does not matter – 8.1%, Russia – 2.1%, not sure – 1.9%, China 1.9%, Kyrgyzstan 0.6%, other (Spain, Belarus, Great Britain) – 0.6%. In terms of age groups, these preferences are presented in Table 11.

Table 11. Preferred country-manufacturer of men's suits by age segments in percentage

No.	Men's suits country of origin	Age groups							
		below 18	18-25	26-35	36-45	46-55	56-65	over 65	
1	Italy	-	29.0	30	48.4	32.3	50	-	
2	Turkey	-	30.3	22.3	16.7	19.4	-	50	
3	Kazakhstan	25	13.1	17.4	7.1	9.7	-	-	
4	Germany	25	9.0	10.6	24.6	32.3	50	50	
5	Russia	25	2.8	1.6	1.6	3.2	-	-	
6	China	-	1.4	2.9	-	3.1	-	-	
7	Kyrgyzstan	-	-	1.3	-	-	-	-	
8	Does not matter	-	9.7	11.0	1.6	-	-	-	
9	Not sure	-	4.1	1.9		-	-	-	
10	Other	25	0.6	1.0		-	-	-	
Total		100	100	100	100	100	100	100	

Note: compiled by the authors on the basis of the marketing research results

The data in Table 11 show the following features in the preferences for the country of origin for men's suits among the following age segments:

- the respondents aged below 18 years prefer three countries: Kazakhstan (due to the fact that up to this age they wore school uniform of domestic producers), Germany and Russia;
- among the preferences of respondents aged 35 years and older, the proportion of German-produced men's suits is growing, which is explained by the fact that the manufacturer has a wide range of men's suits for every group of consumers;
- the consumers aged 56-65 years prefer men's suits from Turkey and Germany, since the manufacturers offer a wide range of prices for different consumer groups;
- around 10% of the respondents aged 18-25 and 26-35 claim that the producing country does not matter.

10. The respondents' preferences for the optimal price range when buying a men's suit is as follows: USD 151-300 (KZT 51-100 thousand) – 40.6%, up to USD 150 (up to KZT 50 thousand) – 40.2%, USD 301-450 (101-150 thousand US dollars) 12.4%, over 450 USD (over 150 thousand tenge) – 6.8%. As one can see, the majority of respondents (80.8%) are satisfied with the price of a men's suit within 300 US dollars (100 thousand tenge). Let us consider the preferences for men's costumes by the age segments (Table 12).



Table 12. Ranking of the respondents' preferences for the optimal price range when buying a men's suit in %

No.	The optimal price range when buying a men's suit in US dollars	Age groups						
		below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	below 150	25	44.5	44.5	38.1	31.6	-	50
2	151-300	25	38.9	40.6	45.1	26.3	60	50
3	301-450	25	8.3	8.1	13.3	31.6	20	-
4	over 450	25	8.3	6.9	3.5	10.5	20	-
Total		100	100	100	100	100	100	100

Note: compiled by the authors on the basis of the marketing research results

As can be seen from the data in Table 12, almost half of the respondents (44.4%) at the age of 18-35 purchase men's suits worth up to \$150. Slightly fewer customers prefer buying men's suits at the price of 151-300 US dollars. The peak period for the purchase of men's suits at the cost of 301-450 US dollars is the age of 46-55 years, when a man reaches the peak of his career; and the peak period of the most expensive suits over 450 US dollars is the age of 56-65 years.

11. When answering the question "Are you familiar with the domestic Kazakhstan trademark of men's suits "QLP"?" the respondents responded as follows: "No, I did not buy or hear of it" – 71.8%, "Yes, I saw, but did not buy it" – 11.4%, "Yes, I know and I've heard something of that brand" – 8.6%, "Yes and I have even purchased and wore their suit" – 5.6%, "Not sure" – 2.6%. As one can see, the majority of respondents (71.8%) are not aware of the existence of "QLP" trademark. Let us analyze what age segment has the highest awareness of "QLP" men's suit trademark (Table 13).

Table 13. The degree of respondents' awareness of domestic Kazakhstan trademark of men's suits "QLP" in percentage

No.	The degree of respondents' awareness of "QLP" men's suit trademark	Age groups						
		below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	No, I did not buy or hear of it	75	75	75	66.4	69.0	-	100
2	Yes, I know and I've heard something of that brand	25	6.9	3.8	6.2	10.3	-	-
3	Yes, I saw, but did not buy it	-	15.3	9.4	12.4	10.3	10.0	-
4	Yes and I have even purchased and wore their suit	-	-	8.8	13.3	6.9	10.0	-
5	Not sure	-	2.8	3	1.7	3.5	80.0	-
Total		100	100	100	100	100	100	100

Note: compiled by the authors on the basis of the marketing research results

Based on the data obtained during the questionnaire survey, one can draw the following conclusions regarding the respondents' awareness of "QLP" men's suit brand:

- low level of awareness among the respondents aged 18-55 years (about 72% of the respondents) and over 65 years (100% of respondents) – they have never heard of the brand name and did not purchase "QLP" men's suits;
- the respondents aged 18-65 have seen, but did not buy men's suits of "QLP" brand – on average about 11.5% of the respondents;
- among those who "have heard, even purchased and wore "QLP" men's suit, the largest share is in the segment aged 36-45 years (13.3%), 56-65 years (10%), 26-35 years (8.8%) and 46-55 years (6.9%);
- the largest proportion of respondents who have answered "Yes, I know something and heard about "QLP" trademark of men's suits were younger than 18 years (25%), from 45 to 55 years (10.3%), from 18 to 25 years (6.9%) and from 36 to 45 years (6.2%);
- the respondents aged 56 and older found it difficult to answer the question of their degree of awareness of the "QLP" trademark (80-100% of the number of respondents).

12. The respondents who did not purchase or wear a men's suit of "QLP" trademark were asked the question "If you were aware of that men's suit brand, would you buy it if it meets your preferences?" Perhaps this question sounds like a nuisance to a positive response, but at the same time, the authors decided to ask it to determine the degree of the respondents' loyalty to the trademarks of men's suits they buy.

The responses were received from 472 respondents (500 people minus 28 people (5.6%) who have bought a men's suit of "QLP" brand for the last time). 64.2% of them answered "yes"; 28.6% answered "Not sure" and

7.2% said "No". It can be assumed that the respondents who had high frequency of purchases with a weak attachment to a particular brand responded positively to this question. Respondents with a low frequency of shopping and a weak attachment to a particular brand found it difficult to answer the question; the respondents who had true loyalty to a certain brand, otherwise adherents of a certain brand of a men's suit, responded negatively.

The analysis showed that the majority of respondents (64.2%) in all age groups responded positively to the question of a possible decision to purchase a men's suit of "QLP" trademark, if they were aware of this brand and the suit complied with their preferences. This indicates the availability of potential for development of the market share of "QLP" trademark of domestic Kazakhstan manufacturer LLP "Kazlegprom-Almaty".

13. The last question of the main part of questionnaire was open "Your wishes for raising awareness about men's suits manufactured in Kazakhstan", while it was designated as optional. This question was answered by 78.2% of the total number of the survey's respondents. In particular, if one combines wishes in terms of similarity and repeatability, they will be as follows:

- to increase the advertising of men's suits in social networks, since there is practically no information on "QLP" trademark. The respondents do not have time to study the market and track newly created brands;
- to open more outlets alongside well-known brands of men's suits;
- to perform various actions on demand generation and sales promotion – for example, to test suits in wearing by a customer with a further lighting of his experience, his recommendations to the others;
- to pay special attention to the quality of fitting in a men's suit tailoring, especially for full-scale consumer groups;
- to organize an SMS campaign for potential customers of "QLP" men's suit with indication of sales locations and information about the trademark;
- to prove to potential consumer that the domestic brand of men's suit corresponds to their requirements of quality and preferences.

14. The distribution of respondents' answers to the question "Please indicate your place of residence?" is as follows: Almaty – 46.8%, Astana – 23.4%, Southern Kazakhstan – 7.4%, West Kazakhstan – 6.4%, North Kazakhstan – 6%, East Kazakhstan – 5.4%, Central Kazakhstan – 4.6%. The respondents' answers by age segments are presented in Table 15.

Table 15. Place of residence of the respondents – consumers of men's suits in %

No.	Place of residence	Age groups						
		below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	Astana city	25	23.6	23.8	23.0	23.0	25	16.7
2	Almaty city	43.5	47.2	46.7	46.0	48.4	47.5	41.8
3	South Kazakhstan	6.3	6.8	7.5	8.0	6.9	7.5	8.3
4	Western Kazakhstan	6.3	5.6	6.3	7.1	5.7	7.5	8.3
5	Northern Kazakhstan	6.3	5.6	6.3	6.2	5.7	5	8.3
6	Eastern Kazakhstan	6.3	5.6	5.0	5.3	5.7	5	8.3
7	Central Kazakhstan	6.3	5.6	4.4	4.4	4.6	2.5	8.3
Total		100	100	100	100	100	100	100

Note: compiled by the authors on the basis of the marketing research results

The data in Table 15 show the identity of respondents by age segment in different places of residence, with the overall dynamics of distribution of the respondents' answers.

14. To the question "What is your line of work?", the respondents answered the following: work in private structures – 32%, the public service – 27.9%, entrepreneurship – 21.5%, students – 6.9%, other (nongovernmental organization) – 6.6%, unemployed – 3.6%, housekeeping – 1.4%, retired – 0%. The structure of the respondents' occupation by age groups is presented in Table 16.

Table 16. The occupation of the respondents –consumers of men's suits in %

No.	Occupation	Age groups						
		below 18	18-25	26-35	36-45	46-55	56-65	over 65
1	Public service	-	18.1	41.9	25.7	13.8	-	-
2	Entrepreneurship	-	15.3	20.6	24.8	34.5	20	-
3	Work in private structures	-	30.6	26.9	38	34.5	40	50
4	Students	75	27.8	0.6	0.9	3.4	-	-
5	Housekeeping	25	-	-	0.9	3.4	20	-
6	Unemployed	-	2.8	4.4	3.5	-	10	-
7	Other	-	5.4	5.6	6.2	10.4	10	50
8	Retired	-	-	-	-	-	-	-
Total		100	100	100	100	100	100	100

Note: compiled by the authors on the basis of the marketing research result

15. Based on the results, the following age groups were identified: 26-35 years – 32%, 36-45 years – 26.6%, 46-55 years – 17.4%, 18-25 years – 14.4%, 55-65 years – 8%, less than 18 years – 3.2%, over 65 years – 2.4%. As one can see, the largest proportion of the respondents responded were 26-55 years old.

In the next section, let us discuss the results of the study.

#### 4. Discussion

In the context of the present study, let us briefly describe the current state of the market of men's suits in the Republic of Kazakhstan. To do this, let us calculate potential consumption of men's suits in the country, based on the respondents' answers on frequency of consumption; given that the number of men aged 18 and over is 5,938,510 people (Table 17).

As the results of calculation show, according to Table 3, in Kazakhstan, on average, one man buys 2 (two) men's suits per year. Proceeding from this, the potential capacity of the market of men's suits will be  $5,938,510 \times 2 = 11,877,020$  units. There are three large factories specializing in the production of men's suits in the market of men's suits of the Republic of Kazakhstan: LLP "GLASMAN", LLP "Kazlegprom-Almaty", LLP "GOLDEN NOMAD". Two major manufacturers carry out individual tailoring of men's suits: LLP "The Academy of Fashion "Symbat" (Almaty 1994, under the trademark "Symbat") and LLP "Angelcher" (Almaty 2002, under the trademark "Angelcher"), as well as other medium and small ateliers (see Table 18).

As can be seen from the data in Table 4, Kazakhstan producers produce several assortment groups of goods. Men's suits are made of woolen, half-woolen and mixed fabrics; on this basis their price varies. Almost every manufacturer offers the service of tailor-made men's suits for consumers with nonstandard figures, while the client can order a suit both from the manufacturer's fabric and from his own fabric.

Table 17. Calculation of the consumption of men's suits in the market of the Republic of Kazakhstan based on the results of marketing research of consumer demand and preferences

No	Frequency of men's suits consumption		Share of respondents' answers on frequency of consumption, %	The number of men at the age of 18 years from the share of suits consumption ( $5,938,510 \times p. 4/100$ )	Consumption of men's suits based on the frequency of consumption ( $p.1 \times p.5$ ), units	Consumption on average per 1 men over 18 in units (total 6/ total 5)
	response options	units per year				
1	2	3	4	5	6	7
1	once a year	1	28.8	1,710,291	1,710,291	1.6 $\approx$ 2 suits per year for 1 person
2	once every 6 months	2	22.8	1,353,980	2,707,961	
3	once a season	4	15.6	926,408	3,705,630	
4	once every 3 years	0.3	15.6	926,408	277,922	
5	once every 2 years	0.5	14.1	837,330	418,665	
6	once a month	12	1.3	77,201	926,408	
7	not more than once every 4 years or more	0.25	1.8	106,893	26,723	
Total		$\approx 20$		5,938,510	9,773,600	

Table 18. General characteristics of the main manufacturers of men's suits in the market of the Republic of Kazakhstan

No.	LLP "The Academy of Fashion "Symbat"	LLP "GLASMAN"	LLP "Angelcher"	LLP "Kazlegprom-Almaty"	TOO "GOLDEN NOMAD"
1	Year of establishment, city:				
	1994, Almaty	1999, Talgar	2002, Almaty	2011, Almaty	2013, Shymkent
2	Trademark name				
	"Symbat"	"GLASMAN"	"Angelcher"	"QLP"	"Altyn Adam"
3	The production capacity of the men's suits line in one shift: Project/actual				
	50/30	400/400	100/50	500/150	300/150
4	Produced product range:				
	1) individual tailor-made men's suits; 2) school uniform	1) men's suits; 2) men's shirts; 3) school uniform; 4) accessories to men's suits and school uniform	1) individual tailor-made men's suits; 2) school uniform; 3) accessories to men's suits and school uniform	1) men's suits and footwear; 2) school uniform and footwear; 3) overalls and footwear; 4) military uniform	1) men's suits; 2) women's suits; 3) school uniform
5	The price range of men's suits, in US dollars from:				
	200-450	65-190	100-450	140-300	140-300
6	Product promotion system:				
	Advertising, sales promotion, personal sales, PR				
7	Sales network, number of outlets:				
	more than 8	more than 20, 1 of them – abroad, in Moscow (Russia), online store	more than 7	more than 5 in Almaty and Astana	more than 5, 1 of them in China
8	Market share in 2016:				
	0.1	1.2	0.2	0.3	0.2

Factories develop their own trading networks, opening outlets in various cities of the Republic of Kazakhstan, while also looking for wholesalers and export routes. At the same time, as one can see from the data in Table 18, the workshops for the production of men's suits of Kazlegprom-Almaty LLP, GOLDENNOMAD LLP, The Academy of Fashion Symbat LLP, Angelcher LLP are not fully loaded due to difficulties with promotion and marketing of products.

The marketing research of demand and consumer preferences of men's suits was made for LLP "Kazlegprom-Almaty". "Kazlegprom-Almaty" LLP is a relatively young sewing and shoe factory in the Republic of Kazakhstan, operating in the market of Kazakhstan since 2011. The production complex is located on 1 hectare. The production capacity reaches up to 1.5 million garments and 500 thousand pairs of shoes per year. The total staff of the factory is 500 people. To develop collections of men's clothing and shoes, the factory attracts designers from Turkey and Italy. The hypothesis H1 was confirmed in the course of the study: due to low consumer awareness of the Kazlegprom-Almaty sewing and shoe factory and lack of information on their preferences, there was low demand for products, and low sales figures for men's suits. The study confirmed the hypothesis that the majority of respondents – 71.8% - were not aware of the existence of "QLP" trademark (Qazaq Luxury Products), while uninformed respondents (64.2%) said they would buy a men's suit of this brand, if it met their preferences.

As for the second hypothesis H2, it is worth noticing that: the need to update the assortment of men's suits in the ranking criteria is in the golden mean, occupying the fifth place (the share is almost 40%) among the 13 proposed selection criteria. Moreover, the emergence of new models takes a low specific weight (3%) in the structure of consumer preferences. All this testifies to the fact that the demand of Kazakhstan consumers is not strongly influenced by the renewal of assortment and the appearance of new models of men's suits. Otherwise, one can say that the second hypothesis of the study was not confirmed.

The Kazakhstan consumer prefers men's suits of trademarks of the following producing countries: Italy, Turkey, Kazakhstan, Germany, Russia, China, Spain, Belarus, England, and Kyrgyzstan. Let us consider the import and export performance of these countries in accordance with the code of TNE FEA EED 6203 – Costumes, suits, jackets, blazers, trousers, overalls with bibs and straps, breeches and shorts (except bathing) for men or boys (Table 19).

Table 19. Export and import of men's suits in the Republic of Kazakhstan in thousands of US dollars

Product and country name			Year				Change in 2016 in%	
			2013	2014	2015	2016	2013	2016
1	6203 – Men's suits – total, of which:	export	2,305.0	2,035.9	1,675.1	6,145.1	*2.6	*3.6
		import	91,212.0	96,939.7	67,892.7	50,505.9	55.4	74.4
CIS countries								
2	<i>Total, of which:</i>	export	1,547.5	1,613.0	1,320.4	5,910.2	*3.8	*4.5
		import	22,183.4	24,946.3	16,923.3	11,108.6	50.1	65.6
	- Belarus	export	-	-	31.3	75.1	-	*2.4
		import	45.1	55.9	11.0	138.1	*3	*12.5
	- Kyrgyzstan	export	2.5	8.3	33.0	205.5	*82.2	*6.2
		import	9,967.8	8,353.6	3,423.5	79.4	0.8	2.3
	- Russia	export	828.4	1,128.9	886.2	5,544.1	*6.7	*6.3
		import	11,383.6	15,262.0	11,138.5	8,339.6	73.3	74.9
	- Uzbekistan	export	57.8	-	0.3	2.8	4.8	933.3
		import	338.7	678.0	2,106.2	2,421.1	*7.1	115.0
Rest of the world								
3	<i>Total, of which:</i>	export	757.5	422.9	354.7	234.9	31.0	66.2
		import	6,9028.6	71,993.3	50,969.4	39,397.2	57.1	77.3
	- Italy	export	-	56.2	53.9	4.1	-	7.6
		import	5,383.9	5,171.7	4,841.1	3,107.2	57.7	64.2
	- Turkey	export	624.0	-	48.9	5.5	0.9	11.2
		import	13,086.9	14,111.4	14,219.8	14,578.9	111.4	102.5
	- Germany	export	0.2	-	0.1	-	-	-
		import	302.2	241.9	110.5	92.0	30.4	83.3
	- China	export	72.1	-	1.1	3.8	5.3	345.5
		import	33,339.2	35,257.3	13,207.5	7,280.8	21.8	55.1
- Spain	export	-	-	-	-	-	-	
	import	34.7	16.8	14.6	9.1	26.2	62.3	
- France	export	41.4	141.2	47.2	23.4	56.5	49.6	
	import	135.1	42.6	51.6	27.0	20.0	52.3	

The data in Table 19 show the following:

- despite the fact that, on the whole, there is positive dynamics in the export of men's suits in the Republic of Kazakhstan, imports exceed exports. In particular, if in 2013 the import of men's suits exceeded the export by 39.6 times, in 2016 – by 8.2 times. This is due to the fact that domestic production of men's suits does not cover the needs of the whole market;
- among the CIS countries, imports also exceed exports in 2013 by 14.3 times, and in 2016 by 1.9 times; among the rest of the world, imports exceed exports in 2013 by 91.1%, and in 2016 by 1.2 times;
- in the structure of imports in 2016, the largest share is accounted for by "the rest of the world" – about 78% and 22% for CIS countries;
- in the structure of Kazakhstan's exports to the CIS countries in 2016, the largest share falls to Russia (93.8%), followed by Kyrgyzstan (3.5%), Belarus (1.3%), Uzbekistan (0.05%). Moreover, in the structure of imports is as follows: Russia (75.1%), Uzbekistan (21.8%), Belarus (1.2%) and Kyrgyzstan (0.7%);
- not all world countries are shown in the table among "the rest of the world", only those that were indicated by consumers. Thus, Kazakhstan exports men's suits to France (10%), Turkey (2.3%), Italy (1.7%), China (1.6%); imports from Turkey (37%), China (18.5%), Italy (7.9%), Germany (0.2%), France (0.1%).

Among the imported brands in the Kazakhstan market, one can purchase all the brands that were named by the respondents during the survey. A major representative of the international network for individual tailoring of elite men's suits is the "Imperial Tailoring Company", which opened first shops in the city of Almaty and Astana in 2001. Based on their research results, one can describe the profile of the Kazakhstan consumer of "QLP" men's suit: the target segment is a man aged 35-45 years. This man:

- buys a men's suit to update his wardrobe (52.2%), for an upcoming celebration (23.8%), to comply with dress code (21.3%), with the emergence of new models (2.7%);



- in this segment, 29.2% buy a men's suit once a year, 22.1% once a season, 19.5% once a year, 16.8% once every three years, 11.5% – once in two years, 0.9% – no more often than once every four years or more;
- prefers the following places to purchase a men's suit: a brand store (48.1%), a clothing market (17.8%), a multibrand store (14.8%), a custom tailoring shop (6.7%), a discount center (3.7%), show room (2.2%), online store (1.5%);
- prefers the following sources of information about new places for men's suits: recommendations of friends/colleagues/relatives (53.7%), manufacturers' sites/outlets (26.4%), social networks (9.9%), television and fashion magazines 2.5%), fashion shows (0.8%);
- selects a men's suit according to the following criteria in terms of importance: ideal fit (85%), fabric composition (62%), practicality/compatibility with the existing wardrobe (51%), price (47%), special promotions/availability of a discount card (44%), the renewal of assortment (43%), quality of customer service and the consultant's advice (42%), compliance with fashion trends (40%), country of origin (35%), the place of sale and advice of friends/acquaintances, on the Internet (26% each), brand recognition (20%), advertising (8%);
- wishes that the men's suit of "QLP" trademark was not inferior to the quality of the men's suits of the following preferred manufacturing countries: Italy (32.3%), Germany (24.6). Foreign men's suits are more expensive than the Kazakh brand "QLP" (up to 8 times), but the potential consumer is ready to pay for a domestic costume from 151-300 US dollars (45.1%) and up to 150 US dollars (38.1%) in case the purchased suit meets his expectations;
- have already purchased and wore a men's suit of "QLP" trademark (13.3%); however, in this segment the awareness of this brand is low – 66.4% are not aware of this product;
- lives in Almaty (46%), Astana (23%), Southern Kazakhstan (8%), Western Kazakhstan (7.1%), Northern Kazakhstan (6.2%), East Kazakhstan (5.3%), Central Kazakhstan (4.4%);
- by occupation: works in private structures (38%), public service (25.7%), in business (24.8%).

The second target segment of "QLP" men's suit is a segment aged 26-35 years, whose profile is described in the report on marketing research. There are consumers among the age segments of 46-55 years (9%) and 56-65 years (5%), but these consumers are in the latter part of their lives. In this regard, Kazlegprom-Almaty LLP is more expedient to conduct marketing activities to raise awareness and attract consumers aged less than 18 years (offering them a school uniform and later a men's suit for graduation party) and 18-25 years, due to a long life cycle of consumption of men's suits in these age groups.

Based on the results of marketing research, it is possible to build a profile of competitors and producers, both domestic and foreign, but in view of the limited volume of this article, it is not possible to disclose all these aspects. Based on the existing concepts of research management marketing potential of light industry enterprises, the authors offer the following interpretation of these concepts:

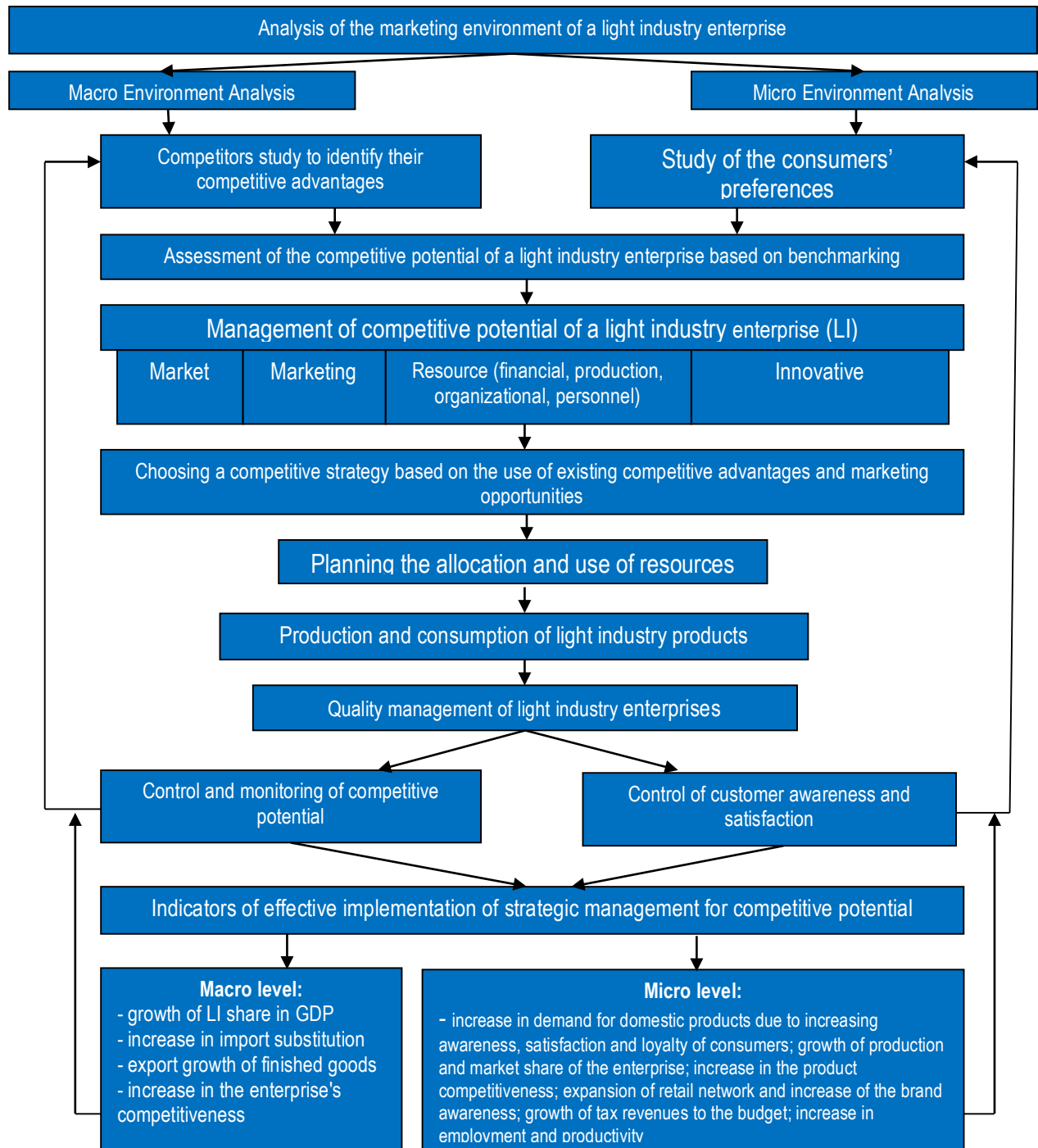
- "Competitive potential of a light industry enterprise is a combination of available resources and marketing opportunities that allow forming sustainable/long-term competitive advantages";
- "Marketing management for competitive potential in light industry enterprises means management of external and internal competitive opportunities of an enterprise with the purpose of their transformation into competitive advantages for achievement of certain marketing purposes".

In general, it should be noted that domestic manufacturers of men's suits do not cover the needs of the Kazakhstan market, and therefore there is no intense competition between them. At the same time, to expand the market share to domestic manufacturers of men's suits, one needs to study the strengths of men's suits of foreign manufacturers. Based on the research results, the authors propose the following marketing management for competitive potential in light industry enterprises for production of men's suits (Figure 4).

Based on the results of marketing research and the proposed model, one can say that the 3<sup>rd</sup> and 4<sup>th</sup> hypotheses of the present study were confirmed. The proposed model is an integrated approach to improving the competitiveness of a light industry enterprise based on assessment of its competitive potential.



Figure 4. Competitive potential management model in light industry enterprises



## Conclusion

Based on the study and the results obtained, one can conclude the following:

1. In the Republic of Kazakhstan, light industry covers only 10% of the needs of domestic market, of which 8% is in the garment and textile industry, and about 2% - in the production of leather and related products. This indicator does not meet the requirements of the country's economic security, since it is 3 times less than the required level and does not reach the threshold of 30%, placing high dependence of the country on imports. At the same time, it should be noted that the largest share in the total volume of light industry production falls on the production of clothing: 2008 – 36.6%, 2016 – 44.3%.
2. Based on the existing concepts of research management of marketing potential for light industry enterprises, the authors offer the following interpretation of these concepts:

- "Competitive potential of a light industry enterprise is a combination of available resources and marketing opportunities that allow forming sustainable/long-term competitive advantages".
  - "Marketing management of competitive potential for a light industry enterprise means managing the external and internal competitive capabilities of an enterprise in order to turn them into competitive advantages for achieving certain marketing goals".
3. Based on the results of marketing research of demand and preferences of men's suit consumers in the market of the Republic of Kazakhstan, the authors have analyzed factors that influence the decision to purchase a men's suit; calculated the share of "mind" and "heart" in relation to men's suits; ranked criteria influencing the choice when buying a men's suit; identified consumers' preferences in choosing sources of information about new sales locations for men's suits, country of origin, optimal price and the quality of a men's suit. In the course of the study, the level of awareness of the domestic Kazakhstan trademark "QLP" was revealed, along with the profile of its potential customer. The authors have developed recommendations for improving marketing management of competitive potential for enterprises producing men's suits based on the results of the study.
  4. The analysis of export and import of men's suits in the market of the Republic of Kazakhstan showed low export potential of light industry enterprises. The first, third and fourth hypotheses set at the beginning of the marketing research were confirmed, and the second hypothesis was disproved.
  5. To enhance the competitiveness of light industry enterprises, the authors developed and proposed a model for managing their competitive potential.

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## Assessment of the Knowledge Base in the Czech Republic Biotechnology Organizations Domain

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### Abstract:

Biotechnology belongs to knowledge-intensive technologies and represents one type of knowledge-based technologies. At the same time biotechnologies are considered as multidisciplinary. Biotechnology represents, in particular, new technological opportunities for businesses, research institutions, governmental and non-governmental organizations, which should be reflected in their growth and good economic and research results. Specific nature of the biotechnological field in the Czech Republic is the weak relationship between science and industry. Typical profile of a biotech enterprise is small business, with less than 50 employees, slowly growing and linked to a large corporation or a research contract. However, it neglects expansion on the foreign market. The knowledge base of biotechnology organizations is evaluated in presented research survey and includes practical example of a biotech company. The methodology of the research is based on the database of Czech biotechnology organizations and applies the biotechnology classification according to the area where the resulting biotechnology product is used. The output is a stratified set of biotech organizations and major biotechnology centers, their particular numbers, including the determination of their field and specializations. At the same time, based on the findings, the relationship between the knowledge base of biotechnology organizations and the innovation system is defined.

**Keywords:** biotechnology organics; green biotechnology; white technology; red technology; knowledge base; viscose pulp

**JEL Classification:** O3; O33; M2

### Introduction

In recent years, biotechnology, new materials and information technologies have been considered as the main technological opportunities for the business and research sector (Niosi 2003). The biotechnology is defined by Fusek (2012) as: the application of science and technology to living organisms or their parts, products and models for the transformation of living and non-living materials to produce knowledge, goods and services. Current areas of applied biotechnology include health, chemical, food and agriculture, waste management, research facilities and supplies. The basis for the development of biotechnology in each country is an effective knowledge base within an existing innovation system (Peterkova 2018, Peterková and Wozniaková 2015). Based on the knowledge base, the author considers a knowledge base that includes technology solutions, methods, solutions in biotechnology, a mechanism for acquiring, using, and retaining knowledge that works based on a mechanism for acquiring, using, and storing knowledge. It is created based on communication and the creation of mutually beneficial networks between biotechnology organizations. The knowledge base is developed by the creators themselves, as well as by the general and professional public. It turns out that the development of biotechnology is not on the same level of knowledge base in all EU member states.

The aim of the paper is to map out the specificities of the Czech environment of biotechnology organizations creating a knowledge base and to define the profile and properties of the Czech biotechnology company. Secondly, the aim is also to determine the impact of biotechnology organizations in defined biotechnology sectors, including the definition of the field and biotechnology specialties. The mapping of the activities of the biotechnology organizations will be carried out mainly through research and the activities of the successful biotechnology company will be documented using a practical example.

### 1. Research background

Biotechnology is defined according to the OECD Factbook (2013) as the application of scientific and technical principles for the processing of materials using biological agents. The definition is based on the use of a range of skills derived from biology, biochemistry, genetics, microbiology, biochemical engineering and separation

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processes. The Czech Republic has a long history in traditional biotechnology - in fermentation, continuous cultivation or biotransformation. This country also participated in a breakthrough in antibiotic production. According to Grubhoffer, *et al.* (2012), biotechnology also has a high added value in intellectual property and is a crucial segment for a knowledge-based economy. The importance of biotechnology is compared to the importance of microelectronics and information technologies (Momma and Sharp 1999). The objective is to make biotechnology the driving force behind economic growth in individual countries to reduce the number of natural resources and biodiversity (Arujanan and Singaram 2017). Biotechnology refers to bio-economy. Authors Patermann and Aguilar (2017) define the concept of Bio-Economy as: renewable biological resources, efficient bioprocesses and eco-industrial clusters to produce sustainable bio products, jobs, and income. These authors also point out that environmental benefits are a powerful incentive for the bio-economy but are not sufficient for social acceptance of bio-economy in individual countries. At the same time, they point out that the economic benefits of using biotechnology and environmental friendliness are combined.

Currently the biotechnology can be seen as an expanding range of implementation technologies (Tidd and Bessant 2013). Firstly, biotechnology has primarily influenced research and development programs of companies in the pharmaceutical, food and agricultural sectors, leading to massive investments by existing companies and to the establishment of specialized biotechnology businesses. Secondly, biotechnology began to be used to improve the efficiency of fundamental manufacturing processes, particularly in food processing, beverage production, and detergents. According to Tidd and Bessant (2013), the creation of value through biotechnology depends on the efficient functioning of the innovation ecosystem. It has three components, namely a scientific base, specialized biotechnology organizations and user industries.

The development of bio-economy in the individual EU member states is supported by the Framework Programs for Research and Technological Development (Patermann and Aguilar 2017). One is the Bioeconomy dedicated activity in the Horizon 2020 Program (2014-2020), and the other is the creation of a public-private partnership of bio-based industries. This challenge belongs to support area 2.1 Breakthrough and Industrial Technologies. Under this call, the subsidy can be applied for three areas: Synthetic biotechnology, an extension of the industrial use of enzymatic processes and downstream processes allowing for technological transformations. The Czech Science Foundation, which supports basic research, provides other sources of support for innovation in the Czech Republic and the Technological Agency supporting applied research. Particular ministries are the other guarantors to support research, development, and innovation (Government of the Czech Republic 2015).

It turns out that biotechnology is the source of growth in developed economies provided that the core science base is interconnected with commercial research and development, generating start-ups and spin-offs with high innovative potential. According to the study (Czech Startups 2016), 2100 start-ups operate in the Czech Republic, with the largest number of start-ups being concentrated in Prague (60%), followed by Brno with 15.3% and Ostrava with 4%. At the same time, the study shows that cooperation with universities and commercial research centers is not very common in case of Czech start-ups and only a small number of start-ups has been created within a university or research center. This is reflected in the areas where start-ups operate. It means that most of them offer IT products and services, not technology solutions. The Czech industry shows little interest in working with the academic sphere. It is because the science is focused on development of theoretical concepts, compared to the practice orientation on real-world applications (Watts and Hamilton 2011). According to Grubhoffer, *et al.* (2012) industry's interest in research and development is measured by the EBRD/GERD (Gross Domestic Expenditure on Research and Development) Ratio. This indicator was confirmed by the low interest of the industry in research and development. It means that the private funding of the HERD (R&D sector) and GOVERD (State R&D) is much lower than the public support of EBRD (R&D) sector. These results also apply to the biotechnology sector. At the same time, there is little interest in creating a spin-off company in the academic sphere. The exception is the establishment of the postgraduate private education center Contipro, the cooperation between the public and the private sector. One of the primary constraints in the transformation of knowledge into the final product or services is the lack of functioning incubators in the Czech Republic. According to studies (Czech Start-ups 2016), there are 51 business incubators in the Czech Republic, 23 of which are privately owned, 21 are public and 7 are combined. However, the total number of incubators that deal with applied research in the field of biotechnology amounts to only 9% (*e.g.* Academic and University Center Nové Hradky, Biotechnology Incubator INBIT, *etc.*).

In 2008 the Association of Czech Biotechnology Companies CzechBio was founded in the Czech Republic. This association is a cluster and currently has 32 commercial entities and five representatives of public research institutions and universities. It connects the activities of industry, academia, research and government



institutions. Companies represent the industry. According to Grubhoffer, *et al.* (2012), small biotechnology enterprises with fewer than 50 employees predominate in the Czech Republic, accounting for over 90% of all biotech companies. Biotechnology companies are not growing fast. After initial capital investment, they continue either by merging or selling the company to some of the big corporations or by getting a major R&D contract. The specific feature of Czech biotechnology companies is their high orientation on the domestic market with little expansion to international markets compared to other technologies such as ICT. Although it may be economically attractive to focus on the intensive use of the local market in the short run, thus it is in the long run that the focus on global markets has greater benefit. In R&D, there is a strong preference for small businesses supported from public sources, which contrasts with the world where large global and multinational corporations preferentially subsidize small businesses. In the Czech Republic, however, large multinational corporations support research and development at least, somewhat use cheaper and well-qualified workforce. It leads to the absence of integration of large multinational corporations into Czech R&D, most of the companies have only a manufacturing character (Zelený 2012).

Despite the importance of biotechnology in different areas of life and consequently for the Czech economy, there is no sufficient system of analyses or statistical measurement of economic results in this area. Following the accession of the Czech Republic to the EU in 2004, the official economic classification in the Czech Republic underwent significant changes in the area of standardized economic activities (NACE) or products (CPA) in 2008. Since then, the direct assignment of specific biotechnology commodities to the selected specific category has not been made. The result is a limited performance-based rating. However, biotechnology as a major component of the advanced high-tech industry classified by Eurostat and the NACE-intensive services will gain greater importance for statistical evaluation as specific disciplines, comparable, for example, to information and communication technologies (ICT).

At present, the Czech Statistical Office mainly monitors expenditure on research and development in the field of biotechnology defined by the sectors. Within the sectors, there are defined following sectors: the business sector (public enterprises, private domestic and foreign enterprises), which spends the most funds (65%), followed by the university sector with 20.8% (public and state universities, university hospitals, private colleges) government sector (ASCR, departmental research institutes, libraries, archives, museums) with 11.7% and the private non-profit sector with 2.5%. At the same time, patents in biotechnology are being monitored. Biotechnology patents have only begun in the Czech Republic since 2005, mainly by the public sector, because of the desired output within the R&D methodology (Czech Statistical Office 2012). It has resulted in patent applications with the minimal initial idea of their real commercial value and future use, and, moreover, their use is very often limited by restrictive conditions. In the field of education and soft skills, according to Grubhoffer, *et al.* (2012), in the future, it is expected that bankruptcy will occur mainly in technical disciplines and the natural sciences. It is necessary to strengthen the subject of chemistry/physics/biology at the basic level and to introduce biotechnology teaching at secondary schools. It is vital to promote the interest of young people in biotechnology, but the number of science parks where students can perform experiments is scarce. It results in a shortage of staff with biotechnology education and inflexible career growth in the public and private spheres. In the Czech Republic a low priority in the curricula of most universities in the Czech Republic for biotechnology, bioinformatics and applied biology, including managerial skills and entrepreneurship can be noticed. Working with human resources are the primary soft skills that are not embedded in the functioning of our institutions. There is no plan to develop the career of young scientists, both in state and private institutions. Informal activities for the general public are at a very low level.

## 2. Methodology and research survey

The evaluation of the knowledge base at the level of biotechnology organizations (enterprises, research institutions, governmental and non-governmental organizations) is realized through research based on the use of the database of Czech biotechnology organizations. At the same time, a practical example of the application of biotechnology is offer by Biocel Paskov a. s.

The methodology of the research is based on the database of Czech biotechnology organizations (936 organizations in total). The database is available at the Gate2Biotech portal ([www.gate2biotech.cz](http://www.gate2biotech.cz)), the founder of which is the South Bohemian Agency for the Support of Innovative Entrepreneurship. It incorporates organizations to promote the transfer of innovative technologies into a single communication platform. In the database, information on biotechnology organizations can be found in their breakdown into the green, white and red biotechnology sectors, including breakdowns into disciplines and specializations. It represents the main statistic about Czech biotechnology organizations. At the same time, individual organizations can find their name,



subject to business, production assortment and integration into the relevant biotechnology sector, field and specialization. The survey was based on the data on February 25, 2018 and took place for 14 days. The company database cannot be considered as definitive as it is continually updated.

Organizations implementing biotechnology in the Czech Republic include companies, research institutes, and governmental and non-governmental organizations. There are 936 organizations in the Czech Republic, of which 556 companies, 311 research centers and 69 governmental and non-governmental organizations. The Czech Republic is divided into 14 regions, with the largest concentration of biotechnology enterprises in Prague, with 159 organizations following the South Moravian Region (88 organizations) and the Central Bohemian Region (56 organizations). It could be said that biotechnology is centralized into two centers in Prague and Brno; six other regions are average and the remainder extremely undeveloped. It has been found that larger biotech organizations in these regions are linked with biotechnology incubators (such as INBIT) and a scientific base (such as the University of South Bohemia) representing the potential for technology transfer in the given regions.

Also, in these regions, we can find the largest diversity of biotechnology categories. It was found that companies, research institutes, governmental and non-governmental organizations could be divided either into a group of biotech service suppliers or a group of biotech material suppliers, see Table 1. Organizations belonging to a group of biotech service suppliers are engaged in laboratory services, consulting and other human resources and public relations (HR, PR) activities. The organization that is part of biotech material suppliers focuses on the supply of equipment, consumer goods, chemicals, and biological material. Most organizations, up to 62%, belong to a group of biotech suppliers, the rest of the organizations, that is, 38% belong to the supplier of biotech services. At the same time, it can be ascertained that enterprises (412) form only a group of biotech suppliers. Research organizations (54) are represented only in a group of biotech suppliers, particularly in the field of Laboratory services (38). Also, Government and NGOs are only part of a biotech service provider operating in the field of laboratory services (14) and consulting (14).

Table 1. Distribution of biotech organizations in a group of biotech service suppliers and biotech material suppliers

Type of organization	National Standards	Professional Standards	Organizational standards
7. Biotech service suppliers	252	54	15
7.1 Laboratory services	109	38	14
7.2 Consulting	62	6	14
7.3 Other (HR, PR)	199	8	13
8. Biotech material suppliers	412	0	0
8.1 Equipment, consumer goods	309	0	0
8.2 Chemicals	142	0	0
8.3 Biological material	116	0	0

Source: elaborated based on the CZ Biotech companies' database.

For more detailed analysis of biotechnology organizations, the biotechnology classification is used based on the areas where the resulting biotechnology product is used. These are three biotechnology sectors (Green biotechnology, White biotechnology, Red biotechnology). Red biotechnology is used in medicine and pharmacy. White biotechnology (often also grey) is applied in the industrial chemical industry. Green biotechnology is used in agriculture. Green biotechnology includes plant and animal biotechnology; here are the biotechnology branches (1 and 2) and the corresponding specialization (1.1 - 1.5 and 2.1 - 2.6). White biotechnology encompasses environmental and industrial technologies, and it is the responsibility of fields 3 and 4 including biotechnology specializations (3.1 - 3.8, 4.1 - 4.9). Red biotechnology includes research and development of pharmaceutical and medical biotechnology and biotechnology used for diagnostic purposes, corresponding to fields 5 and 6 and biotechnology specializations (5.1-5.7, 6.1-6.7). The division of green, white and red biotechnology, including corresponding branches and specializations, is presented in Table 2. There are even blue biotechnologies that relate to the marine, biological organisms of the world's seas, which are not addressed in the article.

Table 2. Classification of biotechnologies

Green biotechnology (1+2)	White biotechnology (3+4)	Red biotechnology (5+6)
1. Plant biotechnology	3. Environmental biotechnology	5. Medicine and pharmacy biotechnology
1.1 Reproduction and propagation	3.1 Microbial ecology	5.1 Genomics in drug discovery
1.2 Genetic modification introducing	3.2 Biosafety	5.2 Tissue engineering

Green biotechnology (1+2) new/excluding existing genes	White biotechnology (3+4)	Red biotechnology (5+6)
1.3 Growing conditions, plant protection	3.3 Microbial functions for degradation/transformation of pollutants	5.3 Nanotechnologies, structure of biomolecules and study the structure-function
1.4 Plant pathogen diagnosis, genome mapping, biodiversity of plants in agriculture/horti	3.4 Isolation, breeding, and genetic engineering of pollutants, degradation of micro-organism	5.4 Immunology, therapeutic and diagnostic antibodies, vaccinology
1.5 Plant cell biotechnology: plant cell biology	3.5 Biotechnology processes for soil and land treatment	5.5 Therapeutic proteins and oligonucleotides
2. Animal biotechnology	3.6 Biotechnology processes for air and off-gas treatment	5.6 Pharmacy biotechnology, API production
2.1 Reproduction, production	3.7 Bacteria as cell factories: microbiology	5.7 Human gene transfer techniques, human genome mapping
2.2 Breeding, incl. genetic, engineering in animals	3.8 Biological sources of renewable energy	6. Diagnostics and bioinformatics
2.3 Genome mapping, biodiversity of farms animals	4. Industrial biotechnology	6.1 Diagnostics antibodies
2.4 Animal cell biotechnology	4.1 Enzymatic processes	6.2 Peptides, conjugates, oligonucleotides synthesis
2.5 Veterinary medicines, animal health care	4.2 Development of bioprocessing techniques	6.3 DNA diagnostics
2.6 Veterinary diagnostics methods	4.3 Downstream processing	6.4 Biosensors, biomonitoring
	4.4 Genetic engineering and production of enzymes	6.5 Genome analyzing techniques
	4.5 Genetic engineering of micro-organism and yeast	6.6 Bio-data-informatics
	4.6 Cell culture techniques	6.7 Bioinformatics
	4.7 Genome mapping of specific bacteria and yeast	
	4.8 Biodiversity of micro-organisms in production	

Source: elaborated based on Bio Technology report (2012).

Using the existing database of biotechnology organizations (936), the number of enterprises, research institutions, governmental and non-governmental organizations in individual sectors was determined concerning biotechnology breakdowns into individual sectors, cabbage, white and red, including a classification into relevant branches and specializations, see Table 3.

Table 3. Distribution of biotechnology organizations in individual biotechnology sectors

Biotech sectors	Biotech organizations		
	Companies	Research Institutes	Government and NGO
Green biotechnology	153	141	48
1. Plant biotechnology (1.1,1.2,1.3,1.4,1.5)	96	94	24
2. Animal biotechnology (2.1,2.2,2.3,2.4,2.5,2.6)	57	47	24
White biotechnology	320	67	43
3. Environmental biotechnology (3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,)	126	40	27
4. Industrial biotechnology (4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9)	194	27	16
Red biotechnology	179	210	77
5. Medicine and pharmacy biotechnology (5.1,5.2,5.3,5.4,5.5,5.6,5.7)	107	121	42
6. Diagnostics and bioinformatics (6.1,6.2,6.3,6.4,6.5,6.6,6.7)	72	89	35
Green biotechnology	153	141	48

Source: elaborated based on the CZ Biotech companies' database.

Companies were found to be primarily active in the white technology sector (320 firms), industrial biotechnology (field 4), scientific research institutions mainly operate in the red biotechnology sector (210 firms) in the field of medical and pharmaceutical biotechnology (field 5) and NGOs are primarily active in red technologies (77 firms) in the field of Medicine and pharmacy biotechnology (field 5).

Regarding the findings of biotechnology specializations of enterprises, research institutions of governmental and non-governmental organizations, the individual biotechnology sectors are analysed in detail: Green technology, White technology, and Red technology. The results obtained are recorded in Table 4, Table 5 and Table 6.

The analysis of the Green Technology sector shows that most of the biotechnology organizations are most active both in plant technology and Animal Technology (153 subjects) and research institutions (141 subjects). At the same time, both businesses and research institutions are most specialized in Plant biotechnology for Growing conditions, plant protection (1.3).

Table 4. Distribution of biotechnology organizations in Green (1+2) biotechnology sector

Biotech sectors and specialization	Biotech organizations		
	Companies	Research Institutes	Government and NGO
1. Plant biotechnology	96	94	24
1.1 Reproduction and propagation	56	59	21
1.2 Genetic modification introducing new/excluding existing genes	19	59	20
1.3 Growing conditions, plant protection	76	60	20
1.4 Plant pathogen diagnosis, genome mapping, biodiversity of plants in agriculture/horti	55	41	20
1.5 Plant cell biotechnology: plant cell biology	44	38	21
2. Animal biotechnology	57	47	24
2.1 Reproduction, production	26	26	20
2.2 Breeding, incl. genetic, engineering in animals	11	19	18
2.3 Genome mapping, biodiversity of farms animals	26	28	19
2.4 Animal cell biotechnology: animal cell biology	30	16	21
2.5 Veterinary medicines, animal healthcare	15	21	18

Source: elaborated based on the CZ Biotech companies' database.

Contrary to Plant Biotechnology, enterprises are the most specialized in Animal cell biology (animal cell biology) (2.4), and research institutions specialize mainly in Genome mapping, biodiversity of farm animals (2.3). Government and non-governmental organizations operate equally in both the Plant and Animal Biotechnology sectors, but most specialize in Reproduction and Propagation (1.1) and Animal Cell Biology (2.4).

For analysis of White biotechnology, see Table 5, which shows that this sector is a dominant for enterprises (126 subjects), with most of them operating in Industrial biotechnology (specialization 4) where they specialize mainly in Development of bioprocessing techniques (4.2). The research institutions operate primarily in the field of Environmental Biotechnology (40 subjects) and specialize mainly in Microbial functions for degradation/ transformation of pollutants (3.3). Also, governmental and non-governmental organizations are primarily active in the field of Environmental Biotechnology but specialize in Biosafety (3.2).

Table 5. Distribution of biotechnology organizations in White (3+4) biotechnology sector

Biotech sectors and specialization	Biotech organizations		
	Companies	Research Institutes	Government and NGO
3. Environmental biotechnology	126	40	27
3.1 Microbial ecology	16	23	22
3.2 Biosafety	28	21	26
3.3 Microbial functions for degradation/transformation of pollutants	51	26	21
3.4 Isolation, breeding, and genetic engineering of pollutants, degradation of micro-organism	5	20	21
3.5 Biotechnology processes for soil and land treatment	49	28	22
3.6 Biotechnology processes for air and off-gas treatment	11	28	22
3.7 Bacteria as cell factories: microbiology	53	21	21
3.8 Biological sources of renewable energy	15	16	21

Biotech sectors and specialization	Biotech organizations		
	Companies	Research Institutes	Government and NGO
4. Industrial biotechnology	194	27	16
4.1 Enzymatic processes	26	18	16
4.2 Development of bioprocessing techniques	126	17	12
4.3 Downstream processing	19	9	12
4.4 Genetic engineering and production of enzymes	25	4	12
4.5 Genetic engineering of micro-organism and yeast	11	4	12
4.6 Cell culture techniques	32	4	12
4.7 Genome mapping of specific bacterial and yeast genomes	3	4	12
4.8 Biodiversity of micro-organisms in production processes	124	4	12
4.9 Brewing, dairy, winery	95	4	12

Source: elaborated based on the CZ Biotech companies' database.

For the analysis of the Red biotechnology sector, see Tab. 6 which shows that in this sector mainly research institutions (210 subjects) are active mainly in the field of Medicine and pharmacy biotechnology (field 5), where they are concentrating on Tissue engineering (5.2). Business and governmental and non-governmental organizations also operate most in the field of Medicine and Pharmacy Biotechnology (Field 5), with enterprises specializing in Immunology, therapeutic and diagnostic antibodies, Vaccinology (5.4), and Government and NGOs specializing in Pharmacy Biotechnology, API production (5.6).

Table 6. Distribution of biotechnology organizations in Red (5+6) biotechnology sector

Biotech sectors and specialization	Biotech organizations		
	Companies	Research Institutes	Government and NGO
5. Medicine and pharmacy biotechnology	107	121	42
5.1 Genomics in drug discovery	38	45	18
5.2 Tissue engineering	34	52	22
5.3 Nanotechnologies, structure of biomolecules, study structure-function	45	36	18
5.4 Immunology, therapeutic and diagnostic antibodies, vaccinology	56	29	16
5.5 Therapeutic proteins and oligonucleotides	32	29	17
5.6 Pharmacy biotechnology, API production	10	43	24
5.7 Human gene transfer techniques, human genome mapping	19	27	17
6. Diagnostics and bioinformatics	72	89	35
6.1 Diagnostics antibodies	3	44	16
6.2 Peptides, conjugates, oligonucleotides synthesis	47	27	21
6.3 DNA diagnostics	30	28	19
6.4 Biosensors, bio monitoring	9	26	20
6.5 Genome analysing techniques	14	24	19
6.6 Bio-data-informatics	9	22	18
6.7 Bioinformatics	5	25	18

Source: elaborated based on the CZ Biotech companies' database.

### 3. Case study – A biotech company from the white biotech sector

Description of the new studies/software/artwork and the process of production. What has been done, how was it achieved and what was the rationale? This can be, for example, a report on the design and execution of a set of experiments, the development of an innovative software system or the making of innovative art works. If so, this chapter will illuminate it by explaining, at the very least, what is important and new about it.

Biocel Paskov a. s. is an example of Biotech Company operating in the white technology sector was chosen. It focuses on biotechnology in the field of specialization 3.7, *i.e.*, bacteria as cell factories: microbiology in the field 4, in specializations 4.1 Enzymatic processes, 4.2 development of bioprocessing techniques, 4.3. Downstream processing, 4.8 Biodiversity of micro-organisms in production processes. It belongs to a group of companies that supply biotech material (equipment, consumer goods, chemicals, biological material). Biocel Paskov a.s. is a member of the multinational Lenzing Group based in the Moravian-Silesian Region of the Czech Republic. Biocel Paskov was founded in 1979 - 1983 on a "greenfield" as a pulp mill to produce sulphite pulp. Between 2001 and 2010, the company was part of the Austrian Heinzl Group, which is one of the largest

European manufacturers of paper pulp, paper and as well as pulp trading company in all major world markets. In 2010, the Austrian Lenzing group, the world's largest producer of viscose fibres for the textile industry, bought the 75% stake of Biocel Paskov, while the Heinzl Group owns the remaining 25% of shares. With the new owner of Lenzing, new technology to produce viscose pulp was used, but also the possibility of producing paper pulp. Lenzing, based in Austria, is an international group of six viscose fiber-manufacturing companies (Lenzing, Austria, Purwakarta, Indonesia, Nanjing, China, TENCEL fibers are manufactured by Heiligenkreuz, Austria, Mobile, USA and Grimsby, UK). These companies are supplying viscose pulp to produce viscose fibres by Biocel Paskov, which is incorporated into the Business Unit Pulp section. The multinational Lenzing Group employs 6,530 employees, 91.3% of the export, and produces over 1 million tons of viscose fibre per year. Lenzing supplies high-quality viscose fibres for the world's textile and non-woven industry. Biocel Paskov a.s. is a large enterprise with a capacity of 280 thousand tons of viscose pulp per year, considering the number of employees (1 January 2017 371 employees). Pulp revenues account for 95% of the company's total turnover. Concerning the use, much of pulp is sold for hygiene paper production (70%). Indicators are shown in Table 7.

Table 7. Selected economic indicators of the Biocel Paskov a.s.

Economic indicators	2014	2015	2016
The volume of pulp production	258000 tons	262000 tons	254500 tons
Turnover	5,1 bn. CZK	5,7 bn. CZK	5,1 bn. CZK
Profit	575 m. CZK	995,9 m. CZK	1236,8 m. CZK

Note: lower average pulp prices largely influenced the lower revenue in 2016

Source: Biocel Paskov a.s. Annual reports (2014, 2015, 2016).

The production line of the company consists of magnesium bisulphite bleached pulp VIAN-PASKOV, VITEX feed yeast, and VIANPLAST ligno-phosphonates. VIAN-PASKOV pulp with its capacity of 280 thousand tons is the largest European producer of sulphite pulp. Sulphite production technology makes it possible to use fermentable sugars in the waste liquor to produce VITEX feed yeast. They contain a lot of protein and some vitamins. They are made of quality compound feeds for livestock, Pet food products and food flavourings. Partly, ribonucleic extracts are obtained. With an annual production of 24,000 tons, Biocel Paskov a.s. is the largest European producer of this type of yeast. Another product of the company, which exploits part of the overproduction of the leachate, is lignosulfonic plasticizer marketed under the trade name VIANPLAST. This plasticizing additive is used in mortars and concrete mixtures and for the treatment of copper ores. In the production of pulp Biocel Paskov processes spruce wood. The pulp is produced with the using magnesium sulphite technology, ensuring high quality and economy of the process. The wood is the most efficiently utilized input in the production process, and at the same time, all the production waste is used (e.g., fermented yeast), which is one of the main goals of biotechnology.

## Conclusion

Based on the monitoring of Czech and foreign literature, studies on the innovation environment in the Czech Republic, it is possible to define the essential nature of the Czech innovation environment.

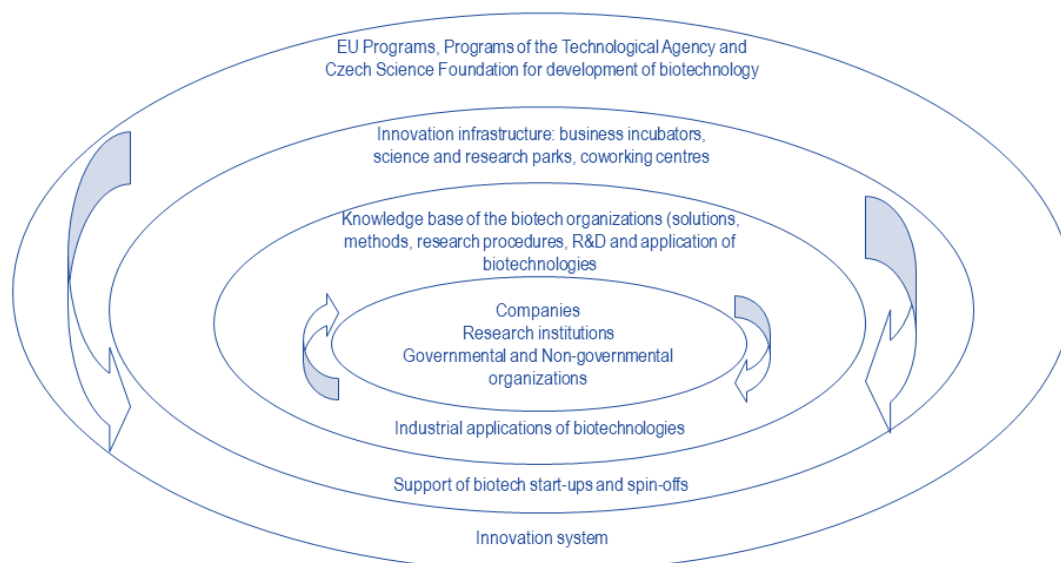
We can see that the competitiveness of Czech biotechnology compared to similarly large EU-27 countries is low. A typical Czech biotechnology enterprise has fewer than 50 employees, is highly oriented to the domestic market and neglects expansion to foreign markets. The growth of the company is realized by merging or selling the company to the big corporations or by obtaining a large R&D contract. In research and development of biotechnology, there is a strong preference of small businesses subsidized from public sources. While large multinational corporations invest the least in Czech R&D, they use mainly cheap and qualified workforce. This phenomenon is reflected in the low quality of the science and industry linkage, having a formal character, often only for the purposeful exploitation of subsidies. Based on the research, it was found that there are 936 biotech organizations in the Czech Republic, of which 556 companies, 311 research centers and 69 governmental and non-governmental organizations. Biotechnology is centralized into two centers in Prague and Brno because there are biotechnology incubators and a scientific base in the centers that contribute to the transfer of biotechnology. At the same time, it was found that most organizations belong to a group of biotech material suppliers rather than a supplier of biotech services. Biotechnology classification has been used for a more detailed analysis of biotechnology organizations according to the area where the resulting biotech product is used. The classification of biotechnology represents the following sectors: Green Technology, White Technology and Red Technology, including the corresponding fields and specializations. Businesses are primarily active in the white technology sector in the field of industrial biotechnology; scientific research institutions operate primarily in the field of red



biotechnology in the field of medical and pharmaceutical biotechnology, and governmental and non-governmental organizations operate in red technologies, but in the field of Medicine and pharmaceutical biotechnology. The impact of biotechnology organizations in individual sectors is being studied to the level of biotechnology specialties.

Based on the findings, it is possible to define the knowledge base at the level of Czech biotechnology organizations in the context of the innovation system, see Figure 1. The impact of the innovation system in the form of innovative infrastructure and programs to support the development of biotechnology on the knowledge base is captured. This is because the innovation system promotes the emergence of new biotechnology companies and, at the same time, leads to the emergence of biotechnology applications in the industrial sectors.

Figure 1. Model of the relationship between the knowledge base of biotechnology organizations and the innovation system of the knowledge base of biotech organizations



Source: own elaboration

In the context of the innovation system in the Czech Republic, Biocel Paskov a. s., which is mainly owned by the multinational Lenzing Group, was selected as a practical example of the use of biotechnology. It is predominantly focused on the production of viscose pulp and economic results show a growing tendency.

The biggest challenge that the Czech society faces towards the knowledge economy is to overcome the stereotypes in the knowledge base operation. At the same time, communication shortcomings between biotechnology organizations and other stakeholders of the innovation system must be eliminated. It will enable the further development of the biotechnology sector.

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## Comparison of the Financing Structure of Industrial Clusters and Service Clusters in the World

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### Abstract:

The sector-based (industry-based) view of the issue of supporting clusters is currently a topic that has rarely received attention within financing clusters. While there are quite a lot of studies devoted to financing clusters in general, as well as in various countries or continents, only few authors have dealt with differences between financing industrial clusters and service clusters in recent years. This is the reason why our own research was carried out, involving 1.414 clusters from Europe and North America. In this way, a unique overview of financing 167 clusters in this area was obtained. These clusters were divided, by industry in which they operate and in accordance with NACE Rev. 2, into two groups: industrial clusters and service clusters. In these two groups, differences between financing them were subsequently analysed. While no statistically significant differences were recorded between the total share of public sources and private sources in the budgets of industrial clusters and service clusters (44.21% to 42.12% for public sources and 55.79% to 57.88% for private sources), a more detailed analysis (using the SUR model) revealed statistically significant differences between industrial clusters and service clusters for two types of public sources used by the clusters most often. These sources are the European Union budgets (EU funds to finance cluster activities) and the national budgets (national/governmental funds).

**Keywords:** industrial clusters; service clusters; financing clusters; public funds; private funds

**JEL Classification:** L52; O38; R58

### Introduction

The topic of the advantages of spatial agglomerations has been analysed since the late 19<sup>th</sup> century in the works of Alfred Marshall (Cumbers and MacKinnon 2004). More recently, the development in the area has been shaped by the 'new geographical economics', most notably Paul Krugman, whose work is according to Tsvetkova (2014) considered as a building block leading to the current cluster theory. However, the topic of clusters, cluster initiatives and cluster policies has become a subject of great interest to the professional public, mainly as a result of the publication of Michael Porter's book (1990) "The Competitive Advantage of the Nations". Since then, research studies dealing with clusters, their funding and various other aspects have been growing in numbers. Clusters have gradually received even more attention from practitioners and policy-makers (Burger *et al.* 2017).

While the cluster financing methods, in particular, in Europe, have been a subject of a number of studies; the authors rarely examine the differences between financing industrial clusters and financing service clusters. Examining the sectoral structure by industry in which clusters operate in terms of financing them is an interesting research topic, also because a number of cluster programmes are focused on supporting particular industries (a typical example was the BioRegio cluster programme in Germany, which supported clusters in biotechnology). This fact gives an added value to the question whether it is appropriate to consider a different level of support to clusters, for example, from public sources, depending on industries in which they operate.

### 1. Theoretical background of financing clusters from public and private funds in the world

Clusters as a geographic concentration of interconnected companies and institutions have become an important object of the innovation policy financial interventions (Ketels 2015, Uyarra and Ramlogan 2012). Clusters represent a network, a grouping of enterprises, which are localised in one area, which operate in certain industries. If a cluster works efficiently and correctly, through its competitive advantages it reaches benefits for its participants (Potomová and Letková 2011). Clusters have a positive impact on the level of innovation and competitiveness and on the overall growth and business development in the long term. Today's economic map of the world is dominated by clusters, *i.e.* critical masses of unusual competitive success in particular fields, concentrated in one place. Cluster development of the regions and the various sectors of the economy provide a

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modern mechanism to improve the efficiency of economic activities (Niyazbayeva *et al.* 2017). For modern economic studies, the phenomenon of clusters is by right one of the central ones, as practice shows that their presence in the economy of a country or a region proves the effectiveness of development of the whole economy of this country. There is a range of clusters in the world economy that provide the regions where they are located with high indicators of the gross regional product, which contributes to the development of the economy and the country which own a cluster (Matkovskaya 2017). Clusters contribute to the creation of new jobs and have an impact on the development of the economy, to the improvement of the prosperity of the region, to the increase of the inflow of foreign direct investment (Sabadka 2013).

The paper focuses on the topic of financing clusters, either from the private sector, the public sector, or their combination, as the possibility to access funding presents one of key factors for cluster development (Zademach 2009). The public sector usually provides support either through grant funding and loans, but may also include a more general framework encompassing legislation, taxation and technical assistance for cluster management organizations and cluster members. The volume and purpose of the funds vary to a great extent depending on the type of cluster and its dominant activities. The OECD study (2007) classifies cluster programmes according to the volume of funds into three groups:

1. building partnerships and networks: the annual finance is usually lower than 100.000 EUR, frequently lower than 50.000 EUR and; as a rule, the funding does not last longer than 3 years (Local Production Systems in France or Visanu Programme in Sweden);
2. cluster programmes typical of "light" investments in science and R&D and the provision of common services. The annual budget ranges from 100.000 to 1.000.000 EUR. (The Basque Country's Competitiveness Programme in Spain, the German InnoRegio Programme);
3. programmes with massive investments in science and R&D, the amounts exceeding one million EUR. (The National Cluster Programme in Finland, BioRegio Programme in Germany, VINNVÄXT in Sweden, or Pôles de compétitivité in France).

Private sources of cluster financing include membership fees, sales of services, and other sources, including private foundations and donations. According to Andersson *et al.* (2004), the evolution of clusters has increased the need for financial actors (such as banks, insurance companies, public pension funds, investment funds, venture capitalists, etc.) to be involved. These actors can provide "seed finance, help in the initial stages of spin-offs, and coordinate the set-up of special funds targeted to the specific needs of the cluster".

A number of the above-mentioned studies examined clusters, cluster initiatives, their support and finance on the worldwide basis (Sölvell *et al.* 2003, OECD 2007, Lindqvist *et al.* 2013) or concentrated on surveying finance predominantly in European countries (Oxford Research AS 2008, Barsoumian *et al.* 2011, Lämmer-Gamp *et al.* 2011, Müller *et al.* 2012, Urbančíková and Burger 2016). Other studies analysed clusters and their support in groups of countries, which are somewhat specific and demonstrate some common features, which frequently distinguish them from others, such as Ketels and Sölvell (2006) dealing with clusters in the EU-10 new member countries. Similarly, part of the research studies concerned mainly financing clusters in some selected European countries (Hantsch *et al.* 2013 - clusters in Germany, France and Norway; and Sölvell and Williams 2013 - clusters in Sweden).

However, there are much fewer studies dealing, among other aspects, with cluster financing differences depending on the industry (sector) in which a cluster operates. One of the most interesting studies is the study published by Ketels *et al.* (2006) "Cluster Initiatives in Developing and Transition Economies".

## 2. Theoretical overview of the sectoral structure of industries used to divide the examined clusters

When comparing the financing of clusters, examining the sectoral structure of industries in which clusters operate is an interesting research topic, also because a number of cluster programmes are focused on supporting particular industries (a typical example was the BioRegio cluster programme in Germany, which supported clusters in biotechnology). This fact gives an added value to the question whether it is appropriate to support clusters in another way (another form) of funds, depending on the industry in which they operate. In this paper, the most commonly used classification was used, dividing sectors into primary, secondary, tertiary and quaternary sectors. Turečková (2012), in line with the general consensus, included agriculture, forestry, fishing, and mining and quarrying in the primary sector, manufacturing, processing of raw materials and construction in the secondary sector, all services – excluding services related to the creation and sharing of knowledge and information – in the tertiary sector, and services related to the creation and sharing of knowledge and information in the quaternary sector. Nosáľová (2011) considers the primary sector to include activities related to natural

resources and the secondary sector to include manufacturing activities. She includes services related to the distribution, storage, repair and transport of tangible assets in the tertiary sector and activities related to the creation, processing and transmission of information in the quaternary sector.

The sectoral structure of industries (also applied in this paper) to a large extent corresponds to the currently valid categorisation under NACE Rev. 2 – Statistical classification of economic activities in the European Community (2008).

To achieve a higher relevance of results (due to a higher number of clusters in individual groups), in our research the clusters were grouped into two groups – the so-called industrial clusters (primary and secondary sectors) and service clusters (tertiary and quaternary sectors). Thus, for the purposes of this research, clusters operating in the primary or secondary sectors, *i.e.* clusters whose main activity can be classified under the primary or secondary sectors under NACE Rev. 2, were included in the group of industrial clusters. Service clusters, on the other hand, included clusters operating in the tertiary or quaternary sectors, *i.e.* clusters whose main activity is a part of the tertiary or quaternary sectors.

Table 1. Classification of economic sectors

Economic sector	Primary sector	Secondary sector	Tertiary sector	Quaternary sector
General classification	Agriculture	Manufacturing	Services	
Detailed theoretical classification	Agriculture; Forestry; Fishing; - Mining and quarrying	Manufacturing: Processing of raw materials; Construction.	All services, excluding services related to the creation and sharing of knowledge and information	Services related to the creation and sharing of knowledge and information
Industry according to NACE Rev. 2	Section A: Agriculture, forestry and fishing. Section B: Mining and quarrying.	Section C: Manufacturing; Section D: Electricity, gas, steam and air conditioning supply; Section E: Water supply, sewerage, waste management and remediation; Activities: Section F: Construction.	Section G: Wholesale and retail trade <i>etc.</i> ; Section H: Transportation and storage; Section I: Accommodation and food service activities; Section L: Real estate activities; Section O: Public administration and defence <i>etc.</i> ; Section R: Arts, entertainment and recreation; Section S: Other service activities; Section T: Activities of households as employers; Section U: Activities of extraterritorial organisations and bodies.	Section J: Information and communication; Section K: Financial and insurance activities; Section M: Professional, scientific and technical activities; Section N: Administrative and support service activities; Section P: Education; Section Q: Human health and social work activities.

Source: European Commission (2008) and Turečková (2012)

### 3. Methodology and hypotheses

In order to identify, analyse and evaluate the differences in financing industrial clusters and service clusters, we carried out an extensive questionnaire survey. The questionnaire survey was carried out via email in 2016. In total, 1,414 organisations from 33 countries were contacted. Only clusters located in Europe (in thirty countries) and in North America (in the USA, Canada, and Mexico) were contacted. The total response rate from clusters in Europe and from clusters in North America was 11.70% and 12.09%, respectively. The total response rate from both regions was 11.81%.

In Europe, 1,017 clusters were contacted. We received 119 correctly completed questionnaires. The largest numbers of correctly completed questionnaires were received from clusters located in the following countries: Czech Republic (13), Poland (11), Germany, Slovakia, Spain and Sweden (10 each), Hungary (7), Norway and Italy (6 each), Austria and Switzerland (5 each), Bulgaria, Denmark, Romania, Slovenia and Great Britain (4 each). In the same way and at the same time we also carried out the questionnaire survey in the countries of North America. In North America, we invited 397 clusters – 296 clusters located in the USA, 55 clusters located in Canada and 46 clusters located in Mexico. We received 34 correctly completed questionnaires from the USA, 7 questionnaires from Canada and 7 questionnaires from Mexico. In total, we received 48 correctly completed questionnaires within the questionnaire survey carried out in North America.

Table 2. Number of clusters participating in the questionnaire survey in Europe and North America in 2016

Region	Number of survey email invitations	Number of correctly completed questionnaires returned	Response rate, %
Clusters in Europe	1,017	119	11.70
Clusters in North America	397	48	12.09
Clusters in total	1,414	167	11.81

Source: Author

The response rate was lower than in the Global Cluster Initiative Survey, 2006 (Ketels *et al.* 2006), where a relatively high response rate was recorded – 32.14%. However, the response rate recorded by us corresponds with a declining trend of the willingness of clusters to respond to questionnaires, since a similar low response rate was also experienced by the authors of the world-famous cluster publication “The Cluster Initiative Greenbook 2.0” Lindqvist, Ketels and Sölvell (2013), whose global questionnaire survey achieved a response rate of 13.80%. Lindqvist *et al.* (2013) refer in this context to the declining willingness of cluster facilitators and their fatigue due to recurring questions placed to them within a large number of surveys.

When including clusters in the group of industrial clusters or the group of service clusters, classification according to NACE Rev. 2 was used. According to this classification, clusters were included in the primary sector, the secondary sector, the tertiary sector and the quaternary sector. For the purposes of this research and in order to achieve a higher relevance of results (due to a higher number of clusters in each group), the clusters were grouped into two groups – the so-called industrial clusters (primary and secondary sectors) and service clusters (tertiary and quaternary sectors).

Table 3. Classification of clusters participating in the questionnaire survey by sector in which they operate

Economic sector	No of correctly completed questionnaires	Description of the most frequently obtained questionnaire responses from clusters by sector	Division into industrial clusters and service clusters	No of correctly completed questionnaires
Primary sector	7	These were mostly wine clusters and clusters involved in fishing and fisheries.	Industrial clusters	101
Secondary sector	94	These were mostly clusters operating in machinery, automotive, chemical, textile, plastics, wood and electrical industries.		
Tertiary sector	25	These were mostly clusters providing services in transport and logistics, maritime clusters and tourism clusters.	Service clusters	66
Quaternary sector	41	These were mostly clusters providing IT services, medical and R&D clusters.		

Source: Author

On the basis of literature (Barsoumian *et al.* 2011, Hantsch *et al.* 2013, Lindqvist *et al.* 2013, Santipolvut and Mali 2015, Meier zu Köcker and Müller 2015, Burger 2016), eight possible funding sources were included in the questionnaire survey (see Table 4). The clusters were also offered the possibility of selecting “Other sources”, without exactly specifying the funding sources. Despite having that possibility, none of the clusters selected such an option. Our categorisation of public and private sources differs only a bit from other studies, such as the study by Lindqvist *et al.* (2013). The main difference lies in the handling of credit instruments, venture capital, “business angels”, and donations, which were included in the category of private sources.

Table 4. Funding sources included in the questionnaire

Abbreviation	Description
Public sources	
Source_1	European Union budgets (EU funds to finance cluster activities).
Source_2	National budgets (national/governmental funds).
Source_3	Regional budgets (regional funds, including state level in case of federal states).
Source_4	Local budgets (municipal funds).
Private sources	
Source_5	Membership fees of cluster members.
Source_6	Revenues generated from the cluster’s own activities.
Source_7	Credit instruments – bank loans.
Source_8	Venture capital, “business angels” (crowd funding circles), and donations.



Note: "source\_1" was an option available only for the European clusters. Source: Author  
The following hypotheses were formulated within this research topic:

- Hypothesis 1: There is no statistically significant difference between industrial clusters and service clusters in utilising public and private sources to finance the clusters.
- Hypothesis 2: There is no statistically significant difference between the structure of public and private sources in financing industrial clusters and service clusters.

Within Hypothesis 1, the Mann-Whitney *U*-Test was applied to statistically process the data collected. Since the normality of distributions cannot be assumed in this case, this test provides a suitable non-parametric alternative to the parametric t-test on normal distributions. The test can be applied under the condition of random variables being independent and showing continuous probability distribution, which can be met in this case (Hudec *et al.* 2007). The Mann-Whitney *U*-Test is employed with ordinal (rank-order) data in a hypothesis-testing situation involving a design with two independent samples/populations. If the result of the Mann-Whitney *U*-Test is significant, it indicates there is a significant difference between the medians of two populations, and as a result of the latter, the researchers can conclude that there is a high probability that the data sets represent populations with different medians (Sheskin 2007). The Mann-Whitney *U*-test belongs to more powerful non-parametric tests (Field 2005, Liptáková and Čonková 2011).

Within Hypothesis 2, we compared the particular types of public/private funding sources. To verify this hypothesis, we used the SUR (Seemingly Unrelated Regression) model. It was developed and first published in 1962 by Arnold Zellner, a renowned American economist and statistician specialising in the fields of Bayes probability and econometrics. The SUR model is a multi-equation model. It is constructed of several one-equation, multi-dimensional economic models, while at first look the connection may seem useless and unrelated, which is why such a kind of model is called the seemingly unrelated regression model (SUR - Seemingly Unrelated Regression). The SUR model is used for analysing cross-sectional units where no interaction between the cross-sectional units is expected, but all cross-sectional units are determined by the environment in that they act (Ivaničová and Surmanová 2013). This property of the SUR model enables us to use it in our case.

$$source_{ij} = \alpha_{j0} + \beta_{j1} budget_{ij} + \beta_{j2} age_{ij} + \beta_{j3} sector_{ij} + \varepsilon_{ij} \quad (1)$$

where: *i* is the number of examined clusters, *j* = 1, 2, 3, ..., 8 is a given equation in our system corresponding to a specific type of public/private source of funding,  $\alpha_{j0}$  is a constant term, and  $\varepsilon_{ij}$  is an error term.

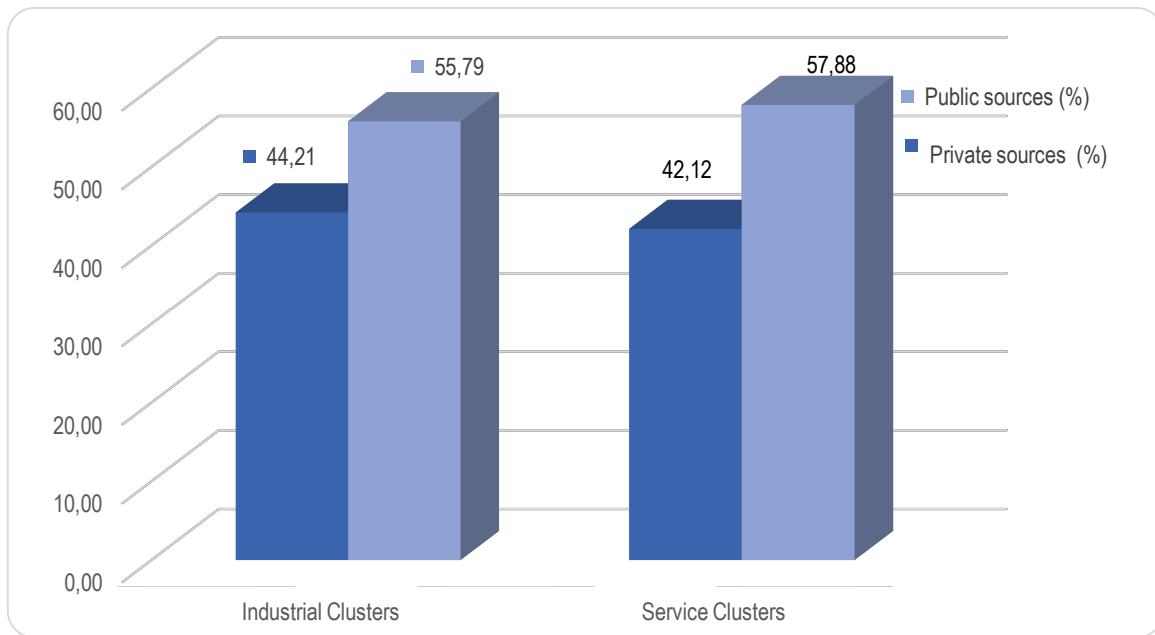
In our setting, we employ *three* explanatory variables: *budget* (budget rank of a given cluster, as there are significant differences among clusters' budget in our sample), *age* is a variable depicting the number of years during which the cluster is operating, and *sector* is a *dummy variable* set to 1 for an industrial cluster and 0 for a service cluster. As we are explaining the ratio of a given funding source to total sources, it is reasonable to assume that error terms are correlated across equations for a given cluster but are uncorrelated across individual clusters. This is also formally tested using the Breusch-Pagan test of independence among residuals.

#### 4. Analysis of results – comparison of individual types of public and private sources in the budgets of industrial clusters and service clusters

When comparing the shares of public funding sources in the budgets of clusters, it can be seen that the difference between financing industrial clusters (44.21%) and financing service clusters (42.12%) is relatively low. The same is situation exists when we compare private sources in the budgets of industrial clusters (55.79%) and service clusters (57.88%). The fact whether these small differences are statistically significant is subsequently verified using the Mann-Whitney test.



Figure 1. Comparison of the level of financing industrial clusters and service clusters, %



Source: Author

#### Mann-Whitney tests

$H_0: \mu_1 = \mu_2$

$\mu_1$  – public sources

$H_1: \mu_1 \neq \mu_2$

$\mu_2$  – private sources

(2)

Table 5. Comparison of shares of public sources and private sources in the budgets of industrial clusters and service clusters

Source type	Division of clusters into industrial clusters and service clusters according to NACE	Number of clusters	Average order	Significance level for rejecting the null hypothesis ( $\alpha = 0.05$ )	
Public sources	Service clusters	66	82.05	p-value	0.671
	Industrial clusters	101	85.28		
	Clusters in total	167			
0.671 > 0.05 $\Rightarrow H_0$ is not rejected (the difference between the share of public sources in the budgets of industrial clusters and the share of public sources in the budgets of service clusters is <i>not</i> statistically significant).					
Private sources	Service clusters	66	85.95	p-value	0.671
	Industrial clusters	101	82.72		
	Clusters in total	167			
0.671 > 0.05 $\Rightarrow H_0$ is not rejected (the difference between the share of private sources in the budgets of industrial clusters and the share of private sources in the budgets of service clusters is <i>not</i> statistically significant).					

Source: Author

The classification of clusters participating in a questionnaire survey by industry (sector) in which they operate and the comparison of individual groups is not very frequent in the cluster theory. Besides Ketels *et al.* (2006), a partial attempt was also made by Balog and Duman (2010), who divided clusters into technological clusters and tourism clusters.

The aim of the research was to find out whether there are statistically significant differences in financing industrial clusters and service clusters from public and private sources, as well as whether there are differences in the structure of individual types of public and private sources in the budgets of clusters examined.

In financing both industrial clusters and service clusters, private sources dominate over public sources. For industrial clusters, this ratio is 55.79% to 44.21%, for service clusters even 57.88% to 42.12%. At the same time, however, it should be noted that it has been demonstrated using the non-parametric Mann-Whitney test (p-value = 0.671) that the differences between the shares of public sources in industrial clusters (44.21%) and service clusters (42.12%) are not statistically significant. Likewise, the differences between the shares of private sources in the two groups of clusters – industrial clusters (55.79%) and service clusters (57.88%) – are not statistically significant. The conclusion therefore is that hypothesis 1 cannot be rejected, *i.e.* there is no

statistically significant difference between industrial clusters and service clusters in financing from public sources and from private sources.

To examine hypothesis 2, it is necessary to create a table (Table 6) with the values of descriptive statistical variables used in the SUR model.

Table 6. Values of descriptive statistical variables used in the SUR model

Variable	Industrial clusters (clusters in the primary and secondary sectors)					Service clusters (clusters in the tertiary and quaternary sectors)				
	No of clusters	Mean value	Standard deviation	Min	Max	No of clusters	Mean value	Standard deviation	Min	Max
Age of cluster, years	101	9.960	5.208	2	24	66	11.879	4.938	2	24
Public sources, %	101	44.208	32.262	0	100	66	42.121	30.635	0	100
Private sources, %	101	55.792	32.262	0	100	66	57.879	30.635	0	100
EU budgets – EU structural funds and framework programmes, % - (source_1)	101	14.307	24.000	0	100	66	21.894	27.439	0	80
National budgets (national/governmental funds), % - (source_2)	101	14.109	21.719	0	85	66	8.712	14.313	0	70
Regional budgets, % - (source_3)	101	8.218	11.524	0	65	66	6.288	7.811	0	25
Local budgets, % (source_4)	101	7.574	13.165	0	80	66	5.227	7.149	0	25
Membership fees of cluster members, % - (source_5)	101	27.921	21.181	0	80	66	28.030	22.700	0	75
Revenues generated from the cluster's own activities, % - (source_6)	101	19.208	16.744	0	80	66	18.333	14.367	0	80
Credit instruments – bank loans, % (source_7)	101	1.089	5.771	0	50	66	1.439	4.704	0	25
Venture capital, "business angels" (crowdfunding circles), and donations, % (source_8)	101	7.574	15.225	0	100	66	10.076	20.503	0	100
Duration of support, years	101	7.257	2.965	0	10	66	6.455	2.983	0	10

Source: Author

Table 7 shows the independent (explanatory) variable employed in the system of equations – budget. The budget amounts of industrial clusters are not very different from that of service clusters. Among service clusters there are more clusters with very low budgets (below 5,000 EUR) than among industrial clusters, but otherwise the differences between industrial clusters and service clusters as regards the amounts of budgets are not too great.

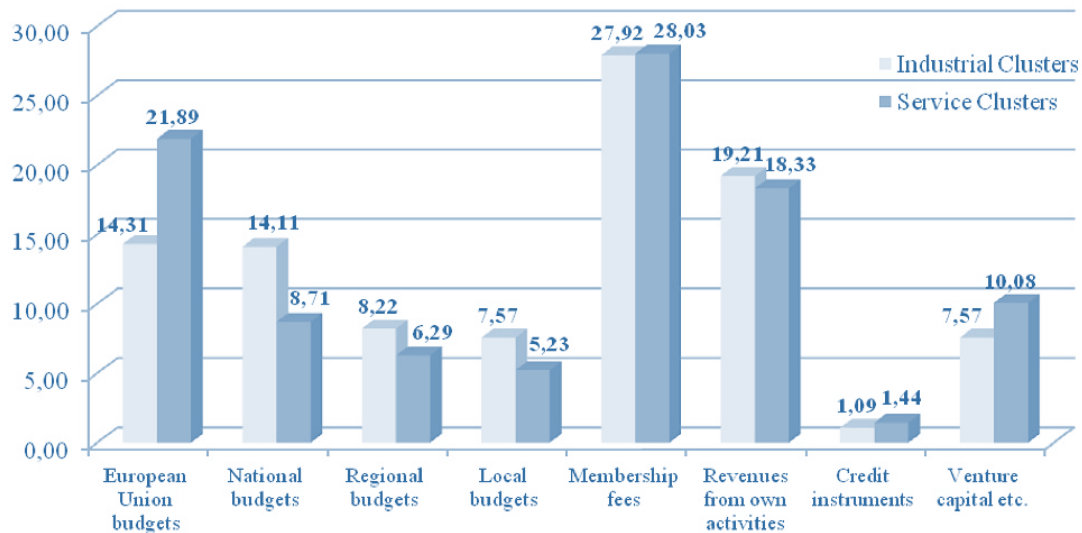
Table 7. Amounts of budgets of clusters examined, €

Budget	All clusters (2016)			Industrial clusters			Service clusters		
	Freq.	%	Cum. %	Freq.	%	Cum. %	Freq.	%	Cum. %
A < 5,000	11	6.6	6.6	3	3	3	8	12.1	12,1
B 5,000-25,000	30	18	24.6	23	22.8	25.7	7	10.6	22,7
C 25,000-50,000	11	6.6	31.1	9	8.9	34.7	2	3	25,8
D 50,000-100,000	33	19.8	50.9	16	15.8	50.5	17	25.8	51,5
E 100,000-500,000	42	25.1	76	24	23.8	74.3	18	27.3	78,8
F 500,000-1,000,000	16	9.6	85.6	9	8.9	83.2	7	10.6	89,4
G 1,000,000-5,000,000	22	13.2	98.8	16	15.8	99	6	9.1	98,5
H > 5,000,000	2	1.2	100	1	1	100	1	1.5	100
Total	167	100		101	100		66	100	

Source: Author

Figure 2 shows relatively small differences between individual types of public and private sources when comparing industrial clusters and service clusters. As regards the shares of the individual types of private sources, the differences between industrial clusters and service clusters seem to be relatively small. However, when we compare the individual types of public sources, differences between industrial clusters and service clusters are higher. The greatest differences seem to be evident when we compare sources from the budget of the European Union (in favour of service clusters) and from the national budgets (in favour of industrial clusters).

Figure 2. Comparison of the level of individual types of public and private sources in the budgets of industrial clusters and service clusters, %



Source: Author

These facts (whether the determined differences are statistically significant) are subsequently verified using the SUR model.

Table 8. Estimation results from the SUR model

Source type	Variable	Coef.	SE	z-stat	p-value	
EU budgets – EU structural funds and framework programmes (source_1)	Budget	-2.4765	1.0857	-2.2800	0.0230	**
	Age	-0.2081	0.3899	-0.5300	0.5930	
	Sector	-7.7760	3.9985	-1.9400	0.0480	**
	Constant	34.7975	6.4281	5.4100	0.0000	***
The estimation results from the SUR model, comparing the shares of the EU funds in the budgets of industrial clusters and service clusters, differ statistically significantly, at the significance level $\alpha = 0.05$ .						
National budgets (national/governmental funds) (source_2)	Budget	4.0737	0.7711	5.2800	0.0000	***
	Age	-0.2058	0.2769	-0.7400	0.4570	
	Sector	4.6561	2.8399	1.6400	0.0970	*
	Constant	-6.0025	4.5655	-1.3100	0.1890	
The estimation results from the SUR model, comparing the shares of national budgets in the budgets of industrial clusters and service clusters, differ statistically significantly, at the significance level $\alpha = 0.1$ .						
Regional budgets (source_3)	Budget	1.3065	0.4323	3.0200	0.0030	***
	Age	0.0304	0.1553	0.2000	0.8450	
	Sector	1.8774	1.5923	1.1800	0.2380	
	Constant	0.4232	2.5598	0.1700	0.8690	
The estimation results from the SUR model, comparing the shares of regional budgets in the budgets of industrial clusters and service clusters, do not differ statistically significantly.						
Local budgets (source_4)	Budget	0.3914	0.4860	0.8100	0.4210	
	Age	0.0336	0.1745	0.1900	0.8470	
	Sector	2.3783	1.7899	1.3300	0.1840	
	Constant	3.1787	2.8775	1.1000	0.2690	
The estimation results from the SUR model, comparing the shares of local budgets in the budgets of industrial clusters and service clusters, do not differ statistically significantly.						
Membership fees of cluster	Budget	-2.2781	0.9320	-2.4400	0.0150	**

Source type	Variable	Coef.	SE	z-stat	p-value	
members (source_5)	Age	0.3245	0.3347	0.9700	0.3320	
	Sector	0.7065	3.4325	0.2100	0.8370	
	Constant	33.7709	5.5183	6.1200	0.0000	***
The estimation results from the SUR model, comparing the shares of revenues from membership fees of cluster members in the budgets of industrial clusters and service clusters, do not differ statistically significantly.						
Revenues generated from the cluster's own activities (source_6)	Budget	-2.1721	0.6685	-3.2500	0.0010	***
	Age	0.0284	0.2400	0.1200	0.9060	
	Sector	1.1136	2.4619	0.4500	0.6510	
	Constant	27.1449	3.9578	6.8600	0.0000	***
The estimation results from the SUR model, comparing the shares of revenues generated from the cluster's own activities in the budgets of industrial clusters and service clusters, do not differ statistically significantly.						
Credit instruments – bank loans (source_7)	Budget	-0.0611	0.2334	-0.2600	0.7930	
	Age	0.0824	0.0838	0.9800	0.3260	
	Sector	-0.1871	0.8597	-0.2200	0.8280	
	Constant	0.7184	1.3820	0.5200	0.6030	
The estimation results from the SUR model, comparing the shares of bank loans in the budgets of industrial clusters and service clusters, do not differ statistically significantly.						
Venture capital, "business angels" (crowd funding circles), and donations (source_8)	Budget	1.2162	0.7560	1.6100	0.1080	
	Age	-0.0855	0.2715	-0.3200	0.7530	
	Sector	-2.7688	2.7843	-0.9900	0.3200	
	Constant	5.9687	4.4761	1.3300	0.1820	
The estimation results from the SUR model, comparing the shares of venture capital, "business angels" (crowd funding circles), and donations in the budgets of industrial clusters and service clusters, do not differ statistically significantly.						

Note: "SE" is standard errors. Symbols \*, \*\*, \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively  
Source: Author

The estimation results from the SUR model recorded two statistically significant differences from eight analysed sources (statistically significant differences in the variable "sector" are important). The first difference was found out by comparing the shares of the EU funds in the budgets of industrial clusters and service clusters, at the significance level  $\alpha = 0.05$ . The second difference was found out by comparing the shares of national budgets in the budgets of industrial clusters and service clusters at the significance level  $\alpha = 0.1$ . For the other six sources used in the budgets of industrial clusters and service clusters, the estimation results from the SUR model are not statistically significant.

## Conclusion

Comparing the revenue composition of the budgets of industry clusters and service clusters in terms of public and private sources is not usual in the world. Studies comparing the ways of financing clusters are fairly common in Europe, less common in North America, with a number of studies comparing cluster revenues, for example, by country. A less common way of comparing is to compare cluster financing by industry. An attempt was made, for example, by Ketels *et al.* (2006) in his publication "Cluster Initiatives in Developing and Transition Economies", where they compared clusters in four different groups by industry in which they operate. The first group comprised clusters operating in agriculture, food, and traditional production, the second group comprised clusters operating in capital intensive manufacturing, such as automotive, chemical or oil and petrochemical industries, the third group comprised clusters operating in "high tech" advanced services (ICT, biotechnology, and others), and the fourth group comprised clusters operating in tourism.

The aim of our research was to compare the financing of clusters operating in the primary, secondary, tertiary and quaternary sectors. Finally, also due to a relatively low response rate from clusters in certain sectors (in particular, in the primary sector), we chose to merge the clusters in the primary and secondary sectors (so-called industrial clusters) and the clusters in the tertiary and quaternary sectors (so-called service clusters). The fact that the both groups of clusters were represented relatively evenly and in a sufficient number (101 industrial clusters and 66 service clusters) increased the informative capability of the comparisons made.

As expected, the differences between the individual types of revenues in the budgets of industrial clusters and service clusters, either from public sources or from private sources, is not too great. Statistically significant differences between industrial clusters and service clusters were only recorded for two of the eight sources constituting the revenues of clusters. In both cases, these are revenues from public sources. In their budgets, service clusters (at the significance level  $\alpha = 0.05$ ) have more sources from the European Union budget (EU

structural funds and framework programmes) – 21.89% than industrial clusters – 14.31%, and industrial clusters (at the significance level  $\alpha = 0.1$ ) have available more sources from national budgets – 14.11%, while for service clusters these sources represent only 8.71% of the cluster's budget revenues. For the other types of sources of revenues, either public or private, there were no statistically significant differences recorded.

In evaluating the hypotheses, it can be concluded that hypothesis 1 in the wording "There is no statistically significant difference between industrial clusters and service clusters in utilising public and private sources to finance the clusters" cannot be rejected. The shares of public sources and private sources are similar in both industrial clusters and service clusters and, according to the results of the Mann-Whitney tests, the differences obtained are not statistically significant. Therefore, there is no statistically significant difference between financing industrial clusters and service clusters from public and private sources.

The evaluation of hypothesis 2 is more complicated. The evaluation of hypothesis 2 with the wording "There is no statistically significant difference between the structure of public and private sources in financing industrial clusters and service clusters" is rather difficult, since differences in the financing structure of industrial clusters and service clusters exist, albeit they are relatively small. Since statistically significant differences were recorded between the budgets of industrial clusters and the budgets of service clusters in the shares of financial sources from the European Union budget, as well as the shares of financial sources from national budgets, hypothesis 2 can be considered false and rejected.

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## Risk Analysis and Hedging of Financial Instruments

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### Abstract:

With the development of global markets and the expansion of opportunities for companies, there is a need for careful, efficient and prudent risk management. Hedging reduces the uncertainty of future financial flows and contributes to strengthening financial management. The purpose of this research is to study the trends and possible hedging measures to develop the derivative financial instruments (DFI) to hedge the risk of companies in Russia and Kazakhstan. The analysis has revealed that currently a limited number of Russian and Kazakh companies use risk hedging tools. The main reasons are the underdevelopment of financial instruments market, the relatively high cost of their use, and lack of the financial instruments market transparency. However, in the past two years, there has been an increase in trading volumes in options on the stock derivatives market. The study has resulted in a set of measures aimed at developing the market of interest-bearing derivatives, improving regulatory impact on the over-the-counter (OTC) market of the DFI, and reducing the hedging transactions costs.

**Keywords:** derivative; financial instruments; hedging; risks; volatility; uncertainty; forwards; options; swaps; over-the-counter

**JEL Classification:** G20; G23; G32

### Introduction

In the fast-paced world of tough competition, the ability to identify all potential risks is of paramount importance for any company and any commercial activity. Therefore, risk management becomes the dominant factor in modern markets.

Complex geopolitical situation and uncertainty in the global economic growth lead to the fact that most of the world's companies are preparing to increase the number of risks in the coming years. Recent geopolitical events have had a significant impact on foreign trade and the economy of Russia. Russian companies are largely subject to risks of price fluctuations, including exchange rates, the growth of interest rates, commodity and stock prices.

To avoid unpredictable losses and be competitive in today's business environment, the companies as part of their risk strategies involve the introduction of financial risks hedging practice.

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Hedging can be used to improve or maintain competitiveness. Companies that have good risk management programs can use hedging to reduce financing costs or reduce their prices in the markets, which are considered strategic and important for the future development of their companies.

It should be noted that in recent years risk-hedging derivatives have been rapidly gaining popularity among Russian companies. This issue has become particularly relevant following the devaluation of the ruble, which resulted in huge losses for companies, the sale proceeds of which were affected by the currency dynamics. After a significant weakening of the ruble, the interest in activities to minimize foreign exchange risks has sharply increased, but at the time when the local currency was at historic lows, these measures were essentially useless. Now, when the ruble has stabilized and its volatility has declined considerably, there has been a recovery of demand for hedging instruments.

Large public corporations of Russia already possess the advanced risk management systems and actively use hedging strategies in their activities. For large companies, it is regular and systemic in nature and often reduced to control of open currency position. Medium-sized companies rely less on stock-market instruments to minimize the risks, which is often associated with a relatively low level of financial literacy, lack of expertise and unwillingness to spend more funds, thus lowering the profitability of the business.

## 1. Literature review

The theoretical literature on risk management originated in the 1980s was focusing equally on both the financial and economic aspects of using the theory of capital (Modigliani and Miller 1963) and Fisher theorems (1930).

Modern literature provided three different definitions of corporate hedging:

- the insurance contract;
- any action that reduces the covariance between the value of the company and the factors that cause the problem;
- the activity on the storage of financial derivatives to reduce the exposure to market risks.

The study of Mayers and Smith (1982) defines hedging as buying an insurance contract that provides some incentives, such as the allocation of risk, lower transaction costs, monitoring requirements, tax benefits, etc.

The study of Huberman (1997) provides the basic adverse selection model, stating that it is advantageous to be insured against bad results improving thereby credit quality and reducing the cost of capital. Decreasing the cost of capital (discount rate) will increase value, and, therefore, insurance can be used as hedging instruments.

The fundamental study by Smith and Stulz (1985) provides a general definition of hedging in the corporate risk management. This work develops a positive theory of hedging behaviour to maximize the value of the firms, giving an analysis, and this work is greatly different from the literature available at the time. This study provides insight into maximizing value by examining the tax advantages, the contracts costs, and transaction costs.

Several studies, such as Breeden and Viswanathan (1998), Froot, Scharfstein and Stein (1993) and Broll and Eckwert (1999), Neuberger (1999) identified hedging as holding derivative instruments to reduce the cost of the covariance between the company and the value of the underlying asset exposed to market fluctuations (interest rates and exchange rates).

In the literature on financial risk management, the most fundamental is the debate about the need for companies to hedge risks (Elgari 2010). In the decision-making process on hedging, 4 stages are highlighted in broad strokes (Curtis and Carey 2012).

In stage 1 the risks are detected and identified, the extent of their impact on the activities of the company is analysed, and the risks are prioritized. In stage 2, the available alternatives for managing each risk are studied and a strategic decision is made on the necessity to hedge risks. The 3rd stage analyses the costs of hedging, as well as collecting, forecasting and evaluation of the data necessary to select the risk for hedging. In stage 4, the options and financial instruments for hedging are selected; and a certain risk hedging plan is developed.

The common opinion is that the firm can increase the value by hedging. There is considerable research to support the motivation of maximizing the value of the company for hedging, with various explanations of where the added value is created. The publication of Froot, Scharfstein and Stein (1993) (1993) shows that hedging can help alleviate the problem of underinvestment and, consequently, increase the cost for the firm, generating additional cash flow, reducing the need of the companies to raise external capital.

Recent studies indicate that the cost increases by reducing interest rates (Campello, Lin, Ma and Zou 2011), currency risk management (Allayannis and Weston 2001), increasing the debt capacity (Graham and Rogers 2002), and reducing the systematic risk (Carter, Rogers and Simkins 2006).

A study conducted by Hommel (2005) revealed a resemblance of ownership of a hedge portfolio with the changes in financial policy, which had changed the statistical distribution of cash flows to shareholders. The purchase of the insurance contract, taking into account the financial policies of the company, provides similar benefits of risk management (Mayers and Smith 1982). On an ongoing basis, companies adopt hedging policy to maximize the value of the firm (Stultz 1984). The study of MacMinn (1987) provides the theory, which asserts that hedging reduces tax credits or depreciation and therefore increases the cost of the firm.

Theoretical grounds for hedging are supported by empirical studies. Campello, Lin, Ma and Zou present the results that confirm that hedging reduces financial costs and taxes, which ultimately increase investment efficiency and company financing. The studies by Spanò (2013) and Marin (2013) suggest that companies are less prone to bankruptcy in managing currency risk. The study suggests that the levers have an endogenous influence on hedging and studies the interaction between corporate hedging and liquidity.

The joint study of Tai, Lai, Yang and Yu (2014) assesses the effect of corporate governance, and the work of Nova, Cerqueira and Brandão (2015) confirms the positive effect of hedging on firm value. It should be noted that the empirical data about hedging risks in Russia are not sufficient due to limited availability. Most of the available studies are devoted only to hedging currency risk (Patnaik and Shah 2010). Thus, the behaviour of hedging financial risks in the Russian environment requires additional empirical research.

## **2. Methods**

The quantitative and qualitative methods have been used in the paper to study risk-hedging processes using derivatives by Russian companies, and a dynamic and comparative analysis of the Russian DFI indicators in 2015-2017 has been carried out.

The information base of the study was official statistics, analytical materials and survey results of the leaders of Russian companies, presented by the IMF, the World Bank, the Ministry of Finance of the Russian Federation, the Central Bank of Russia, the Federal Financial Monitoring Service of the Russian Federation, the Moscow Stock Exchange, and the International Association of Swaps and Derivatives (ISDA).

## **3. Results**

Large-scale revolutionary changes in business environment observed in the last few years have resulted in companies seeking to become more flexible to be able to quickly respond to changes and seize new opportunities. However, in the context of the current economic volatility caused by uncertainty over oil prices, volatile stock markets, the slowdown in the Chinese economy, it is not surprising that 66% of executives participating in the PwC's 19th Annual Survey of CEOs Worldwide believe that today there are more threats than opportunities for business (2016).

Russia and Kazakhstan have been developing in the common economic space and have a similar economic model, the structure of imports and exports. The partners, Kazakhstan and Russia, have a commonality of historical destiny on certain stretches, as well as the foundation of relations in integration projects. Today, the Russian Federation is the main trading partner of Kazakhstan; the countries are the members of the Eurasian Economic Union, which implies mutual dependence on the on-going processes.

Despite the relatively upbeat assessment of prospects for the development of the global economy, Russia and Kazakhstan as energy-exporting countries continue experiencing difficulties; their economies remain vulnerable to external shocks and are subject to increased political, economic and legal risks.

Due to the transition of countries to the floating exchange rate regime in the currency markets of Russia and Kazakhstan, there was an increase in volatility, which, in turn, necessitated the creation of a full-fledged market for derivative financial instruments (DFI). The exchange rates of the Russian ruble and Kazakh tenge have common patterns, of course, with some quantitative differences and differences in form of motion (Figure 1).

According to the survey of top managers of the largest companies conducted annually by PwC, the volatility of the exchange rate is considered to be one of the main risk factors for 82% of the largest Russian companies (Figure 2).

Tenge exchange rate volatility raises strong concerns among Kazakhstani enterprises: it marked the second most important factors that affect their business. The anxiety of business leaders is clear: short-term plans and implementation of the long-term strategy strongly depend on the "behaviours" of the national currency. Experience shows that it is almost impossible to predict the dynamics of tenge because of the influence of the factors that are not always known to the market.

Figure 1. Weighted average US dollar rate against the national currencies of Russia and Kazakhstan at the trades of the STS and KASE

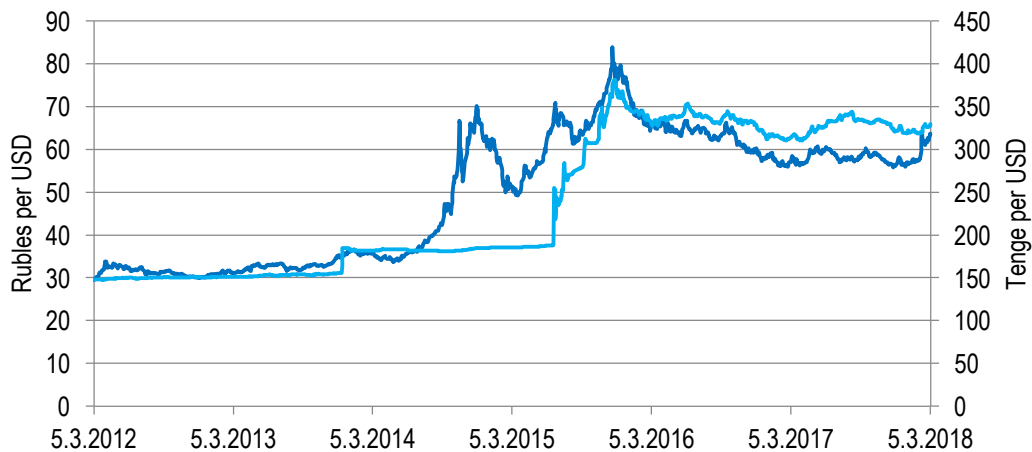
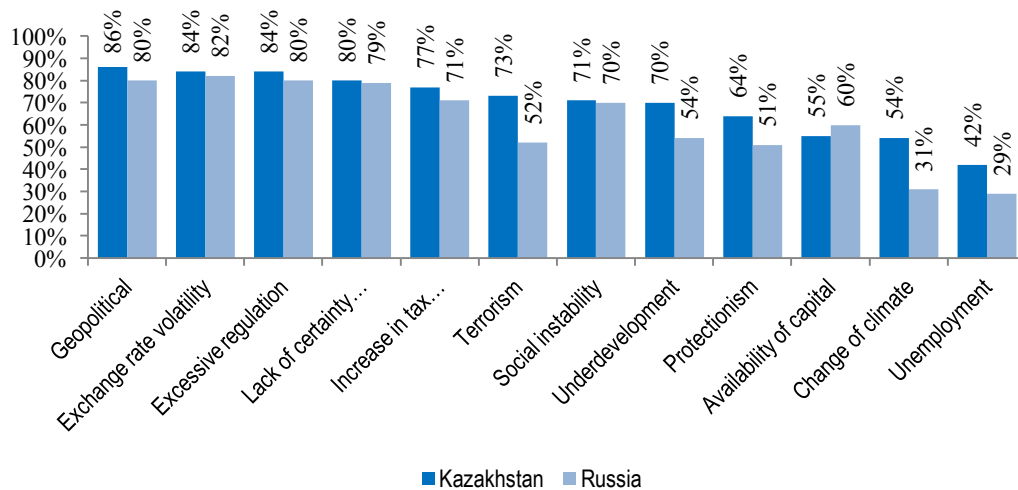


Figure 2. The threats that bother leaders of companies in Russia and Kazakhstan (compiled by the authors according to the materials of the poll of top managers)



At the same time, the positive trend of reducing volatility in the exchange rate of the national currency of Russia in 2017 should be noted. Thus, in the fourth quarter the average volatility of the ruble stood at 9.5%, while in early 2017 the level was 15%, and in early 2016 the volatility of the ruble exceeded the 27% mark.

In the Republic of Kazakhstan, in the conditions of stabilization of the situation on foreign markets, gradual strengthening of tenge was observed in the first half of 2017. In the third quartile, the dynamics of the exchange rate of the national currency were formed mainly under the influence of internal market factors. The increase in devaluation expectations led to an excessive demand for foreign currency and, as a result, increased volatility and the tendency of the weakening of tenge (National Bank of Kazakhstan, 2017). High volatility in exchange rates has adverse effects on the participants of foreign economic activity of both countries and entails risks of cash flow change and the changes in financial reporting indicators, etc.

According to the study of the practice of financial and treasury management, most companies in Russia and Kazakhstan use the natural hedging (balancing the currency structure of incoming and outgoing cash flows and balancing of foreign currency structured assets and liabilities) (KPMG 2016). The number of respondents who noted the use of financial instruments for hedging the risks decreased from 29% in 2011 to 20% in 2015. About 14% of companies that participated in the survey use OTC hedging instruments (forwards, options, swaps), and 6% use exchange instruments (futures and options).

In Kazakh companies the management of market risks through the purchase of financial instruments is not a popular measure of risk management: only 27% of the interviewed companies manage market risks through the

purchase of financial instruments while 31% of respondents did not use and do not plan to use such instrument in their practice.

In 2015-2017, there was a decrease in the volume of trading on the futures market of the Russian Federation. In 2017, the total turnover amounted to RUB 84,497 billion, while the volume of trading in futures fell by 29% compared to 2016, to RUB 77,624 billion, and the volume in options trading grew by 19% compared to 2016, to RUB 6,873 billion (Table 1).

Table 1. Volumes of Exchange Trading in DFI in the Russian Federation in 2015-2017, RUB, bln

DFI	2015	2016	2017	Change, %	
				2017/2016	2017/2015
TOTAL	93,713	115,271	84,497	-26.7%	-9.8%
Futures	90,231	109,489	77,624	-29.1%	-14.0%
Incl. Currency	62,478	64,561	39,460	-38.9%	-36.8%
Percentage	25	27	17	-37.0%	-32.0%
Stock	3,054	3,529	3,383	-4.1%	10.8%
Index	20,291	26,138	18,486	-29.3%	-8.9%
Commodity	4,383	15,234	16,278	6.9%	271.4%
Options	3,482	5,782	6,873	18.9%	97.4%
Incl. Currency	1,412	2,119	2,184	3.1%	54.7%
Stock	60	87	35	-59.8%	-41.7%
Index	2,002	3,434	4,440	29.3%	121.8%
Commodity	7	142	213	50.0%	2,942.9%

Source: Moscow Exchange, 2017.

Growth in the volume of trades in options and an increase in open positions on the futures indicate a growing proportion of Russian and international institutional investors (banks, asset management companies, funds) that hedge their risks in the market of stock derivatives.

The development of the product line of the Moscow Stock Exchange (MOEX) contributed to the activation of options trading in 2017. In October 2017, options for futures on the currency pairs "pound sterling – US dollar" and "US dollar – Japanese yen" were admitted to trading. In addition, weekly options on the most liquid instruments – futures on the United States dollar – Russian rouble rate and the RTS index – became available to participants for trading. New instruments supplemented the line of monthly and quarterly options, and allowed implementing trading strategies on short deadlines.

In the Republic of Kazakhstan, the volume of trades in derivatives demonstrated impressive dynamics. In 2017 trading volume reached KZT 22.1 billion, whereas in 2016 at the KASE Kazakhstan Stock Exchange the volume of transactions amounted to KZT 1.8 million (KASE 2017). Currently, this sector of the stock market of the Republic of Kazakhstan allows trading in futures, the underlying assets of which are the United States dollar, KASE index, individual names of shares.

A huge difference in the volume of trades in derivatives between MOEX and KASE should be noted. The lack of a full range of financial instruments is one of the main problems of the Kazakhstan stock market development. KASE still lacks options and commodity market section. The inability to trade derivatives and commodities slows the growth of trading volume and attracting liquidity on the exchange.

Trade in financial derivative instruments for hedging risks also takes place in the OTC markets of Russia and Kazakhstan.

The results of the analysis of 23 largest Russian enterprises conducted by the Bank of Russia in 2016 show that OTC derivatives are not used by risk management actively enough (Central Bank of Russia 2016). In the total value of the balance sheet, the small proportion is represented by the assets and liabilities on transactions with OTC derivatives. Thus, for 75% of companies' obligations on OTC derivatives do not exceed 1.1%. At the same time, a significant number of companies do not use market risk hedging instruments at all.

Currency derivatives are traditionally quite popular on the Russian market of DFI. The structure of the OTC market basically consists of swap and forward transactions. The market of OTC currency DFI – forwards and swaps – has increased significantly, which indicates a common interest in currency derivatives, both as a tool to hedge foreign exchange risk and as a tool to reduce the cost of funding. In 2015-2017, the volume of open transactions with forward contracts and currency swaps increased by 57.4% and reached USD 100.5 billion (Table 2).



Table 2. Gross volume of open positions on transactions with DFI of the OTC market of the Russian Federation

DFI	01.01.2016	01.01.2017	01.01.2018	Change 01.01.2018 / 01.01.2016, USD mln	
				+/-	%
Forward contracts and currency swaps	63,847	85,751	100,506	36,659	57.4%
Options	19,737	8,160	9,255	-10,483	-53.1%
Currency interest swap	54,479	30,620	41,652	-12,827	-23.5%
Interest swap	73,066	61,687	69,182	-3,884	-5.3%
TOTAL	211,129	186,219	220,595	9,465	4.5%

Source: Central Bank of Russia, *n. d.*

Forward contracts, as the main instrument of hedging currency risk, are widely used in transactions between noncredit financial organizations (NFOs), public and private banks: public and private banks purchased foreign currency from the NFOs, mainly based on short forwards, up to 6 months.

Swaps, as a financial instrument, are primarily used in hedging the risks associated with the obligations of companies and, as a rule, are initially selected in such a way that they coincide with the terms of the hedged liabilities. The «cross-currency and interest-rate swap» OTC derivative is the most active among traded swaps in the Russian Federation. The attraction of currency in the market of cross-currency and interest-rate swap is characteristic of nonbanking financial organizations owned by large banking groups with State participation and registered in foreign jurisdictions. The cross-currency and interest-rate swaps are the main instruments for hedging currency risks in the Republic of Kazakhstan.

Overall, this study demonstrates that, despite the positive dynamics, the Russian and Kazakh markets of derivatives remain very limited, both in terms of instruments and underlying assets. The weak use of hedging methods in Russia and the Republic of Kazakhstan may be due to a number of factors, among which the most significant are, first of all, the underdevelopment of the financial instruments market, the relatively high cost of their use, the lack of transparency of the OTC DFI market, and the increased risk of default on them.

#### 4. Discussion

According to the experts of the Analytical Credit Rating Agency (ACRA), internal risk hedging arrangements that would compensate for losses from terms incorrectly fixed in long-term contracts are currently undeveloped. Low availability of external hedging mechanisms should also be noted.

This is evident in that the turnover of the DFI market, on the basis of which a hedge can be built, is small in comparison with the volume of accepted risks (in particular, interest rates). In addition, the situation is aggravated by the lack of experience of the legal infrastructure in resolving disputes involving such contracts, and a relatively low financial literacy of the population (ACRA 2018).

According to market experts, possible measures to develop financial hedging instruments include the following:

a) Restriction of «currency swap» operations in the Republic of Kazakhstan.

Since mid-2016 in the Republic of Kazakhstan, there has been a problem of high liquidity of tenge, which the National Bank of Kazakhstan has regulated by issuing short-term debt instruments. In order to eliminate excess liquidity, IMF experts recommended the National Bank of Kazakhstan to close and not reopen currency swaps, because of the associated high cost as well as tighten reserve requirements, and to issue debt instruments.

The currency swap transactions for the period of one day may become one of the tools of monetary policy used to withdrawal liquidity in local currency.

KASE previously conducted these operations; however, it was not on a permanent basis and only in the event of significant fluctuations in the rates on this market. The new line of instruments should include a permanent currency swap when the National Bank of Kazakhstan is ready, at the request of a second-tier bank, to provide or withdraw tenge funds for one day against security in US dollars. Carrying out of constant access operations at the currency swap site will reduce the volatility of rates in this market. It seems advisable to develop a methodology for the daily calculation of rates, taking into account the differential rates in the US and Kazakhstan in accordance with international experience.

b) The development of the market of interest-bearing derivatives in Russia and Republic of Kazakhstan.

As the currency market stabilizes, over time interest risk may become more important than the currency risk for the Russian financial system. Targeting inflation, achieving low levels of interest rates, and a tight budget rule

with a less volatile rate increase the likelihood of unsynchronized implementation of interest and currency risks. The interest rate risk dominates in the developed financial markets and can theoretically arise in Russia.

According to the agency's specialists, the cycle of reducing the key rate is close to completion - by the end of 2018 they expect a rate cut to 6.75%, i.e. another two minimal steps. Banks assume interest risks in lending. In the event of an increase in market rates, banks are entitled to raise the rate under the contract. However, since banks cannot raise the rate for their key customers, and the rate increase for other customers occurs with a time lag, the banking organizations will incur losses. In the event of a drop in market rates, customers have more attractive terms for refinancing, and banks lose part of the margin. Specialists note that it is necessary to develop the market of nonrate hedging debt instruments, and the economic entities themselves should keep the problem of interest risk in sight. IRS is offered by market experts as possible measures for market development (Anoshin 2018):

- standardization of credit documentation and avoidance of the practice of granting free options (rate reduction, prepayment);
- development of the infrastructure of the SDFI section for IRS transactions with the Central Counterparty;
- further work to improve legislation - the definition of hedging, amendments to the law on bankruptcy as regards CSA.

c) Improving the regulatory impact on the market of OTC derivatives in Russia and Kazakhstan. Currently, a significant number of derivatives have not been standardized, and with respect to obligations arising from them, clearing is not performed with the participation of a central counterparty. This means that the risk of default on the DFI is quite high.

Starting from 2019, Bank Russia introduces new requirements for the OTC derivatives market. It is supposed to develop threshold values for the initial (guarantee deposit) and variation (the minimum amount on the account that allows holding the position) margin. Mandatory merging for off-exchange DFIs is planned to be introduced in several stages for various market participants specially allocated by the Central Bank of Russia for these purposes.

According to professional market participants, for banks this will result in lower margins and commissions, and for the market – in lower liquidity. From the point of view of experts, if transactions with the DFI are concluded with a view to hedging the risks of corporate customers, the condition of their mandatory margin should be excluded. Despite the fact that the Central Bank of Russia, in general, has taken into account their point of view, their most important proposal has not yet been supported by the regulator.

Obviously, the first reaction of the market will be an increase in the liquidity risk of companies that have unmerged transactions with DFI on the balance sheet, and a reduction in the income of banks. At the same time, according to the regulator, the reform will increase competition in the market and increase the number of participants at the expense of small financial companies, the work of which in the derivatives market was considered too risky.

d) Reducing the cost of hedging with the use of DFI.

The processes for servicing OTC derivatives are time-consuming since all counterparties are independently engaged in this. Significant potential for lowering the cost of hedging is embedded in the use of innovative technologies during servicing derivatives. For example, the use of smart contracts can lead to the fact that the standard rules for derivatives will simplify OTC financial arrangements. The CEO of Symbiont and the co-chairman of the Smart Contracts Alliance, Mark Smith, called the OTC financial agreements one of the most pressing opportunities for smart contracts (PCmag 2017).

## **Conclusion**

One of the main risk factors for business development in Russia and Kazakhstan is the volatility of the exchange rate, which has negative impact on participants in the foreign economic activity and entails risks of changes in cash flows, changes in financial reporting indicators. At the same time in 2014-2015 the number of companies applying DFI in hedging risks has decreased.

However, it should be noted that in 2016-2017, despite a general decline in trading volumes on the FDI futures market, the growth of transactions with options demonstrated a growing share of investors who hedged risks in the market of stock derivatives.

The increased interest in the OTC currency derivatives (forwards and swaps) should be noted as promising instruments for hedging the foreign exchange risk and reducing the cost of funding. The key problems

of the development of the DFI market in both countries are the underdevelopment of the markets for interest-bearing derivatives, high hedging costs, and an increased risk of nonfulfillment of obligations by the OTC DFI.

Further efforts should be aimed at developing the market of interest-bearing derivatives, improving regulatory impact on the OTC market of the DFI, and reducing the hedging transactions costs.

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## Stock Market Volatility Spillover in West Africa: Regional and Global Perspectives

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### Abstract:

This study examines volatility spillover between stock markets in the West African region, and with the United States of America (US) and United Kingdom (UK) stock markets using the Exponential Generalized Autoregressive Conditional Heteroscedastic (E-GARCH). Daily stock market index returns from 2008-2016 were analysed considering two sub-sample periods representing periods of turbulence and tranquil. Findings from the study reveal that there is the presence of significant volatility spillover effects between stock markets in the West African region and also with major global markets of US and UK. Significant changes are also observed in the direction, magnitude and sign of impact during the period of crises and in the post crises period. The results of this study is important to local, regional and international investors, market participants and regulatory bodies as it implicates on portfolio diversification strategies, capital controls policies and efforts towards regional stock market integration.

**Keyword:** integration; volatility spillovers; E-GARCH; stock markets; West Africa; financial crises

**JEL Classification:** G15; G01; C58; F36; F37; F65; G23

### Introduction

International portfolio diversification comes handy with financial globalization fostered by; the ease of funds transfers through technology, computerized securities clearing system, online trading of securities and electronic banking. International investors are able to react to market news and revise their portfolio strategy thus investing and divesting at will from markets with little or no capital flow restriction in this age of economic liberalization and technological innovation. Global financial integration has taking its toll on many stock markets leading to interdependence and co-movements between markets such that volatile prices changes in one market could have a spillover effect on others. Recent studies have shown that liberalization and internationalization of stock markets world over have come with its gains and pains (Yao, He, Chen and Ou 2018, Asaleye, Adama and Ogunjobi 2018, Bai and Chow 2017).

The Autoregressive Conditional Heteroscedasticity (ARCH) as proposed by Engle (1982) is able to model volatility. Other modifications of ARCH including the Generalized ARCH (GARCH) by Bollerslev (1986) can reveal if the volatility inherent in one market is affected by the volatility in another market. Other information available through the ARCH and GARCH models include if the mean reverts slowly or fast, and if the magnitude of the effect of a negative shock is more than that of a positive shock (known as the leverage effect) as established to be commonly exhibited in financial series. Closely integrated markets without substantial capital flow restrictions usually experience volatility spillovers, but arguments exist as to the extent of interactions that exist among stock



markets in the West African region on one hand, and the extent of such interactions between the stock markets in the region and major global stock market.

There are insufficient studies on the existence of volatility spillover within stock markets in the West African region related to major global stock markets. This study intends to fill this gap by examining volatility in major stock markets in the West African region and further examine if there are spills over among them and between them and major global stock markets. The general notion is that stock markets in the West African region are disintegrated among themselves and independent from the global stock market. Assessing the nature and extent of volatility spillovers has implication for both local and foreign investors, other market participants and regulators in the face the dynamic interdependencies of equity markets in a financial globalization era and against the background of efforts towards a higher level of regional market cooperation in West Africa. The study hereby examines volatility spillover of stock returns in the West African region from a regional and global perspective in the stock markets of Nigeria, Ghana, the West African Economic and Monetary Union (WAEMU), United Kingdom (UK) and the United States (US).

## **1. Empirical review**

Examining the co-movement of stock market indexes has been established as a yardstick for integration in the literature. Kanas (1998) is one of the early studies on volatility spillover between stock markets. The author examined the volatility spillover between the London, Paris, and Frankfurt stock markets using Exponential Generalized Autoregressive Conditional Heteroscedasticity (E-GARCH) on daily data of whole sample period from 1984-1993 and sub-sample periods of 1984-1987 and 1987-1983. While bi-directional spillover was found between Paris and London and Paris and Frankfurt, a unidirectional spillover was found from London to Frankfurt. From the sub-period analysis, the study reveals that the intensity of volatility spillover was higher during the later (post market crash) period.

Rockinger and Urga (1999) is another early study on stock market integration. A time-varying parameter model was used to test for predictability and integration in stock markets of Czech, Poland, Hungary, and Russia. Daily data from April 1994 to July 1997 were used for the study. The Kalman's filter framework that allows for a GARCH structure for the residuals was employed. The evidence from the study revealed that the importance of Germany has changed over time for all the markets and that shocks in the UK were positively related to the Czech and Polish markets, but neither with the Russian nor Hungarian market. Findings further show that the markets exhibit significant asymmetric GARCH effects where bad news generates greater volatility, although in Hungary, good news instead generates greater volatility.

Kim, Moshirian, and Wu (2005) examined the impact of the introduction of the euro currency on the dynamic interactions and interdependencies between stock markets in the European Monetary Union (EMU) from 1989-2003. The authors employed a bivariate E-GARCH model and the seemingly unrelated regression estimations (SURE). Findings from the study reveal a striking number of significant return and volatility spillover within the region, and for the entire region with the US and Japan. More so the results revealed that market linkages have strengthened since the introduction of the euro. It further shows that the introduction of the euro has resulted to stock market integration and that the integration is an unrelenting and seasonal process being basically determined by the existing levels of integration and stock market development.

Caporale and Spagnolo (2010) estimated a trivariate Vector Autoregressive - GARCH (1,1) model to examine volatility spillovers between the stock markets of three Central and Eastern European countries (CEECs), namely the Czech Republic, Hungary, and Poland. Similar to the findings of Kim, Moshirian, and WU(2005) the author's findings suggest that following the accession of the EU, linkages between markets in the region have become even stronger, thus making intra-regional portfolio diversification a less effective investment strategy.

Hochstotter and Weskamp (2012) conducted a study on international co-movement of equity markets and foreign exchange, using a large international dataset covering the most important markets. They measured the mutual influence on the levels by correlation, linear regression, vector autoregression, and Granger causality as well as the dynamics in the co-movement behaviour by means of DCC-GARCH. Findings of the study show significant negative, as well as positive co-movements. It was observed that co-movement measured by linear dependence tends to be much more stable in developing economies than in the leading economies. On the other hand, a significant regional cluster of co-movement behaviour is not found.

Arouri, Lahiani and Nguyen (2013) examine the co-movement between Argentina, Brazil, Chile and Mexico using DCC-GARCH and BEKK-GARCH from 1988-2009. Their findings revealed evidence of time-varying market co-movement. Syriopoulos (2014) studied equity market volatility and contagion in South Eastern Europe



from 2000-2013 using the vector error correction model, the univariate GARCH and the Asymmetric Dynamic Conditional Correlation (ADCC). The stock indexes of markets in the sub-region that includes: Cyprus, Turkey, Croatia, Romania, Bulgaria, and Greece were compared with major global stock markets of Germany and USA. The ADCC analysis showed more correlations between the southeastern European stock markets than with the major world markets.

Donadelli (2014) studied 35 stock markets in both advanced and emerging countries using national and sector-based stock market indexes and examined the effect of the global integration process on international stock market returns from 1988-2011. The co-movement measures show that benefits of cross-country and cross-industry diversification have reduced, implying that index in both advanced and emerging countries tend to co-move using the DCC-GARCH. The study also revealed that emerging stock market indexes (including Nigeria) have been greatly influenced by domestic shocks. It also showed that liberalization has not affected excess returns without some delays. Furthermore, it was observed based on the analysis that there were increases both at the country and sector level indexes as *de facto* integration increased.

Stuart (2017) examined stock market returns comovement between the London Stock and Ireland Exchanges from 1869-1929 using monthly data, employing the BEKK GARCH model. The study revealed that the direction of volatility spill was unidirectional from the London stock market to Ireland stock market. The study by Yao, He, Chen and Ou (2018) investigates the impact of China's financial liberalization policies on the world within the period of 2000 – 2015. The Authors' findings reveal that the market integration has positive and negative effects on China's stock market.

Most empirical studies have focused more on markets in developed economies and other emerging markets, with little focus on emerging markets in the West African region. Few studies that have included the stock Markets in West Africa have not examined volatility spillover. The aim of the study is to examine the extent of market integration in West Africa from a regional and global perspective by investigating for the nature of volatility spillover existing within the markets in the region and between major global equity markets.

## 2. Data and descriptive statistics

Stock market index returns of Nigeria, Ghana, WAMEU, UK and the US were used for the study. The All-share index was selected for the Nigerian stock exchange, the Ghanaian composite index/All share index for Ghana, the BRVM composite index for the WAMEU countries, the FTSE 100 index for the UK stock market and the SP500 for the US market. The acronyms representing the index returns of Nigeria, Ghana, BRVM, US, and UK are NSE, GSE, BRVM, FT and SP respectively. All the indexes were converted to returns. Index returns were calculated using the formulae  $X=100*\log (X/X (-1))$  where X represents daily market index datum. Daily index data returns are used for the study in order to sufficiently capture the volatile movement of stock prices through their index and the spillover effect from one market to the other.

Data were obtained from different sources. The Nigerian all share index data was obtained from the African Markets and Cash Craft websites. The GSE composite index (from 2011-2016) and the GSE all share index (2008-2010) were obtained from GSE Annual Report and African Markets. The BRVM composite index was obtained from African Markets. The SP 500 index was obtained from yahoo finance while the FTSE100 from the Financial Times market data website. The GSE all share index which was the major market index for the Ghanaian stock market prior to 2011 (*i.e.* 2008-2010) was converted to 1000 base year index point which the Ghana composite index is based on for uniformity of the series.

The descriptive statistics for the crises period (*i.e.* from 2008-2010) and post-crises period (2011-2016) are presented in Table 1 and 2 respectively. The mean returns for all the series are negative for the crises period except for the GSE, compared to the mean returns in the post-crises sample period where all the returns are positive. In the crises period, the NSE had the highest negative value followed by BRVM, SP, and FTSE, indicating that investors may have made more losses from the NSE and BRVM than their global counterparts during the crises period. Meanwhile, in the post-crises period, NSE had the highest returns followed by the GSE, the FTSE, BRVM and lastly the SP. We can infer from the mean returns in the crises and post-crises period that emerging market have higher returns but also higher risk especially during periods of turbulence.

In the crises period, the highest and lowest maximum and minimum mean return values respectively were observed in the NSE. Meanwhile, in the post-crises period, the SP had the highest maximum return value, while the GSE had the lowest minimum return value. In the crises period, the SP had the highest standard deviation implying a high level of volatility followed by the FTSE, NSE, GSE and the BRVM. In the post-crises period the SP also had the highest standard deviation but was followed by the BRVM, GSE, NSE, and the FTSE respectively.

In the crises period the NSE and BRVM were positively skewed while the GSE, FTSE, and SP were negatively skewed. Meanwhile, in the post-crisis period the NSE, GRVM, and BRVM were all negatively skewed while the SP and FTSE were positively skewed. All the return series in both sub-sample periods exhibited excess kurtosis. The Jarque-Bera test for the index returns similarly indicates that skewness and kurtosis of the entire index return data in both sub-periods do not conform to that of a normal distribution.

Table 1. Descriptive statistics for 2008-2010 sub-sample period index returns

	NSE	GSE	BRVM	FTSE	SP
Mean	-0.112060	0.014420	-0.032181	-0.016627	-0.027086
Median	-0.019169	0.002484	0.000000	0.000000	0.053939
Maximum	11.758360	5.142638	6.230127	9.384339	10.95720
Minimum	-9.475281	-8.754035	-5.444762	-9.265572	-9.469512
Std. Dev.	1.485540	1.017351	0.924785	1.710515	1.885917
Skewness	0.360110	-0.882074	0.547868	-0.028840	-0.164798
Kurtosis	13.210760	15.969670	10.626290	8.591833	8.993523
Jarque-Bera	3,370.368000	5,510.942000	1,909.444000	1,005.914000	1,158.996000
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	772	772	772	772	772

Source: Author's computation

Table 2. Descriptive statistics for 2011 to 2016 sub-sample period index returns

	NSE	GSE	BRVM	FTAE	SP
Mean	0.038774	0.036155	0.012223	0.033516	0.004994
Median	0.000000	0.019283	0.011698	0.000000	0.000000
Maximum	3.438337	4.631738	3.942950	4.440781	7.972911
Minimum	-5.999722	-6.895833	-4.779456	-2.758154	-4.353162
Std. Dev.	0.752125	0.935008	0.981583	0.526903	0.970966
Skewness	-0.363405	-0.503794	-0.209091	0.595906	0.292340
Kurtosis	10.877190	8.048962	5.308629	10.69657	9.385788
Jarque-Bera	4,078.023000	1,727.389000	358.7193000	3952.857000	2,679.662000
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	1,564	1,564	1,564	1,564	1,564

Source: Author's computation

### 3. Methodology

The multivariate E-GARCH (1,1) by Nelson (1991) was used for the study to model volatility in the series and examine volatility spillover between the regional market, and between the regional markets and the two selected global stock markets. The E-GARCH model is able to capture asymmetric volatility effects. The  $\gamma$  parameter as seen in equation 1 captures the asymmetric effect, where a negative and significant coefficient indicates that negative volatility has a greater effect on future volatility than positive volatility.

$$\log(\sigma_t^2) = \omega + \beta_t \log(\sigma_{t-1}^2) + \alpha \left\{ \left| \frac{\varepsilon_t - 1}{\sigma_t - 1} \right| \sqrt{\frac{2}{\pi}} \right\} - \gamma \frac{\varepsilon_t - 1}{\sigma_t - 1} \quad (1)$$

### 4. Findings

The ARCH test is first conducted as indicated in Table 3. The output indicates the presence of ARCH effect as the Chi-square and the F statistics probability values are statistically significant, implying that GARCH analysis can be further conducted.

The E-GARCH outputs for the two sub-periods considered are presented in Table 4 and Table 5. The ARCH term indicated by  $\alpha$  which captures the effect of past innovations of a series on its current volatility is significant for all the markets returns in the study both in the crises and post period. This implies that past news of each market influences the current volatility in significantly way. On the other hand, the GARCH term coefficient indicated by  $\beta$  that captures the impact of the last period volatility on current volatility is significant for all the market returns in the crises period except for the BRVM, and significant for all the markets in the post-crisis period.

The coefficient of the asymmetric term ( $\gamma$ ) in the E-GARCH model with the NSE as the dependent variable is negative but insignificant, implying an insignificant leverage effect both in the period of turbulence and tranquil. From the GSE to the NSE volatility spillover is negative and significant in both the crises period periods [-0.091144(0.0028)] and the post-crises period [-0,061609(0,0213)]. From the BRVM to the NSE, volatility spillover is positive but insignificant in the crises period [0.023821(0.3234)] but positive and significant in the post-crises period [0.113999(0.0000)]. From the FTSE to the NSE volatility spillover is also positive and insignificant [0.029172(0.2016)] in the crises period, and similarly positive but significant in the post-crises period [0.091293(0.0006)]. From the SP to the NSE, volatility spillover is negative and significant [-0.048468(0.0015)] while in the post-crises period it is positive and significant [0.068762 (0.0000)].

The presence of leverage effect in the model with the GSE as the dependent variable is indicated by a negative coefficient and significant probability both in the crises period [-0.023956(0.0016)], and post-crises period [-0.164180(0.0000)]. From the NSE to the GSE volatility spillover is positive and significant in the crises period [0.059962(0.0000)] and positive but insignificant in the post-crises period [0.017411(0.2326,)]. Volatility spillover from the BRVM to the GSE is positive and significant in the crises period [0.062574(0.0000)], while it is negative but also significant in the post-crises period [-0.105667(0.0000)]. Volatility spillover from the FTSE to the GSE is positive and significant [0.116653(0.5037)] in the crises period but negative and insignificant in the post-crises period [-0.008618(0.5037)]. Volatility spillover from the SP to the GSE is positive and significant for both the crises and post-crises sub-sample periods respectively [0.034182(0.0000)], [0.068762 (0,0000)].

The asymmetric term for the model with the BRVM as the dependent variable in the crises period is positive and insignificant implying the absence of a leverage effect in that period [0.048642(0.2402)], whereas the presence of leverage effect is found in the post-crises period [-0.084809(0.0000)]. Volatility spillover from the NSE to the BRVM is negative but insignificant in the crises period [-0.018034 (0.2746)], but positive and significant in the post-crises period [0.042642(0.0136)]. Spillover effect is positive and significant from the GSE to the BRVM in the crises period [0.129888(0.0000)], but negative and also significant in the post-crises period [-0.131292(0.0000)]. Volatility spillover is positive and significant from the FTSE to the BRVM in the crises period [0.061131(0.0032)], and remained positive but insignificant in the post-crises period [0.013152(0.3076)]. Spillover effect is negative and significant from the SP to the BRVM in the crises period [-0.119112(0.0000)], but became positive and significant in the post-crises period [0.017524 (0.0449)].

The asymmetric term for the model with the FTSE as dependent variable is negative and significant implying the presence of a leverage effect in the crises period [-0.128096(0.0000)], meanwhile in the post-crises period, the asymmetric term is positive and significant implying that the impact of negative news is same as or less than that positive news (*i.e.* leverage effect is absent) [0.023112(0.0161)]. From the NSE to the FTSE volatility spillover is negative but insignificant in both sample periods [-0.000555(0.9503)], [-0.026729(0.2028)]. From the GSE to the FTSE volatility spillover is negative but insignificant in the crises period [-0.007911(0.3933)], and was also negative but significant [-0.040155(0.0754)] in the period of tranquil. From the BRVM to the FTSE volatility spillover is negative and significant in both sub-sample periods respectively [0.062853(0.0002)], [-0.062016(0.0086)]. From the SP to the FTSE, volatility spillover is negative and significant in the crises period [-0.053730(0.0000)], but became positive and significant in the post-crises period [0.035704(0.0007)].

The asymmetric term in the model with the SP as the dependent variable is negative but not significant in the crises period [-0.026276(0.3859)] implying an insignificant leverage effect, and positive and not significant implying the non-existence of leverage effect in the market for the post-crises period [0.00440(0.6234)]. From the NSE to the SP, volatility spillover is positive but insignificant in the crises period [0.001399(0.8590)], and positive but significant [0.03622(0.0265)] in the post-crises period. From the GSE to the SP volatility spillover is also positive but insignificant in the crises period [0.000203(0.9752)], and negative but also insignificant [-0.020314(0.4872)] in the post-crises period. From the BRVM to the SP, volatility spillover is negative and significant in both sub-sample periods respectively, [-0.062354(0.0004)], [-0.099993(0.0001)]. Lastly from the FTSE to the SP volatility spillover is negative and significant in the crises period [-0.103703 (0.0000)], and also negative but insignificant in the post-crises period [-0.015682(0.2032)].

Table 3. Heteroskedasticity Test-ARCH

F-statistic	104.4442	Prob. F(1,2345)	0.0000
Obs*R-squared	100.0760	Prob. Chi-Square (1)	0.0000

Source: Author's computation

Table 4. E-GARCH Output for Crises (2008-2010) Sample Period

Coefficient	NSE	GSE	BRVM	FTSE	SP
$\Omega$	-0.304029 (0.0000)	-0.046501 (0.0000)	-0.474589 (0.0000)	-0.031293 (0.2093)	-0.030555 (0.1105)
A	0.475512 (0.0000)	0.083346 (0.0000)	0.356987 (0.0000)	0.059403 (0.0584)	0.053916 (0.0293)
B	0.910040 (0.0000)	0.960788 (0.0000)	0.073190 (0.4848)	0.963842 (0.0000)	0.976410 (0.0000)
$\Gamma$	-0.041155 (0.1206)	-0.023956 (0.0016)	0.048642 (0.2402)	-0.128096 (0.0000)	-0.026276 (0.3859)
NSE		0.059962 (0.0000)	-0.018034 (0.2746)	-0.000555 (0.9503)	0.001399 (0.8590)
GSE	-0.091144 (0.0028)		0.129888 (0.0000)	-0.007911 (0.3933)	0.000203 (0.9752)
BRVM	0.023821 (0.3234)	0.062574 (0.0000)		-0.062853 (0.0002)	-0.062354 (0.0004)
FTSE	0.029172 (0.2016)	0.116653 (0.0000)	0.061131 (0.0032)		-0.103703 (0.0000)
SP	-0.048468 (0.0015)	-0.008709 (0.3799)	-0.119112 (0.0000)	-0.053730 (0.0000)	

Source: Author's computation

Table 5. E-GARCH Output for Post Crises (2011-2016) Sample Period

Coefficient	NSE	GSE	BRVM	FTSE	SP
$\Omega$	-0.292925 (0.0000)	-0.109267 (0.0000)	-0.087298 (0.0000)	-0.334889 (0.0000)	-0.178221 (0.0000)
A	0.185053 (0.0000)	0.123411 (0.0000)	0.107449 (0.0000)	0.273187 (0.0000)	0.228663 (0.0000)
B	0.735827 (0.0000)	0.966061 (0.0000)	0.983842 (0.0000)	0.890063 (0.0000)	0.956648 (0.0000)
$\Gamma$	-0.037545 (0.0180)	-0.164180 (0.0000)	-0.084809 (0.0000)	0.023112 (0.0161)	0.004409 (0.6234)
NSE		0.017411 (0.2326)	0.042642 (0.0136)	-0.026729 (0.2028)	0.036322 (0.0265)
GSE	-0.061609 (0.0213)		-0.131292 (0.0000)	-0.040156 (0.0754)	-0.020313 (0.4872)
BRVM	0.113999 (0.0000)	-0.105667 (0.0000)		-0.062016 (0.0086)	-0.099993 (0.0001)
FTSE	0.091293 (0.0006)	-0.008618 (0.5037)	0.013152 (0.3076)		-0.015682 (0.2032)
SP	0.068762 (0.0000)	0.034182 (0.0000)	0.017524 (0.0449)	0.035704 (0.0007)	

Source: Author's computation

## Conclusion

The study set out to examine volatility spillovers among stock markets in West Africa vis a vis the markets of the US and the UK from 2008-2016 using sub-sample period representing the global crises period and the post-crises period. Findings from the study reveal the presence of leverage effect in most of the markets and volatility spillover between most of the markets in the two sub-periods.

In the crises period, negative asymmetric term indicated by  $\gamma$  is found in four of the five markets (*i.e* the NSE, GSE FTSE and SP), while only that of the GSE and the FTSE were significant implying the existence of leverage effect. Meanwhile, in the post-crises period, a significant leverage effect was found in all the markets indexes returns except for the SP. The absence of leverage effect in the SP may be due to the sample period under consideration. The presence of a leverage effect in the other indexes indicates that past negative volatility has a greater impact than past positive volatility on current volatility. Thus investors tend to divest from the respective markets either to other market or to other asset types due to negative volatility in a flight to safety response.

Furthermore, significant volatility spillovers are found both between regional markets and the global markets both in the crises and post-crisis period. In the crises period bidirectional volatility spillover are observed between GSE and NSE; SP and FTSE; and BRVM and FTSE while significant unidirectional spillover effect is observed from GSE to BRVM; FTSE to GSE, and from the SP to NSE with no significant volatility spillover effect between the other pairs. In the post-crisis period, more significant spillover effects are observed between market pairs. Bidirectional volatility spillovers are observed between GSE and BRVM; GSE and FTSE; NSE and BRVM SP and NSE, while unidirectional spillover effect is observed from the GSE to NSE; SP to GSE; FTSE to NSE; SP to FTSE and from the BRVM to FTSE in the post-crisis period. It can be inferred that market integration is on the increase post the global crises period both at the regional and global level. This can be attributed to a number of factors including increase effort towards regional stock market cooperation and integration in the West African region, more drive towards internationalization of individual stock markets, more inter-market diversification activities by international investors and the growing level of financial globalization.

These findings have implications for international investors and policymakers at the national, regional and international levels. The leverage effect found in most of the markets in the study is of importance to international investors that employ active portfolio management strategies. Since significant interactions are observed between the markets in the study, they should be viewed as interdependent rather than as isolated. Though the magnitude of spillover effects is small in some of the cases, the implications could be far-reaching. Based on the extent of interactions, it can be inferred that some diversification opportunities still exist both within the regional market and beyond. Based on these, efforts towards regional market integration should be fostered with due considerations to interactions that exist between the stock markets in the form of volatility spillover both on a regional and global scale. Further studies can be considered using different data frequency and varying longitudinal scope at market wide, sub-sector or industry level. Also, other analytical tools can be employed including other variants of GARCH.

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## Analysis, Monitoring and Forecasting Financial Stability

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### Abstract:

In this article the authors consider a set of theoretical and practical questions on the formation of an effective system for analysing and forecasting the financial condition of the management object. The development of multifactorial economic-mathematical models of financial stability for the enterprise, influence the quality management that will improve the effectiveness of a multi-level management system and ensure the reliability of forecasts.

**Keywords:** factor analysis; multiple regression models; correlation coefficient; ratio of financial stability; permissible error

**JEL Classification:** G17; C13

### Introduction

An important condition for the sustainable development of the financial system of Kazakhstan is to ensure the financial stability of commercial organizations maintaining in the long term the optimal structure of their sources of financing. Ensuring financial stability is a time-consuming process of analysis, monitoring and forecasting of its main indicators as well as the implementation of measures based on the results of identified deviations (Balabanov 2016).

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In order to improve the management of financial stability of Kazakh enterprises in a market economy it is necessary to increase the requirements for its provision, to offer tools that will allow to predict its level and the risks of reducing financial stability at an early stage of diagnosis.

The undoubted importance of and insufficient knowledge about multidimensional problems and multivariate analysis of methods of prognostication of the financial state, the necessity of formation of forecasting and analytical systems, allowing to obtain the actual and potential assessment of efficiency of activity of commercial organizations, and the establishment of its components, determine the relevance of these studies (Markaryan and Gerasimenko 2016).

## 1. Research background

To varying degrees, the study of these problems is devoted to the work of many well-known scientists and economists: Balabanov (2016), Volkova (2016), Kovalev (2016), Sheremet (2017) and others.

Forecasting of financial stability of a commercial organization is a set of analytical procedures used to diagnose the financial stability of an economic entity in the future through the developed methods of analysis and forecasting of financial stability on the basis of the current methodology (methods and techniques) of economic analysis and forecasting. The importance of forecasting financial stability is in the information support of the financial management process of a commercial organization.

Currently a large number of different models aimed at determining the projected value of financial stability of the enterprise have been developed. Most of the models are based on the trend of a number of indicators, the signs of trends in the financial position of the enterprise. However, the functioning of any economic system takes place in a complex interaction of internal and external factors (Savchuk 2015).

In the study of the laws of economic phenomena is of great importance to identify the links between interrelated, developing over time phenomena, related analysis of the dynamics. To this end multi-factor models of interrelated time series are constructed. Factor analysis is a method of complex and systematic study and measurement of the impact of factors on the value of effective indicators.

A multi-factor model is a model that is built on several time series whose levels relate to the same time segments or dates. Correlation and regression analysis is of particular importance in the simulation of multidimensional time series (Fridman 2016). Modeling of connected series of dynamics is based on the use of regression equations. Such models reflect the relationship between the studied indicators with a sufficient degree of accuracy and allow to assess the degree of influence of individual factors on the effective feature as well as the effectiveness of the influence of all factor features.

## 2. Methodology

As shown by the studies described in the works of different authors the results of forecasts of economic processes on the model built on a series of dynamics quite satisfactory. Therefore, it seems appropriate to consider in more detail this method of constructing a dynamic model of multi-factor forecasting (Novashina 2011).

For each year  $l$  of the study period  $L$  a multifactor model is constructed taking into account the exclusion of multicollinearity and the justification of the analytical form of the model. It is necessary that the estimates of the main factor be unbiased, consistent and effective at the time interval under consideration. We write in the form of a linear model (1) (Kovalev and Volkova 2016):

$$\hat{Y}_l = a_0 x_0 + a_1 x_1 + a_2 x_2 + \dots + a_m x_m \quad (1)$$

where:  $Y_l$  – modelled indicator  $l$ -year ;  $x_i$  – factors affecting this indicator,  $i = \overline{0, m}$ ;  $a_i$  – model parameter,  $i = \overline{0, m}$   $m$  – the number of factor variables.

We obtain a system of  $L$  such model that is checked for adequacy by F-criterion and t-criterion. To predict the dependent variable (effective feature) by  $L$  steps forward it is necessary to know the forecast values of all the factors included in the model. These values can be obtained from trend models for example using the extrapolation method or directly specified by the researcher of the economic process. Forecast values of the factors are substituted in the model and receive point forecast estimates of the studied indicator.

To determine the range of possible values of the effective indicator for known values of factors, *i.e.* the confidence interval of the forecast, it is necessary to take into account two possible sources of errors. Errors of the first kind are caused by dispersion of observations with respect to the regression line and they can be taken into account in particular the value of the mean square error of the studied indicator using a regression model  $S_j$ .

Errors of the second kind are due to the fact that the regression coefficients specified in the model are random variables distributed according to the normal law. These errors are taken into account by entering the correction factor when calculating the width of the confidence interval; the formula for its calculation includes a table value of t-statistics at a given level of significance and depends on the type of regression model.

A stable financial condition is formed in the process of production and economic activity of the enterprise. Determining it for a particular date answers the question of how correctly the enterprise managed financial resources during the reporting period. However, the partners and shareholders of this enterprise are interested not in the process, but in the result, that is, the indicators themselves and the assessment of the financial condition that can be determined on the basis of official public reporting (Piech 2015).

We will calculate the forecasted dynamics of the financial stability coefficients of the conditional enterprise based on the data for the reporting period (Table 1).

Table 1. Values of indicators, coefficients characterizing the state of financial stability of an enterprise

Indicators	2012	2013	2014	2015	2016	2017
The coefficient of financial risk (coefficient debt, the ratio of debt and equity, leverage)	0,42	0,60	0,50	0,50	0,50	0,60
Debt ratio	0,29	2,00	2,10	2,80	2,40	2,00
Coefficient of autonomy	0,71	0,01	0,12	0,15	0,16	0,01
Coefficient of financial sustainability	0,80	0,30	0,30	0,40	0,50	0,30
Coefficient of manoeuvrability own funds	-0,03	0,50	1,00	1,40	1,30	0,50
Coefficient of stability - Mobile means	0,07	0,40	0,50	0,60	0,60	0,40
Coefficient of working capital with own sources of financing	-0,08	0,30	0,3	0,20	0,30	0,30

Source: compiled by authors

In our opinion, from the existing methods of medium-term forecasting the most acceptable method is trend forecast calculations.

At present, many methods of forecasting over one time series have been developed. The purpose of such a forecast is to show what results can be achieved in the future if we move to it with the same speed or acceleration as in the past. The forecast determines the expected variants of economic development based on the hypothesis that the main factors and trends of the past period will remain for the forecast period or that one can justify and take into account the direction of their changes in the perspective under consideration (Cruz and Scapens 2011). A similar hypothesis is advanced on the basis of the inertia of economic phenomena and processes.

In order to reveal the general trend of growth of social and economic factors during the analysed period, the time series is smoothed out. This is due to the fact that, in addition to the influence of the main factors, the level of the calculated index is affected by numerous random factors, thereby causing a deviation of the levels from the trend. The result of this action is formed by the residual random component. With all methods of smoothing time series in order to reveal the main trend, one starts from the actual development of dynamics during the considered time. The most common method of smoothing time series is the method of least squares. The mathematical apparatus of the method of least squares is described in detail in the literature.

Models obtained with the help of regression analysis make it possible to predict the variants of the development of economic processes and phenomena, to study trends in the change of economic indicators, i.e. serve as a tool for scientifically based predictions. The results of the forecast are the starting material for setting real economic goals and objectives, for identifying and adopting the best management decisions, for developing an economic and financial strategy in the future.

We will carry out a quantitative analysis of forecasting on the basis of formalized methods of forecasting, which are based on the actually available information material using the extrapolation method for analytical levelling of the trend.

In the methodical plan, the main tool of any forecast is the extrapolation scheme. The essence of extrapolation consists in studying past and present stable trends in the development of the forecast object and transferring them to the future. There are formal and predictive extrapolations. The formal is based on the assumption of the preservation in the future of past and present trends in the development of the prognosis object; when predictive - the actual development is linked to hypotheses about the dynamics of the process under consideration, taking into account changes in the influence of various factors in the future.

Extrapolation methods are the most common and well developed. The basis of extrapolation prediction methods is the study of dynamic series. A dynamic series is a set of observations obtained successively in time.

In economic forecasting, the method of mathematical extrapolation is widely used, in the mathematical sense, meaning the propagation of the law of change of the function from the field of its observation to the region lying outside the observation segment. The trend described by some function of time is called a trend. The trend is a long trend of changing economic indicators. The function represents the simplest mathematical-statistical (trend) model of the phenomenon under study. Forecasts based on the extrapolation of the dynamics series can be represented as a definite value of the function:

$$Y_{t+l}^* = f(y_i, l, a_j) \quad (2)$$

where:  $Y_{t+l}^*$  - predicted value of a number of dynamics;  $l$  – pre-emption period;  $y_i$  – the level of the series adopted for the extrapolation base;  $a_j$  is the parameter of the trend equation.

After smoothing the time series by the method of least squares, we obtain a linear trend dependence of the form:

$$\hat{Y}_t = f(t) \quad (3)$$

Extrapolation is carried out by substituting in the trend equation the value of the independent variable  $t$ , corresponding to the value of the anticipation period (forecast). Extrapolation makes it possible to obtain a point value of the forecast, that is, an estimate of the predicted index at a point by the equation describing the trend of the predicted index. It is the average estimate for the predicted time interval.

The value of the confidence interval for the extrapolation of the trend is determined as follows:

$$Y_{t+l}^* \pm K^* \cdot S_y \quad t = n, \quad l = 1, 2, \dots L \quad (4)$$

where:  $Y_{t+l}^*$  — point forecast for the moment  $(t+l)$ ;  $S_y$  — mean square error of the trend;  $K^*$  - multiplier determined by the table with a given probability.

The value of  $K^*$  depends only on the number of observations (the number of levels of the series  $n$ ) and  $l$  (the period of anticipation). With increasing  $n$ , the values of  $K^*$  decrease, but increase with  $l$ . Therefore, an adequately reliable forecast is obtained with a sufficiently large number of observations (for a linear trend, for example, no less than 6 and the lead time is not very large.) For the same  $n$ , with increasing  $l$ , the confidence interval of the forecast increases.

The standard (mean square) error in estimating the predicted indicator  $S_y$  is determined by the formula (5):

$$S_y = \sqrt{\frac{\sum_{i=1}^n (Y - \hat{Y})^2}{n - m}} \quad (5)$$

where:  $Y$  - actual level value;  $\hat{Y}$  - estimated estimation of the corresponding indicator by model;  $n$  - sample size;  $m$  - number of parameters depending  $f(t)$ .

The tightness of the relationship between the indicator and the factor was determined by the correlation coefficient:

$$r = \frac{\frac{1}{n} \sum y_i x_i - \bar{x}\bar{y}}{\sigma_x \sigma_y}, \quad (6)$$

where:  $\sigma_x$   $\sigma_y$  - mean square deviations calculated by the formulas:

$$\sigma_x = \sqrt{\frac{1}{n-1} \sum (x_i - \bar{x})^2} \quad \sigma_y = \sqrt{\frac{1}{n-1} \sum (y_i - \bar{y})^2}, \text{ and } \bar{x}, \bar{y} \text{ is the average arithmetic values of the factor } x \text{ and the exponent } y.$$

Let us illustrate the use of this method on the example of forecasting the studied indicators: the coefficients characterizing the state of financial stability of the enterprise. To perform the calculations, we use the time series data for the period 2012-2017, which is presented in the Table 1 and obtained results will have summarized in the Table 2.

Table 2 Equations of trend models of forecast indicators, coefficients characterizing the state of financial stability of an enterprise

Estimation	The equation off trend models	The average quad. of evaluation error	Coefficient of determ., $r^2_{yx}$	Fisher coefficient F-curve	The Darbin-Watson criterion, d
The ratio of financial risk (debt ratio, debt to equity ratio, leverage ratio)	$Y_t = 0,471 + 0,023 t$	1,01	0,543	19,07	2,773
Debt ratio	$Y_t = -0,012 - 0,205 t$	4,12	0,291	21,32	1,360
Coefficient Autonomy	$Y_t = 0,432 - 0,015 t$	18,23	0,711	12,50	1,670
Coefficient of financial stability	$Y_t = 0,611 + 0,014 t$	5,37	0,249	8,07	1,368
Coefficient of manoeuvrability of own funds	$Y_t = 0,095 - 0,019 t$	4,33	0,263	3,59	1,297
Coefficient of stability of mobile structure	$Y_t = 0,329 + 0,021 t$	6,71	0,121	2,62	1,305
Coefficient of working capital with own sources of financing	$Y_t = 0,295 + 0,032 t$	16,32	0,858	14,11	1,954

Source: compiled and calculated by authors

The model, based on which the forecast was carried out, with the obtained probability levels  $R^2$  allows us to state that if the existing patterns of development are maintained, the predicted value falls into the calculated value of the revealed trend of change in the indicators (Table 3).

Table 3. Forecast values of the forecasted indicators, coefficients characterizing the state of financial stability of enterprise

Indicators	2018	2019	2020
The coefficient of financial risk (coefficient debt, the ratio of debt and equity, leverage)	0,64	0,67	0,69
Debt ratio	0,15	0,13	0,11
Coefficient of autonomy	0,34	0,31	0,30
Coefficient of financial sustainability	0,65	0,67	0,69
Coefficient of maneuverability own funds	0,09	0,09	0,09
Coefficient of stability Mobile means	0,48	0,53	0,59
Coefficient of working capital with own sources of financing	0,50	0,52	0,55

Source: compiled and calculated by authors

Analysis of calculated values makes it possible to track the dynamics of growth in the values of the indicators the financial risk ratio (debt ratio, debt to equity ratio, leverage ratio), debt ratio, maneuverability coefficient of own funds, stability factor of mobile structure, financing.

There is an unstable development trend in the values of indicators: the coefficient of autonomy, the coefficient of financial stability.

One of the most important characteristics of the financial condition of an enterprise is the stability of its activities in the long term. It is connected with the overall financial structure of the enterprise, the degree of its dependence on creditors and investors. Many businessmen in Kazakhstan prefer to invest at least a minimum of their own funds, and finance it mainly at the expense of money borrowed. Financial stability indicators characterize the degree of dependence of the enterprise on external sources of financing. However, if the structure of "equity capital - borrowed funds" has a significant bias towards debt, the enterprise can easily go bankrupt if several creditors simultaneously demand their money back at the same time.

Thus, the preliminary forecast of the company's financial stability system would help optimize the company's financial policy and thereby ensure the company's financial stability.

As the situation shows, the further effective development of small and medium-sized enterprises (SMEs) is constrained by significant financial deficiencies, which include insufficient amounts of financial support. The market economy is characterized by a multiplicity of sources of financial support for production costs, forms and methods, principles and conditions of financing. Optimization of the relationship between forms of financial security is carried out by the state through its financial policy (Uakhitzhanova 2017).

The analysis of coefficients is the most common method of economic analysis, which is due to the visibility of the results obtained.

### 3. Results

To develop a model of financial stability optimization we use the method of correlation and regression analysis. The correlation represents the probable dependence between the indicators that are not in functional dependence. This method is used to determine the close relationship between financial stability indicators (Galitskaya 2015).

We introduce the following symbols to do this:  $x_1$  - autonomy ratio;  $x_2$  - financial risk ratio;  $x_3$  - debt ratio;  $x_4$  - the ratio of financial stability;  $x_5$  - the coefficient of maneuverability;  $x_6$  - the ratio of self-sufficiency in working capital. We draw up an economic model of multiple regressions in the form of (7):

$$\hat{y} = a_0 + a_1 \cdot x_1 + \dots + a_n \cdot x_n \tag{7}$$

We define the estimates  $a_0, a_1, \dots, a_n$  parameters by the least squares method (LSM). Coefficients  $a_i$  – show how much to change the effective indicator when the factor per unit. On the basis of the above we distinguish the main target indicators of financial stability of the economic entity that we consider necessary to take into account when building a forecasting model. The necessary initial data are taken from the Table 4 and calculate the parameters of the regression equation.

Table 4. The parameters of the regression equation

Year	y – the ratio of financial stability	$x_1$ - financial risk ratio (debt ratio, debt and equity ratio, leverage)	$x_2$ - debt ratio	$x_3$ - coefficient of autonomy	$x_4$ - coefficient of maneuverability of own funds	$x_5$ - coefficient of stability for structure of mobile means	$x_6$ - ratio of working capital own sources of financing
2012	0,80	0,42	0,29	0,71	-0,03	0,07	-0,08
2013	0,30	0,60	2,00	0,01	0,50	0,40	0,30
2014	0,30	0,50	2,10	0,12	1,00	0,50	0,30
2015	0,40	0,50	2,80	0,15	1,40	0,60	0,20
2016	0,50	0,50	2,40	0,16	1,30	0,60	0,30
2017	0,30	0,60	2,00	0,01	0,50	0,40	0,30
2018	0,30	0,50	2,10	0,12	1,00	0,50	0,30

Source: calculated by the authors on the basis of calculation

We draw up an economic model (3) according to Table 1 and obtain a system of multifactor models that form the financial stability index (Kovalev 2010):

$$\begin{cases} y = a_0 + x_2 a_1 \\ x_2 = a_0 + x_1 a_1 + x_6 a_2 \\ x_1 = a_0 + x_3 a_1 \\ x_6 = a_0 + x_4 a_1 + x_5 a_2 \end{cases} \tag{8}$$

Thus we solve the problem of maximizing the value of  $y$  under the given restrictions that is we find the optimal solution of the financial stability coefficient for the enterprise with varying values of other coefficients. Estimates of  $a_0, a_1, a_2$  are calculated by LSM. The regression equation with parameter estimates has the form:

$$\hat{y} = 0.809 - 0,198 \cdot x_2$$

The total coefficient of multiple correlation  $r_y$  characterizes the tightness of the effective  $y$  and factor  $x_1, x_2, \dots, x_m$  features and in the general case is determined by the formula (9):

$$r_y = \sqrt{\frac{\sigma_{y12\dots m}^2}{\sigma_x^2}} = \sqrt{1 - \frac{\sigma_{y(12\dots m)}^2}{\sigma_y^2}} \tag{9}$$



where:  $\sigma_{y_{12\dots m}}^2$  - factor variance;  $\sigma_{y(12\dots m)}^2$  - residual variance (5);  $\sigma_{y^2}$  - variance of the resultant variable (6):

$$\sigma_{y_{12\dots m}}^2 = \frac{\sum_{i=1}^n (\hat{y}_i - \bar{y})^2}{n-1}; \quad \sigma_{y(12\dots m)}^2 = \frac{\sum_{i=1}^n (y_i - \hat{y}_i)^2}{n-1} \quad (10)$$

$$\sigma_{y^2} = \frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n-1} \quad (11)$$

where:  $\hat{y}_i$  - the calculated value of the effective feature;  $\bar{y}_j$  - the average value of the effective feature.

The given form of index recording is interpreted as follows:  $\sigma_{y_{12\dots m}}^2$  - the dispersion  $\hat{y}$  obtained taking into account the factors  $x_1, x_2, \dots, x_m$ ;  $\sigma_{y(12\dots m)}^2$  - the dispersion  $Y$  obtained taking into account the factors  $x_1, \dots, x_m$ .

The denser the actual values  $y_i$  are relative to the regression line, the smaller the residual variance (the larger the factor variance) and therefore the greater the magnitude  $r_y$ . Thus the coefficient of multiple correlations as well as the value of the residual variance characterizes the quality of the regression equation selection (Kovalev 2010). The square of the value  $r_y$  is the coefficient of multiple determination and characterizes the share of the influence of the selected features on the effective factor (7):

$$B_y = r_y^2 = \frac{\sigma_{y_{12\dots m}}^2}{\sigma_{y^2}} \quad (12)$$

According to the end-to-end example we have:

$$\sigma_{y_{12}}^2 = 0,0346 \quad \sigma_{y(12)}^2 = 0,0138 \quad \sigma_y^2 = 0,0484 \quad r_y = 0,8457 \quad r_y^2 = 0,7151$$

In accordance with the table of Cheddok communication effective characteristics is considered high (0,71). Regression of  $y$  on  $x_1$  explains 71% index: the ratio of debt. The value of the coefficients is in the range  $0 \leq r_y \leq 1$ .

In the absence of a connection between the effective and factor characteristics, the factor variance is zero, the multiple correlation coefficients is zero, and the regression line coincides with the line  $\hat{y} = \bar{y}$ . In the case of functional coupling the factor variance is the same as the total variance and the correlation coefficient is 1.

Evaluation of the significance of the coefficient of determination is determined using the Fisher criterion. According to the calculations the Fisher criterion has the following value (13):

$$F = \frac{r_{y_{12}}^2 (n - m - 1)}{m(1 - r_{y_{12}}^2)} = 15,0625 \quad (13)$$

According to the table of F-distribution we find for degrees of freedom  $f_1 = m = 2$  and  $f_2 = n - m - 1 = 7 - 2 - 1 = 4$ ,  $\alpha = 5\%$ ,  $F_{cr} = 5,32$  and therefore value of the determination coefficient and the value of the multiple correlation coefficient are significant ( $F > F_{cr}$ ). To estimate the contribution to the multiple correlation coefficients of each factor, the partial correlation coefficients are used.

A particular correlation coefficient is an indicator that characterizes the closeness of the relationship between the features in the elimination of all other features. In general, the formula for determining the particular correlation coefficient between the factors  $y$  and  $x$  with the elimination of the influence of factors  $x_1, \dots, x_{m-1}$  is (9):

$$R_{ym(12\dots m-1)} = \sqrt{\frac{\sigma_{y12\dots m}^2 - \sigma_{y12\dots m-1}^2}{\sigma_{y(12\dots m-1)}^2}} = \sqrt{\frac{\sigma_{y12\dots m}^2 - \sigma_{y12\dots m-1}^2}{\sigma_y^2 - \sigma_{y12\dots m-1}^2}} \tag{14}$$

where:  $\sigma_{y12\dots m}^2$  - factor the variance of the regression of  $y$  on  $x_1, x_2, \dots, x_m$ ;  $\sigma_{y(12\dots m)}^2$  - factor dispersion  $y$  obtained taking into account the factors  $x_1, \dots, x_{m-1}$ ;  $\sigma_{y(12\dots m-1)}^2$  - the residual variance of the regression  $y$  obtained taking into account the factors  $x_1, x_2, \dots, x$ ;  $\sigma_y^2$  - variance of the performance factor.

The value of the particular correlation coefficient is in the range from 0 to 1 and the sign is determined by the sign of the corresponding regression parameters. Taking instead  $\sigma^2$  its estimate  $S^2$  (15):

$$S^2 = \sum_{i=1}^n e_i^2 / (n - m - 1) \tag{15}$$

where:  $n$  – number of observations;  $m$  – number of explanatory variables.

Then  $S_{aj}^2 = S^2 \cdot b_{jj}$ , (16)

where:  $b_{jj}$  – the diagonal elements of the matrix of the parameter estimates of the regression equation.

The mean square error  $S_{aj}$  is equal to (17):

$$S_{aj} = S \sqrt{b_{jj}} \tag{17}$$

The obtained mean square errors can be used to calculate the confidence intervals of the estimates of the regression parameters and to test the significance of differences from zero.

Given that  $S^2 = \sum_{i=1}^n e_i^2 / (n - m - 1)$  we have:  $S = 0,4625$

$$Sa_0 = 0,0998 \qquad Sa_1 = 0,0511$$

The calculated criterion  $t_i$  is:  $t_0 = \frac{a_0}{Sa_0} = 8,1034$ ;  $t_1 = \frac{a_1}{Sa_1} = 3,8843$

For the confidence probability  $p = 0,95$  and the number of degrees of freedom  $k = 8$  on the Student table is  $t_{kp} = 2,57$ . Therefore the criterion in the regression equation is significant all the parameters:  $a_0, a_1, a_2, t_0 = 8,1034 > t_{cr} = 2,57, t_1 = 3,8834 > t_{cr} = 2,57$

Table 5. Projected values of the financial stability coefficient for the period 2015-2018

Factor	Year	Forecast	Characteristics of the equation
	Model equation: $Y = 0.809 - 0.198 X_2$		
The ratio of financial stability	2015	0.265	$R^2 = 0.7151$ $F_{calc} = 15.0625$
	2016	0.181	$Sy = 0.4625$ $F_{tabl} = 5.3200$
	2017	0.115	$t_{cr} = 2.57$ $t_0 = 8.1034$
	2018	0.102	$t_1 = 3.8834$

Source: compiled by the authors on the basis of calculation

For other financial indicators a number of multivariate models have been developed and the following calculated characteristics of these equations have been obtained.

Table 6. Projected debt ratio for the period 2015-2018

Factor	Year	Forecast	Characteristics of the equation
Debt ratio	Model equation: $X_2 = 1.760 - 2.154 X_1 + 5.584 X_6$		
	2015	2.859	$R^2 = 0.8151$ $F_{calc} = 11.0224$
	2016	3.230	$Sy = 1.7475$ $F_{tabl} = 4.4600$
	2017	3.473	$t_{cr} = 2.57$ $t_0 = 0.8261$
	2018	3.751	$t_1 = 0.4547$ $t_2 = 3.0805$

Source: compiled by the authors on the basis of calculation

Table 7. Forecast values of the financial risk ratio (debt ratio, loan-equity ratio, leverage ratio) for period 2015-2018

Factor	Year	Forecast	Characteristics of the equation
Financial risk ratio (debt ratio, loan-equity ratio, leverage ratio)	Model equation: $X_1 = 0.556 - 0.204 X_3$		
	2015	0.581	$R^2 = 0.7557$ $F_{calc} = 18.5560$
	2016	0.601	$Sy = 0.5050$ $F_{tabl} = 5.3200$
	2017	0.618	$t_{cr} = 2.45$ $t_0 = 32.6939$
	2018	0.635	$t_1 = 4.4356$

Source: compiled by the authors on the basis of calculation

Table 8. The predicted values of the ratio of working capital private sources of funding for period 2015-2018

Factor	Year	Forecast	Characteristics of the equation
The ratio of working capital private sources of funding	Model equation: $X_6 = -0.270 - 0.637 X_4 + 2.323 X_5$		
	2015	0.369	$R^2 = 0.9817$ $F_{calc} = 35.7374$
	2016	0.452	$Sy = 0.1925$ $F_{tabl} = 4.4600$
	2017	0.519	$t_{cr} = 2.57$ $t_0 = 5.7499$
	2018	0.578	$t_1 = 5.4518$ $t_2 = 7.6027$

Source: compiled by the authors on the basis of calculation

We analyse the numerical data given in the list of multivariate regression equations. In general, the predicted values obtained on the basis of the solution of multivariate regression equations and the predicted values calculated on the basis of single regression equations from the time trend have a more confidence preference, since the latter in most cases reflect only the trend perspective, although they are within the permissible error.

The equation  $Y = 0.809 - 0.198 X_2$  indicates a decrease in the financial stability coefficient by 0.198 units (hereinafter-units) in the case of an increase in  $X_2$  - debt ratio by 1.0 units. The equation  $X_2 = 1.760 - 2.154 X_1 + 5.584 X_6$  also indicates that debt ratio changes the value of 1.0 unit in response to the shifting parameters of the ratio of financial risk to 2,154 units and the ratio of working capital to private sources of funding to 5,584 units.

In the case of a decrease in the coefficient of autonomy of 1.0 units according to the equation  $X_1 = 0.556 - 0.204 X_3$  is a decrease in the financial risk ratio of 0.204 units.

The equation  $X_6 = -0.270 - 0.637 X_4 + 2.323 X_5$  shows the dependence of the working capital security coefficient of own sources of financing on the coefficient of maneuverability of own funds by 0.637 units and the coefficient of stability of the structure of mobile funds by 2.323 units.

## Conclusion

Thus the predicted values obtained by the system of multivariate regression equations can serve as the basis for indicative planning of the financial strategy of the enterprise for the relevant years. The deviations are quite acceptable if we take into account the structure of the initial statistical series.

In an effort to maximize the value of the financial stability coefficient that is the main market coefficient of financial stability the obtained forecast values indicate that the company's financial risk and debt ratio should be close to or equal to zero. The coefficient of manoeuvrability tends to decrease which indicates the inflexible use of own sources. These solutions are quite feasible and applicable in practice in case of borrowing necessary for the normal operation of the enterprise.

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## Optimal Fiscal and Monetary Policy Rules in Nigeria

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### Abstract:

Commodity-exporting and developing economies such as Nigeria can adopt fiscal rules that guarantee short-term macroeconomic stability and long-term fiscal sustainability. This study, in this respect, considered the relevance of fiscal rules where the fiscal balance of government reacts to the revenue base and state of the economy. The study also examined the desirability of the Taylor-type rule for the Nigerian economy. The study computed optimal monetary and fiscal rules using a Linear-Quadratic approximation of the equilibrium conditions in a New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model. The parameters of the DSGE model were calibrated to suit the Nigerian economy. The main findings of the study showed that the optimized monetary rule obeys the Taylor principle while the optimized fiscal rule ensures a passive and countercyclical fiscal path. The implication of the finding shows that in the presence of a government that commits to a fiscal balance rule, it is desirable for the central bank to stabilize inflation while the government should avoid the procyclical bias.

**Keywords:** fiscal; monetary; policy rules; optimal; DSGE; Nigeria

**JEL Classification:** E61; E63; C69

### Introduction

The Nigerian economy slipped into a recession after it contracted by -0.36% and -2.06% in 2016Q1 and 2016Q2. At the same time, inflation rate rose from an average of 12.24% over the period 1996-2016 to 18.10% in October 2016 (National Bureau of Statistics 2016). Policy analysts deduced that these twin problems were aggravated by the conflicting and uncoordinated stances of both fiscal and monetary policy. This paper, in this regard, argues that the design and implementation of optimal fiscal and monetary policy is a channel to guarantee future efficient macroeconomic outcomes in Nigeria. Both policies aid the short-term stabilization of the economy that guarantees medium to long-term outcomes in growth and welfare (World Bank 2014, Ayopo *et al.* 2015). In practice, Taylor (1993, 2000) shows that economic policy decisions can be approximated using simple feedback rules and that these rules produce good macroeconomic outcomes.

This study, therefore, examined the design of optimal policy rules that lead to efficient outcomes in inflation and output in Nigeria within a new Keynesian Dynamic Stochastic General Equilibrium model. Only few authors have contributed to the literature on optimal macroeconomic policy in Nigeria (Olayeni 2015, Udom and Yaaba 2015, Adegboye 2015). Adegboye (2015) is the only exception that considered the joint optimal fiscal and monetary policy but left out peculiar factors such as rent-seeking and fossil oil. In this respect, Baansguard (2003) and Snudden (2016) argue that oil-exporting economies such as Nigeria should consider the relevance of this commodity in explaining fiscal decisions. This study, therefore, differs from Adegboye (2015) by combining an oil revenue-based fiscal rule with a Taylor-type rule in order to obtain the optimal mix of fiscal and monetary policy in Nigeria.

## 1. Research background

Several studies have examined the joint optimal paths for fiscal and monetary policy. Optimal policies can be described as rules or discretionary. This section however focuses on optimal fiscal and monetary policy rules which can be characterized as Ramsey policies or optimal simple rules. Lucas and Stokey (1983), Chari, Christiano and Kehoe (1991) are some earlier contributions to optimal fiscal and monetary policy. These studies compute joint Ramsey policies within a dynamic general equilibrium framework. Other studies include Schmitt-Grohe and Uribe (2004) who simulated a DSGE model and found that the Ramsey planner desires monetary policy paths in nominal interest rates to be greater than zero and highly volatile over time. The authors characterized the Ramsey fiscal policy to feature stable income tax rates. Bhandari *et al.* (2018) examined the optimal fiscal and monetary paths in a New Keynesian model with heterogeneous agents where a Ramsey planner is assumed to be concerned with inflation stability and mitigating against mark-up shocks. The study characterized optimal monetary policy to fall in response to a mark-up shock while the reaction of the optimal tax depends on whether the planner is concerned with price stability or with insuring the household agents against shocks.

Studies that compute optimal simple rules include Chadha and Nolan (2007) who showed that the optimized combination of Taylor and fiscal surplus rules obey the assignment consensus. In this case, the optimal monetary policy is concerned with inflation stability while the optimal fiscal policy focuses on smoothing the output gap. Schmitt-Grohe and Uribe (2007) used the second-order approximation of equilibrium conditions within a DSGE model to compute values for optimized feedback policy rules. The mix of the optimal simple fiscal and Taylor-type rules have the features of active-passive monetary and fiscal policies. In the same vein, Gali and Monacelli (2008) used the second-order approximation method to derive the optimal fiscal and monetary rules that maximizes households' welfare in the European Union, within a dynamic general equilibrium framework. The study found that optimal monetary policy be assigned to price level stability. The optimal fiscal policy in individual economies is pro-stabilizing and is void of constraining the monetary stance of the Union's central bank.

Bi and Kumhof (2011) found that in a general equilibrium model with non-Ricardian households and the presence of huge debt and distortionary taxes, the optimized simple fiscal rule in surplus as percent of GDP smooths the income of non-Ricardian household. The optimized nominal interest rate rule is highly persistent and passive in nature according to the classification of Leeper (1991). Phillippopoulos, Varthalitis and Vasillatos (2015) calibrated a New Keynesian DSGE model to data on the Euro area. They used the second-order approximation method to compute the optimized simple rules that guarantees both output and debt stabilization. The study specified more than one fiscal instrument in distortionary taxes and government spending, alongside a Taylor-type monetary rule. The author found that the optimized monetary path followed the Taylor principle, such that it has inflation-stabilizing aim. The optimized fiscal rule, on the other hand, should focus on balancing role of debt consolidation or economic stabilization. This balancing role depends on the distortedness in the nature of the fiscal instrument. In addition, Cantore *et al.* (2017) studied a richer set of optimal fiscal-monetary rules, that is the Ramsey policy, time-consistent policy and optimal simple rules under a normal and abnormal or crisis period. The result from the study revealed that the nature of optimal policy depends on the initial debt level in the economy and whether the government is committed to a set of rules or not.

The aforementioned studies reviewed have been calibrated to suit developed economies such as the United States and Euro area. This study differs from the most of the rest by considering optimal fiscal and monetary policy rules for a developing economy such as Nigeria. In this light, a Taylor rule is combined with a fiscal rule that responds to the peculiarity of Nigeria as an oil-exporter. This study corroborates Snudden (2016) who showed that commodity-exporting economies such as Nigeria should consider the relevance of this commodity in the design of fiscal rules.

## 2. Methodology

### 2.1. An open economy New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model

The model is constructed drawing on the works of Gali and Monacelli (2008). It comprises of four optimising agents that include households, firms, the central bank and the government who form model-consistent expectation based on available information. The infinitely lived households decide how much units of goods to consume and labour to supply in order to maximise its lifetime utility subject to budget constraints. The household sector is also assumed to supply labour to firms in a perfectly competitive labour market. The production sector comprises of intermediate-goods producers. The intermediate-goods producers are in monopolistic competition and cannot change prices. Following the Calvo (1983) sticky price setting, a fraction of the intermediate-goods



firms is allowed to re-set their price. The third agent is a monetary authority, the Central Bank of Nigeria that implements monetary policy by following a Taylor-rule to set its policy rate. The fiscal authority is also assumed to implement policies by committing to fiscal rules in government spending and budget surplus. Finally, the model is perturbed by some exogenous shock processes.

### 2.1.1. The households

There is a continuum of infinitely lived households  $j \in [0,1]$  who decides how much units of goods to consume and labour to supply in order to maximize its lifetime utility subject to its inter-temporal budget constraints. The household sector consists of forward-looking optimisers who have access to the financial markets and can own firms in the economy. The household derives utility at time  $t$  from consuming a composite good,  $C_t$ , public good  $G_t$  and leisure  $1 - N_t$ . Furthermore, there is neither saving nor investment. The households' objective is therefore to maximize the sum of discounted expected future utility in equation (1):

$$E_t \sum_{t=0}^{\infty} \beta^t \left[ \left( \frac{C_t}{1-\sigma} \right)^{1-\sigma} + \chi \frac{G_t^{1-\rho}}{1-\rho} - \frac{N_t^{1+\varphi}}{1+\varphi} \right] \quad (1)$$

where:  $E_t$  is the rational expectation operator;  $\beta^t$  is the inter-temporal discount factor;  $C_t$  comprises of private consumption of composite goods;  $G_t$  is the consumption of public goods;  $N_t$  is the amount of labour supplied;  $\sigma$  is the parameter for inverse of elasticity of substitution;  $\chi$  is the weight on public goods consumption and  $\varphi$  is the inverse on frisch elasticity of labour supply.

The household maximizes utility function in equation (1) subject to a standard budget constraint in nominal terms (2). The budget constraint postulates that the household receive wages for their labour supply  $W_t N_t$ , they own the firm and receive profit in form of dividend  $DV_t$ , they own stock of risk-free financial assets,  $D_t$  and receive lump sum transfer from government  $TP_t$ . The household uses their resources to pay lump sum tax  $P_t C_t$  and to purchase portfolio of financial assets,  $D_{t+1}$ . This relation can be written as:

$$P_t C_t + E_t(Q_{t,t+1} D_{t+1}) + \leq W_t N_t + D_t + TP_t + DV_t \quad (2)$$

where:  $E_t(Q_{t,t+1}) \equiv Q_t = \left( \frac{1}{1+i_t} \right)$  is the one period ahead stochastic discount factor;  $i_t$  is the nominal interest rate. The equilibrium conditions in the household sector include the consumption Euler equation (3) and the labour supply schedule (4):

$$c_t = E_t(c_{t+1}) - \frac{1}{\sigma} (i - E_t \Pi_{t+1} - \rho) \quad (3)$$

where:  $\Pi_{t+1} = P_{t+1} - P_t$ ;  $\rho \equiv -\log \beta$  and  $i \equiv -\log Q_t$

$$w_t - p_t = \sigma c_t + \varphi n_t \quad (4)$$

### 2.1.2. The firms

The monopolistic competitive firms in the production sector produce differentiated goods using a linear production technology:

$$Y_t = A_t N_t \quad (5)$$

where:  $A_t$  denotes the Total Factor Productivity;  $N_t$  is the labour input,  $\log A_t \equiv a_t$  is assumed to evolve with an AR(1) process such that:  $a_t = \rho_a a_{t-1} + \varepsilon_t^a$ ,  $\varepsilon_t^a$  is the technology shock to production in the economy. It is normally distributed with mean of zero and the standard deviation is  $\sigma_{\varepsilon^a}$ , i.e.,  $\varepsilon_t^a \sim N(0, \sigma_{\varepsilon^a}^2)$ .

Log-linearize equation (5) to get the production relation:

$$y_t = a_t + n_t \quad (6)$$

### Price setting

The intermediate firms are concerned with the optimal pricing of their goods. The firms in this regard, choose the price that maximizes the discounted real profits. It is also assumed that the firms follow the Calvo (1983) price-setting mechanism such that while a fraction  $\theta$  cannot reset their prices, the other fraction  $1 - \theta$  can. The firms fix prices,  $P_t^*$ , by maximizing their real discounted profits subject to demand such that:

$$\text{Max } E_t \sum_{k=0}^{\infty} (\beta\theta)^k E_{t,t+k} Y_{t+k|t} [P_t^* - mc_{t+k|t}] \quad (7)$$

Subject to:

$$Y_{t+k|t} = \left[ \frac{P_t^*}{P_{t+k}} \right]^{-\varepsilon} Y_{t+k} \quad (8)$$

This yields the optimal pricing equation of the resetting firm such that:

$$P_t^* = \mu + 1 - \beta\theta \sum_{k=0}^{\infty} (\beta\theta)^k E_t [\widehat{mc}_{t+k|t} + P_{t+k}] \quad (9)$$

where:  $\widehat{mc}_{t+k|t} = mc_{t+k|t} - mc$

### 2.1.3. International risk sharing

In a complete and integrated international financial market, it is assumed that there is perfect risk sharing between households in the domestic and foreign countries i.e. it is assumed that the prices of domestic and foreign bonds are the same. It is also believed that the household in the domestic and foreign economies shares similar preferences. The first order condition on consumption for the domestic economy (10) is combined with a similar one for the foreign economy (11).

$$\beta \left( \frac{c_{t+1}}{c_t} \right)^{-\sigma} \frac{P_t}{P_{t+1}} = Q_{t,t+1} \quad (10)$$

$$\beta \left( \frac{c_{t+1}^f}{c_t^f} \right)^{-\sigma} \frac{P_t^f}{P_{t+1}} = Q_{t,t+1} \quad (11)$$

This gives:

$$c_t = c_t^f + \frac{1-\alpha}{\sigma} s_t \quad (12)$$

This relation links the domestic consumption ( $c_t$ ), world consumption ( $c_t^f$ ) and the terms of trade ( $s_t$ )

### 2.1.4. The monetary authority

The central bank is assumed to follow a simple Taylor-type rule. Under this rule, the monetary authority sets the nominal interest rate by considering past value of interest rate, the deviation of inflation, output growth and exchange rate from target

$$r_t = \rho_R r_{t-1} + (1 - \rho_R) [\varphi_\pi \widehat{\pi}_t + \varphi_Y \widehat{y}_t + \varphi_e \Delta e_t] + \varepsilon_t^R \quad (13)$$

where:  $r_t$  denotes the nominal interest rate;  $r_{t-1}$  is the lagged interest rate;  $\pi_t$  is the inflation rate;  $y_t$  is the output growth;  $e_t$  is the exchange rate;  $\varepsilon_t^R$  is the innovation to monetary policy;  $\rho_R$  is the degree of interest rate smoothing while  $\varphi_\pi, \varphi_Y, \varphi_e$  are the parameters that measure the response of central bank to inflation, output and exchange rate.

### 2.1.5. The fiscal authority

The fiscal authority is assumed to be benevolent. The fiscal authority faces a budget constraint where the revenue it earns from issuing bonds ( $r_{t-1} d_{t-1}$ ) is expended on government provision of goods and services ( $g_t$ ). The fiscal policy maker, therefore, has a nominal budget constraint that is defined as:

$$r_{t-1} d_{t-1} = g_t \quad (14)$$

The government implements a generalized fiscal-balance rule as specified in Snudden (2016). This rule assumes that the fiscal-balance reacts to the structural fiscal balance, the deviation of oil and non-oil revenues and government liability from steady state and the level of real GDP. It is specified such that:

$$d_t = d_t^{SS} + \rho_{nor} (NOR_t - NOR_t^{SS}) + \rho_{or} (OR_t - OR_t^{SS}) + \rho_b (B_t - B_t^{SS}) + \rho_{gdp} GDP_t + \varepsilon_t^d \quad (15)$$

### 2.1.6. Exogenous shock processes

The model is assumed to be perturbed by exogenous shocks in technology, monetary policy and fiscal policy. These are expressed as:

$$\text{Technology: } a_t = \rho_a a_{t-1} + \varepsilon_t^a \quad (16)$$

$$\text{Monetary Policy: } r_t = \rho_r r_{t-1} + \varepsilon_t^r \quad (17)$$

$$\text{Fiscal policy: } \mu_t = \rho_\mu \mu_{t-1} + \varepsilon_t^\mu \quad (18)$$

### 2.1.7. Market clearing conditions

Goods market clearing condition for the domestic economy requires that aggregate output equals aggregate domestic and foreign demand for locally produced goods with government demand such that:

$$y_t = c_t + g_t + \alpha s_t \quad (19)$$

### 2.1.8. Equilibrium dynamics

Dynamic Investment-Saving (IS) Curve:

Equation (19) of the goods market clearing condition can be combined with the consumption Euler equation (3) to obtain the dynamic IS curve such that:

$$\tilde{y}_t = E_t \tilde{y}_{t+1} - (i - E_t \Pi_{D,t+1} - r_t^n) - E_t (\Delta \tilde{g}_{t+1}) \quad (20)$$

New Keynesian Philips Curve:

The optimal price setting condition in equation (9) is combined with the dynamics of the aggregate price level in equation (21) to obtain the NK Philips curve in equation (22):

$$\pi_t = (1 - \theta)(P_t^* - P_{t-1}) \quad (21)$$

$$\pi_{D,t} = \beta E_t [\pi_{D,t+1}] + \lambda \widehat{m}c_t \quad (22)$$

$$\text{where: } \lambda = \frac{(1-\theta)(1-\beta\theta)}{\theta}$$

Equation (22) shows that domestic inflation is proportion to the deviation of the marginal cost from its steady state. The real marginal cost is such that:

$$\widehat{m}c = (1 + \varphi)\tilde{y}_t - \tilde{g}_t \quad (23)$$

## 2.2. Optimal simple policy rules

The optimal fiscal and monetary policy is defined as the path of budget surplus and nominal interest rate rules that optimize the objective function of the policymaker. The optimal simple rules are computed in this section using the Linear Quadratic approximation on Dynare 4.5.1 software. The policymaker, therefore, seeks to minimize the deviation of the actual values of output, inflation and budget surplus from their target values such that:

Minimize

$$\sum_{t=0}^{\infty} \pi^2 + 0.5y^2 + 0.5d^2 \quad (24)$$

Subject to the structural constraints that include the Dynamic IS curve, New Keynesian Philips curve, the monetary and fiscal policy rules.

## 2.3. Calibration of parameters

Some of the parameters of the model used in this study are borrowed from existing studies on Nigeria such as Adegboye (2015). The discount factor, calvo price stickiness and Inverse of Frisch elasticity () are fixed at 0.99, 0.5 and 4.38 in line with Adegboye (2015).

The persistent parameters on oil and non-oil revenues, government spending, and debt are fixed at 0.7 while the degree of interest rate smoothing is fixed at 0.8. The Taylor reaction to inflation and output are calibrated to take the value of 1.5 and 0.5. The parameters of the response of oil revenue, non-oil revenue, debt and real GDP to the fiscal-balance are fixed at 0.145, -1.089, 0.158 and -0.198. These values were obtained by running a regression on the generalized fiscal rule using Nigerian data for the period 1970 to 2013. The target values for the fiscal balance to GDP, non-oil revenue to GDP and debt to GDP are selected based on projections in the Medium Term Expenditure Framework (2018-2020) of the Budget Office of the Federation (2017). These values are fixed at 1.63, 15 and 18% respectively. The target value for the oil revenue as a ratio of GDP is selected using its average over the period 1970-2013.

Table 1 presents the optimized fiscal and monetary policy rules under four fiscal regimes. In fiscal regime one, the government is assumed to implement a generalized budget balanced rule such that the fiscal balance reacts to both oil and non-oil revenue and to macroeconomic indicators in debt and Real GDP. This rule has the potential to guarantee long-term fiscal sustainability while at the same time stabilizing the economy against cyclical volatility.

The fiscal regime two is a balanced-budget rule that requires that government revenue offset its liabilities such that the budget is balanced in each period. In the third fiscal regime, a structural surplus rule is designed. This rule ensures that government spending matches the long-term sustainable path of revenue. The fourth fiscal regime is a countercyclical rule. The fiscal parameters in the balanced budget, structural surplus and countercyclical are calibrated in line with Snudden (2016).

Table 1. Optimized parameters

	$\varphi_{\pi}$	$\varphi_y$	$\rho_{or}$	$\rho_{nor}$	$\rho_b$	$\rho_{gdp}$
1. Generalized budget balanced rule	2.204 (1.5)	0.737 (0.5)	0.151 (-1.089)	-0.514 (0.145)	-0.439 (0.158)	-0.183 (-0.198)
2. Budget balanced rule	227.892 (1.5)	76.602 (0.5)	-0.0000131 (0)	-0.0000131 (0)	-0.000024 (0)	-0.000011 (0)
3. Structural surplus rule	2.041 (1.5)	0.682 (0.5)	0.644 (1)	0.644 (1)	0.711 (0)	-0.000000492 (0)
4. Countercyclical rule	3.25 (1.5)	1.094 (0.5)	-0.149 (1.1)	-0.149 (1.1)	-	-0.315 (-0.5)

Source: Authors' computation using Dynare

Note: \*Values in the brackets are the calibrated parameters

### 3.1. Optimized fiscal rule

The optimized parameter values of the fiscal balance reaction to debt ( $\rho_b$ ) shows that the fiscal policy in regimes 1, 2 and 4 take a passive fiscal path, in line with the classification of Leeper (1991). This implies that government adjusts the budget balance instrument to stabilize debt. It shows that elements of fiscal dominance that stifles central bank independence and induces fiscal inflation are reduced under these regimes.

This result corroborates Oye, Alege and Olomola (2018) who find that passive fiscal rules have the higher welfare benefits than active fiscal rules. The optimized coefficients of fiscal balance reaction to real output ( $\rho_{gdp}$ ) shows that the fiscal regimes have the potential to guarantee the adoption of countercyclical fiscal policies. This becomes necessary to address the fiscal- procyclical bias in several developing economies. In addition, the autocorrelation coefficient shows the low inertial of the fiscal balance instrument. This implies that the economy quickly responds to adjustments in this instrument.

### 3.2. Optimized monetary rule

The central bank implements a Taylor rule such that the nominal interest rate reacts to inflation and output. The optimal coefficient values of the Taylor response to inflation ( $\varphi_{\pi}$ ) are greater than unity in the four regimes. This means that the Taylor principle is satisfied and the central bank ought to adopt an active monetary stance in line with Leeper (1991).

The autocorrelation coefficient also depict that the optimal monetary stance has low persistence such that variations in the monetary instrument is short-lived and transmits quickly onto the economy. The fiscal instrument, however, is less persistent than the monetary instrument.

### 3.3. Welfare and volatility

The welfare losses of the policymaker obtained from minimizing the variances in output, inflation and fiscal balance are presented in Table 2. In addition, the volatility in output, inflation and debt stock are reported. The result in Table 2 reveals that the welfare loss of the policymaker is best minimized under the countercyclical fiscal regime. It has the least loss value compared to the other regimes.

The loss function, on the other hand, is least minimized under the generalized budget balanced rule. It can then be concluded based on the results in Table 2 that fiscal rules that guarantee short-term macroeconomic stability, are more appealing to the policymaker, since it minimizes their loss function than rules tailored to long-term fiscal sustainability. The volatility values reported in Table 2 shows that output and inflation are best stabilized under the budget-balanced rule while debt is equally stabilized under the four regimes.

Table 2. Welfare and Volatility

	Welfare loss	SD(y)	SD( $\pi$ )	SD (b)
Generalized budget balanced rule	0.00521	0.065	0.168	0.221
Budget balanced rule	0.00518	0.041	0.015	0.221
Structural surplus rule	0.00293	0.068	0.179	0.221
Countercyclical rule	0.00118	0.557	0.123	0.221

Source: Authors' computation using Dynare

## Conclusion

Chile is one example of a country that has adopted a fiscal rule that ensures long-term fiscal sustainability and reduces macroeconomic volatility. Commodity-exporting and developing economies such as Nigeria can also adopt such fiscal rule (Baansgaard 2003, Snudden 2016).

The study, therefore, examined a generalized budget rule where the fiscal balance of government reacts to the revenue base and state of the economy. The study compared the outcome of this rule with three similar variants. The main findings of the study showed that the optimized monetary rule obeys the Taylor principle while the optimized fiscal rule ensures a passive and countercyclical fiscal path. The implication of the finding shows that in the presence of a government which commits to a fiscal balance rule, it is desirable for the central bank to stabilize inflation while the government should avoid the procyclical bias.

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## Assessment of the Current Mechanism and Factors of Income Generation in the Service Sector of the Republic of Uzbekistan

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### Abstract:

The work has identified opportunities to raise the level of wages in the service sector, which determines the overall development of the state as a matter of fact. The author shows that there is a direct relationship between the growth of economic indicators and the level of wages. The urgency of the work is conditioned by the fact that most of the modern economic goods in the state are accumulated from the sphere of services. The subject of the study is the services sector and its derivatives, which are reflected in the economies of the post-Soviet countries. Uzbekistan is taken as an example. The novelty of the research is determined by the fact that each of the parameters that stimulates the development of the country's economy and especially the sphere of services depends not only on the level of infrastructure development but also on the level of wages, which in turn forms the level of consumption and the level of demand in the economic sphere of services. The paper reflects that the formation of the level of wages is based on an understanding of the overall process of the development of sectoral parameters of the service sector. The prospect of further research is the organization of an equilibrium-balancing model during the transformation of the national economy and the transition from the technological order to the information society.

**Keywords:** economic environment; Uzbekistan; service sector; wages; technological reception

**JEL Classification:** E24; G17

### Introduction

The labor market is one of the main elements of a market economy, and also one of the main subjects of the study of the labor economy. The labor market is not limited to employment relations for the unemployed and filling vacancies, but covers the entire scope of wage labor. From the position of Zhou (2016) it follows that the object of labor market policy should be a wide range of labor relations and all economically active population. The modern labor market in Uzbekistan is characterized by considerable tension due to a decline in demand for labor force; drop in the level of real wages, an increase in the number of released workers, and hidden unemployment growth.

The problems of the labor market are inseparably linked with the processes taking place in the public life of the country (Ritzen and Zimmermann 2017, Silagadze 2017). The main problems that prevent the Uzbek labor market from developing and being more effective are the following:

- low price of labor force;
- excessive inequality of incomes of different strata;
- low demand for labor and unemployment;
- structural and interregional imbalances;
- low labor mobility of workers and their weak protection;
- social indifference;
- "shadowing" of the economy.

Sustainable development of the state cannot be considered in isolation from the economic and social stability of the regions (Adamopoulou *et al.* 2016). Successful implementation of social and economic transformations in Uzbekistan depends to a large extent on rational combination of state interests with interests and peculiarities of regions, effective use of their natural resources, labor, scientific, technical and production potentials. The level of real wages in Uzbekistan does not correspond to the notion of decent wages and does not provide access to the benefits needed to ensure expanded human reproduction (Buley *et al.* 2016). For most workers, the accrued wages remain lower than the average level in the country. Despite the positive dynamics of average wage growth, the differentiation of its level remains quite high and has a negative tendency to increase

(Van *et al.* 2017). The ILO determines the level of wages to be low if it does not reach 2/3 of the median level of hourly earnings, which is typical of Uzbekistan today.

Wan and Zhou (2017) argue that the assessment of the mechanism of generating income of the population is necessary to determine the completeness of the implementation of the mechanism of its goals and objectives, the analysis of the implementation of policies to improve the welfare of the population and the effectiveness of social programs, the rationale for improving the living standards of the population and growth of its well-being in strategic planning, operational management of the process of generating income of the population and ensuring their growth.

Eliasson and Hansson (2016) suggest that ensuring the formation of income of the population is the main goal of the mechanism, which is realized annually by calculating the incomes of the population according to their types, and then in the total amount. Lu (2016) believes that the necessary information is contained in the materials of state statistics, which is collected continuously and in an organized manner. The monetary incomes of the population are determined on the basis of the balance of the monetary incomes and expenditures of the population (Diebolt and Perrin 2017). Byttebier (2017) shows that the revenue side of the balance sheet combines receipts from various sources that are identified through statistical and financial reporting, sample surveys, refining calculations, and other methods (Zhou 2016).

## 2. Methodology

Important ways of further macroeconomic research by methods of econometric modelling are analysis and forecasting of trends in unemployment, employment and income indicators at different phases of the economic cycle, assessing the main long-term and short-term unemployment factors, analysing the impact of shock therapy methods on the dynamics of labor market processes (Shtal *et al.* 2018).

Econometric modelling of the processes of functioning and development of the labor market in Uzbekistan will allow building adequate strategies for its regulation and forecasting. Modern economic theories in research use the apparatus of mathematical models, probabilistic and statistical methods of analysis of these models. The tool of analysis of the economic object is the methods of mathematical statistics (regression and correlation analysis) and econometrics. We form questions about the requirements for the service sector on the basis of how the level of wages is calculated, since it is not based on direct receipt of funds from production facilities (Nagore and García 2017, Shtal *et al.* 2018).

## 3. Results and discussion

The problem of analyzing the service sector in the national economy has recently gained increasing importance (Daleure 2017). This is due to the growing role of services in the economy, increasing public needs and the deployment of the process of globalization. There was an understanding that it was human services that created human capital. From a secondary nonproductive or unproductive sphere, it has become an independent, equal in rights, and the prevailing sector of the economy in developed countries. More and more branches of material production create products, which are then used to provide services (Naumenkova 2015).

In the national economy, the services sector is still at the stage of formation. Uzbekistan inherited an economy with hypertrophically developed industry and agriculture from the planned economy, in which the "non-productive sphere" occupied peripheral places in political and economic programs, was financed by a residual principle. Development of effective practical recommendations for reforming the service sector and building a balanced state policy should be preceded by a deep theoretical and methodological analysis of its essence and the construction of a categorical apparatus (Kunze 2017). Under the sphere, in the broadest sense, one must understand the region, the limit of the propagation of something; in a narrower economic sense, a set of industries characterized by common essential features or types of economic activity that have well-defined general functions, a special purpose in the social division of labor, and a number of characteristics that significantly distinguish these types of economic activity from others (von Brasch 2016). The industry is most often treated as a set of enterprises and organizations for which the commonality of products, technology of production, fixed assets and professional skills of employees are characteristic. (Buley *et al.* 2017)

The most common approach among the analyzed concepts is to understand the service as an activity, an action, a process or a work (Junankar and Pope 2016, Vinichenko *et al.* 2016). The following two interpretations do not contradict the first, but represent its alternative. The disclosure of the essence through the activity is not entirely correct, since for the consumer of the service the most valuable is its result, and the result of the provision of the service will depend on the process itself. Therefore, in our opinion, the most acceptable approach

will be the third option, which sees the essence of services in the indivisible unity of activity and its result, as it allows explaining the nature of all the services that are produced in the national economy (Rani 2017).

The approach to the definition of services as a kind of good is somewhat blurred, since everything that is produced and is able to satisfy needs is called a boon or a product in the economy. Interpretation of the service as a product or merchandise also does not take into account certain aspects. Material product is usually understood by production, which is created in the process of material production, so it is not entirely correct to identify the service with the product. The commodity form of an economic product provides for its mandatory implementation, whereas services do not always become commodities. From the point of view of the national economy, the definition of service as a form of relationship that is directly related to production or forms the socio-economic conditions of its functioning is not comprehensive (Campos *at al.* 2017). This interpretation characterizes relations only in production, whereas the totality of social non-production relations is not taken into account here. At the same time, the relationship between people in society or between the producer and the consumer in the market may not be directly related to the provision of services (Sardadvar and Vakulenko 2017).

The last group is represented by the definitions of the service as a result of a new quality that arises in the course of economic activity or a change in the state of a person or an object. Relying on the technique of constructing a categorical apparatus, we concluded that these definitions distort the essence of the service for pointing directly at the result of the phenomenon without revealing its content. The content of the concept of "service" in the analysed definitions is most often explained through its properties. This approach seems reasonable at first sight. However, under the influence of globalization factors, new services are emerging, the properties of which are constantly changing. Modern services can have more or less material character, but can be consumed non-simultaneously with production and can be stored (Gumata and Ndou 2017).

It is the property of the service to be useful and to provide a permanent or temporary, reversible or irreversible physical or mental effect, is key to the national economy, since it takes into account the development trends of post-industrial society in the context of globalization. This utility is two-sided: not only the consumers satisfy their own needs, but also the service providers (Junankar and Neale 2016). In the case of commercial services, the latter receive income, and when providing non-commercial services, the benefit is received by the state as a whole not as a material benefit, but as the creation of public goods. Analysing the identified approaches and relying on the principles of consistency, complexity and objectivity, indicated in our methodology, the most rating definitions of the service sector were assessed and highlighted. Approaches from all analysed have all three necessary elements: the essence of the phenomenon, the content of the phenomenon and its result. In addition, it is expedient to define the essence of the services sphere for analysis on the scale of the national economy through the aggregate, system or complex of industries (Baumann 2016). This approach does not contradict the definition of the terms "sphere" and "service" in the economic aspect. All the rest have some omissions.

The practicality of the above definition for the study of the national economy is explained by the use of a systematic approach that allows focusing attention on the structure of the service sector. Such an interpretation makes it possible to select a set of indicators that will determine the state of institutional units and their transformation under the globalization conditions. In the future, this will contribute to the analysis and identification of trends in the development of the tertiary sector of the economy, assessing the impact of various factors on it. This determines the need to create conditions in which the understanding of the service sector will be formed in the overall structure of wages and form an attitude of workers in the service sector to the wages along with the production sector.

The current reporting system does not fully cover the formation of income of the population. In particular, in statistical reporting there is no data separately for incomes of workers in the service sector; although from the point of view of macroeconomic analysis it is of fundamental importance. In addition, the size of the income of the population formed in the shadow economy, as well as self-employment, is not always reflected in income declarations and is not covered by accounting and reporting. The composition and structure of monetary incomes of workers in the service sector was determined by means of sample surveys. In this regard, we, when assessing the current mechanism for generating income of workers in the service sector, used data on wages. In the course of our analysis, we found a lagging growth in the average monthly salary in the service sector from the growth rate of the average republican salary. Thus, in the Republic of Uzbekistan, the average wage in the economy as a whole increased by 15 times in 2005-2016, and by 13 times in the service sector. In addition, the average wage in the service sector is much lower than the average wage in the economy as a whole.

Table 1. Dynamics of average wages by branches of the economy of the Republic of Uzbekistan for 2005-2016 (in %)

Economic sectors	Years				Changes (+ more; - less)	Growth rate, 2016 to 2005 - %
	2005	2010	2015	2016		
All economic sectors	100.0	100.0	100.0	100.0	-	-
Industry	175.1	150.4	136.4	150.2	-24.9	85.8
Construction	173.5	154.7	124.6	135.6	-37.9	78.2
Service sector	80.2	84.2	87.3	98.6	+18.4	122.9

From the data in Table 1 it follows that the average wage in the service sector is well below the average wage of some branches of material production (for example, industry). For example, in the republic in 2005, the average wage in the service sector relative to the average wage in industry was 80.2%, and although as a result of a regular increase in wages in the services sector, this share increased to 98.6% in 2016, the situation with pay for workers in the service sector continues to be low. With the increasing role of the service sector in the social and economic life of the society in modern conditions, this situation can hardly be considered normal. It seems to us that the wages of workers in the service sector should not be lower than the wages of workers in the sphere of material production. This is already an out-dated approach, *i.e.* neglect of the labour of service workers. This attitude to the work of service workers must be changed. First of all, for the reason that in this sphere, because of the increased needs of society for the quality of services, work people with a high level of education, creatively gifted and good human qualities (Rogach 2012). A highly qualified and quality work should always be evaluated highly.

The results of the analysis of statistical data have also shown a sufficiently deep differentiation in the levels of remuneration among industries within the service sector itself (Table 2). For example, if in 2016 the lowest wages were recorded in such sectors as Health, physical culture and sports, Social security and education, Culture and art, Science and scientific services, which amounted to 71.5% and 82, 7% of the average wage as a whole for the economy. The highest wages were recorded in the sector Finance, credit and insurance, which exceed the average monthly salary in the economy by 2.05 times. However, it should be noted that the amount of wages in certain branches of the service sector in 2005-2016 has a growth trend in comparison with its average level in the economy (especially in the sphere of education and health care, since 2009, there has been a gradual increase in the wage rate relative to the average for the economy as a whole) (Asyaeva *et al.* 2016). This was the result of a strong social policy of the country.

Table 2. Average monthly salary of employees by branches of the economy of the Republic of Uzbekistan for 2005-2016

Economic sectors	Years				Change (+,-)
	2005	2010	2015	2016	
All economic sectors	100.0	100.0	100.0	100.0	-
Industry	175.1	150.4	136.4	150.2	-24.9
Construction	173.5	154.7	124.6	135.6	-37.9
Transport	143.2	120.0	122.2	125.5	-17.7
Communication	144.6	127.2	112.7	122.8	-21.8
Trade, catering, sales and procurement	71.1	93.5	93.7	94.0	+22.9
Housing and communal services; non-productive types of consumer services	97.2	89.6	94.3	94.4	-2.8
Health, physical culture and sports, social security	55.8	74.1	72.6	71.5	+15.7
Education, culture and art, science and scientific services	66.2	79.6	82.8	82.7	+16.5
Finance, credit and insurance	199.1	157.6	197.3	204.9	+5.8
Other	94.0	100.9	103.0	103.4	+9.4

The criterion for assessing the current mechanism of generating income of the population engaged in the service sector is the ratio of the average monthly wage with the minimum wage. This ratio determines the degree of realization of the reproductive function of the mechanism for generating income of the population. The results of the analysis showed that the average monthly salary of workers in the service sector exceeds the minimum wage accepted for comparison as an officially established indicator by more than 9 times. But this indicator, as shown by the results of the analysis, tends to decrease. Obviously, this is due to the relatively low growth rate of the minimum wage compared to the growth rate of nominal wages. This comparison allows us to conclude that the mechanism for generating income of the population ensures the realization of the replenishment function of incomes in the amounts corresponding to the current state of the economy. Comparison of the average monthly

wage of certain branches of the sphere with the minimum wage revealed quite a significant differentiation in the context of industries. In such industries as "Communication", "Transport", "Finance, credit and insurance", the average monthly wage exceeded minimum salary at 7.4; 7.2 and 12.0 times, respectively. These are the service industries that operate on the basis of market relations, *i.e.*, full self-financing. The lowest ratio is observed in "Housing and communal services and non-productive types of consumer services", "Health, physical culture and sports, social security" and "Education, culture and art, science and scientific services" (5.5, 4.2, 4.8 times). It should be noted that this ratio varies depending on the sources of financing, *i.e.* it is lower in areas that are mainly financed from the state budget.

The author conducted an analysis of the ownership factor influence on the level of incomes of workers in the service sector.

Table 3. Indicators of economic development of enterprises in the sphere of services of various forms of ownership of the Samarkand region in 2016

Indicators	Education	
	State-owned legal entity	Private legal entity
Gross income, thousand sums	1,965,335.30	120,162.00
Prime cost, thousand sums	1,965,335.30	50,379.00
Labor compensation fund, thousand sums	400,928.40	33,223.60
Gross profit, thousand sums	-	69,783.00
Net profit, thousand sums	-	29,588.70
Average annual value of fixed assets, thousand sums	1,005,091.2	1,856,150.90
Cost effectiveness, %	1.95	6.47
Number of employees, people	287.00	21.00
Share of wages in gross income, %	20.40	27.60
Labor productivity, amount	1397.00	1,582.00

As the data in the Table 3 show, the procedure and mechanism for generating income for employees of enterprises based on different forms of ownership differ significantly. The share of wages in gross income in the public school (20.4%) is less than in the private school (27.6%) and this led to the conclusion that private enterprises have greater independence in determining the wage rates of their employees. The sample survey of service companies conducted by us showed that the average weight of the tariff in the payment of labor is about 90% at state enterprises, and the rest of the LCF is paid in the form of premiums, allowances and compensations (10%). At private enterprises, the share of the tariff part, according to the survey, is up to 75%. But as it is characteristic of private enterprises to conceal wages and incomes it can be assumed that the actual tariff part of the LCF also does not exceed 50%. At the same time, in many enterprises compensation payments to employees that are not remuneration for labour (payments for food, transportation in urban transport, for the preparation of agricultural products) significantly exceed wages (Table 4).

Table 4. Main indicators of development of economic sectors of the Republic of Uzbekistan for 2016

Economic sectors	GDP, Billion sum	Number of employed population, thousand people	Labour productivity, sum	Average monthly salary, sum
Industry	111,869.4	1,802.4	6,206.7	1,369,729.3
Agriculture and forestry	48,431.1	3,646.7	1,328.1	1,044,007.7
Building	47,486.1	1,263.6	3,758.0	1,241,576.4
Service sector	92,536.0	6,585.7	1,405.1	995,635.9
In the economy in general	199,325.1	13,298.4	1,498.9	1,009,772.7

The next factor that determines the size and level of income of workers in the service sector is the productivity of their labor. Analysis of statistical data showed that in the service sphere labor productivity in 2016 was 1405.1 sum, it is lower than in other sectors of the economy. This determines the level of low wages for workers in this sphere, and, first of all, for workers in the budgetary sphere.

Let us consider the influence of the professional factor on the incomes of the population in the republic for 2005-2016. Table 5 shows three generalized professions and their average monthly nominal wage.

It is clear from the table that incomes by profession do grow, but do it unevenly. In 2005-2016, incomes of healthcare workers grew at a faster rate, but the people working in the sphere of finance still have the highest cash income.



Table 5. Average monthly nominal wages in the Republic of Uzbekistan by occupation for 2005-2016, in sum

Years	Finance, credit and insurance		Health, physical culture and sports, social security		Education, culture and art, science and scientific services	
	Amount	Rate of growth	Amount	Rate of growth	Amount	Rate of growth
2005	135,334.5	-	37,949.1	-	44,990.1	-
2010	502,625.9	371.4	236,365.7	622.8	253,904.7	564.4
2015	1,794,672.7	357.1	660,565.7	279.5	753,184.0	296.6
2016	2,069,445.4	115.3	722,024.1	109.3	835,305.5	110.9
Average	1,125,519.6	-	414,226.2	-	471,846.1	-

The final financial result of the activity (profitability and cost effectiveness) of service enterprises is one of the fundamental factors affecting the formation of incomes of workers in the service sector, since the change in the structure of the distribution of the net product may become a factor in the growth of enterprises' profits. In this regard, we have examined the influence of individual factors on the profits formation of service enterprises. First of all, attention was paid to determining the influence of scientific and technical progress on the size of profit through the capital-labor ratio in the use of fixed and circulating funds (Table 6).

Table 6. Dynamics of profit margins in a private school

Indicators	Years			
	2014	2015	2016	2014 in % to 2016
Gross income, t.s.	48,634.0	66,317.9	120,162.00	247.10
Prime cost, t.s.	26,435.0	33,059.0	50,379.00	190.60
Labor compensation fund, t.s.	12,772.7	17,022.0	33,223.60	260.10
Capital-labor ratio, sum	14,990.8	19,217.1	88,388.10	589.60
Net income, t.s.	10,213.1	14,588.6	29,588.70	289.70
Cost effectiveness, %	12.9	16.4	6.47	- 6.43
Labor productivity, t.s.	510.9	740.0	1,582.00	309.60

The analysis showed that the fund-raising ratio increased from 14,990.8 sum in 2014 to 88,388.1 sum in 2016. This was the result of the fact that in 2015, 1,499,355.0 thousand of sum was invested. The growth of the capital-labor ratio, in turn, contributed to the growth of labor productivity, which has increased more than 3-fold as compared to 2014. Econometric modelling of real socio-economic processes and systems is usually aimed at achieving two types of final applied results: obtaining a forecast of economic indicators characterizing the state and development of the economic system and imitating various possible scenarios of the socio-economic development of the economic system. In setting the problems of econometric modeling, it is expedient to determine their hierarchical level and type. The tasks set may belong to the macro level (country, interstate analysis), medium level (regions within the country) and micro level (enterprises, firms, families) and may be aimed at addressing investment, financial or social policy issues, pricing, distributive relations, etc. (Chaston 2017).

Any econometric model is a simplification of a real situation, which is always a complex interlacing of various factors, many of which are not taken into account in the model. This generates a deviation of the real values of the dependent variable from its model values. The economic process is characterized by certain economic parameters (indicators). The meaning and behavior of these parameters depends on a large number of factors that affect these parameters, and it is impossible to fully take into account all the factors. Of the entire set of factors, only a certain limited amount has a significant effect on the parameters chosen for the study. The specific weight of the other factors should be so insignificant that their ignoring of the behavior of the simplified economic system in the process of studying does not lead to significant deviations from the real one. The problem lies in the fact that it is never known in advance what factors under the existing conditions are really decisive, and which ones can be neglected. Consequently, the allocation and accounting in the model of only a limited number of really dominant factors is an important prerequisite for qualitative analysis, forecasting and situation management. Therefore, the task is to determine such dominant factors correctly. The choice of variables in the econometric model implies:

- definition of a set of variables describing the process of functioning of the objects under study;
- analysis of structural links between individual variables;
- choice of a rational type of econometric model.

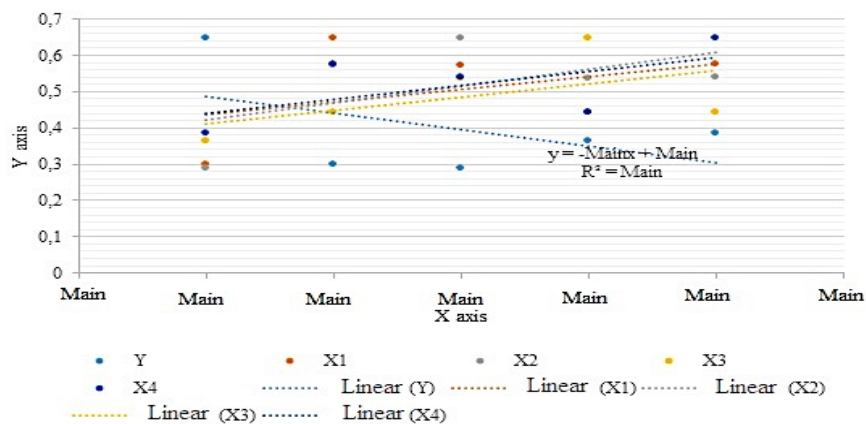


For the needs of modeling the regional labor market in the service sector of Uzbekistan, the average employment rate for 2010 -2017 was chosen as the performance indicator Y. As the factor signs x, affecting the formation of the regional labor market for 2014, the following were chosen:  $x_1$  – the total coefficient of natural increase in population (per 1000 people);  $x_2$  – the share of the unemployed, who are assigned unemployment benefits in the total number of registered unemployed;  $x_3$  – the ratio of the number of pensioners and the number of the population in able-bodied age per 1000 people of the population ("pension load");  $x_4$  – labor productivity, thousand sum/1 person;  $x_5$  – the index of the physical volume of retail trade turnover by the previous year;  $x_6$  – coefficient of migration increase per 1000 people;  $x_7$  – volume of capital investments, million sum;  $x_8$  – economically active population, thousand persons;  $x_9$  – tension coefficient in the labor market, person for 10 vacancies;  $x_{10}$  – average monthly salary of full-time employees, sum;  $x_{11}$  – the number of employment service subjects.

The most common mathematical form of the investigated relationships is linear with respect to the parameters and additive in form. To determine the necessity of including a multifactor regression of certain factors in the equation, as well as to evaluate the obtained equation for correspondence to the revealed relationships, a matrix of correlation coefficients was constructed. It was determined that for further research into the model it is advisable to include the following factors:  $x_4$  – labor productivity, thousand sum/1 person;  $x_7$  – volume of capital investments, million sum;  $x_8$  – economically active population, thousand persons;  $x_{10}$  – average monthly salary of full-time employees, sum. In our case, it is also advisable to include the factors  $x_1$ ,  $x_7$ ,  $x_8$ ,  $x_{10}$  in the model. To ensure the adequacy of statistical data from the time of formation of the multifactorial model, the average data of Uzgoscomstat for the period 2010-2015 was used.

The influence of the above factors on the level of employment of the population is determined using the correlation matrix (here we denote the variable  $x_4$  by  $x_1$ , we denote the variable  $x_7$  by  $x_2$ , we denote  $x_3$  by  $x_3$ , and  $x_4$  denotes the variable  $x_{10}$ ). Pair correlation coefficients (Figure 1) show different strengths of the connection between the level of employment of the population and individual factors. Thus, a close relationship is observed with the average monthly salary (0.595) and the number of economically active population (0.561).

Figure 1. Pairwise correlation coefficients



Since the values of the pair correlation coefficients  $r_{x_1x_2}, r_{x_2x_3}, r_{x_2x_4}, r_{x_1x_4}$ , exceed 0.8, then there is reason to test the model for multicollinearity. Using the Ferrara-Glober algorithm, we make sure that the phenomenon of multicollinearity takes place; therefore, it is not worthwhile to estimate the parameters of the model by the least-squares method. Estimates of the regression coefficients obtained by the least-squares method and their standard errors become unstable, very sensitive to the slightest changes in the data. We delete the variable  $x_3$ , (which has the smallest pair correlation coefficient with the dependent variable and too high pair correlation coefficients with all explanatory variables) from the list of model variables. Since this did not eliminate multicollinearity, we use the principal component method, which makes it possible to investigate the interrelations between the indices, correcting multicollinearity during the multifactorial correlation-regression analysis.

With the help of component analysis, we will investigate the relationship between the value of labor productivity, the number of economically active population and the average monthly salary of full-time employees.

The matrix of pair correlation coefficients R has the form:

$$R^* = \begin{pmatrix} 1 & 0,6835 & 0,8873 \\ 0,6835 & 1 & 0,6847 \\ 0,8873 & 0,6847 & 1 \end{pmatrix}$$

The characteristic matrix for the matrix  $R^*$  has the form:

$$R^* - \lambda E = \begin{pmatrix} 1 - \lambda & 0,6835 & 0,8873 \\ 0,6835 & 1 - \lambda & 0,6847 \\ 0,8873 & 0,6847 & 1 - \lambda \end{pmatrix}$$

The eigenvalues of the matrix  $R^*$  are found from the cubic equation:

$$\begin{vmatrix} 1 - \lambda & 0,6835 & 0,8873 \\ 0,6835 & 1 - \lambda & 0,6847 \\ 0,8873 & 0,6847 & 1 - \lambda \end{vmatrix} = 0$$

Solving this equation by the Cardano formula, we obtain the following result:

$$\lambda_1 = 2,5080; \lambda_2 = 0,3793; \lambda_3 = 0,1127.$$

The matrix  $\Lambda$  of eigenvalues of the matrix  $R^*$  has the form:

$$\Lambda = \begin{pmatrix} 2,5080 & 0 & 0 \\ 0 & 0,3793 & 0 \\ 0 & 0 & 0,1127 \end{pmatrix}$$

The calculated eigenvalues  $\lambda_j$  characterize the contributions of the main components to the total variance of the input characteristics  $X_1, X_2, X_3$ . Thus, the first component explains 83.60%, the second – 12.64%, the third – 3.76% of the total variance. For economic interpretation, it is sufficient to leave only the first two components, the total contribution of which is 96.24% of the total variance of all input characteristics.

The eigenvectors have the form:

$$U_1 = \begin{pmatrix} 0,9995 \\ 0,9071 \\ 1 \end{pmatrix}, U_2 = \begin{pmatrix} 1,0102 \\ -2,2155 \\ 1 \end{pmatrix}, U_3 = \begin{pmatrix} -0,9974 \\ -0,0034 \\ 1 \end{pmatrix}$$

The norm of each of the eigenvectors is

$$|U_1| = 1,6799, |U_2| = 2,6323, |U_3| = 1,4124.$$

The matrix  $V$ , consisting of the normalized vectors  $V_j$ , has the form:

$$V = \begin{pmatrix} 0,5950 & 0,3838 & -0,7062 \\ 0,5400 & -0,8417 & -0,0024 \\ 0,5953 & 0,3799 & 0,7080 \end{pmatrix}$$

Matrix of factor loads:

$$A = V \times \Lambda^{1/2} = \begin{pmatrix} 0,9423 & 0,2363 & -0,2371 \\ 0,8552 & -0,5183 & 0,0008 \\ 0,9427 & 0,2340 & 0,2377 \end{pmatrix}$$

Analysis of the matrix of factor loads  $A$ , shows that the first main component is closely related to all three factors: labor productivity ( $a_{11}=0,9423$ ), the number of economically active population ( $a_{21}=0,8552$ ) and the average monthly salary of full-time employees ( $a_{31}=0,9427$ ). The values of the principal components are assumed by the matrix:

$$G = A^{-1} \times Z \quad (1)$$

where:  $z_{ji} = \frac{x_{ij} - \bar{x}_j}{s_j}$  is the normalized values of the factor attributes ( $i=1,2,3; j=1,2,3$ ).

Thus, the matrix of values of the main components of GT can be used as input information for the multidimensional classification of economic activity using discriminant and cluster analysis. The values of the principal components make it possible to classify the aggregate of initial factor attributes and groups whose generalized indices are the principal components. For the main components, the phenomenon of multicollinearity is absent; they are very convenient for constructing multifactorial correlation-regression models.

The model with the main components has the form:

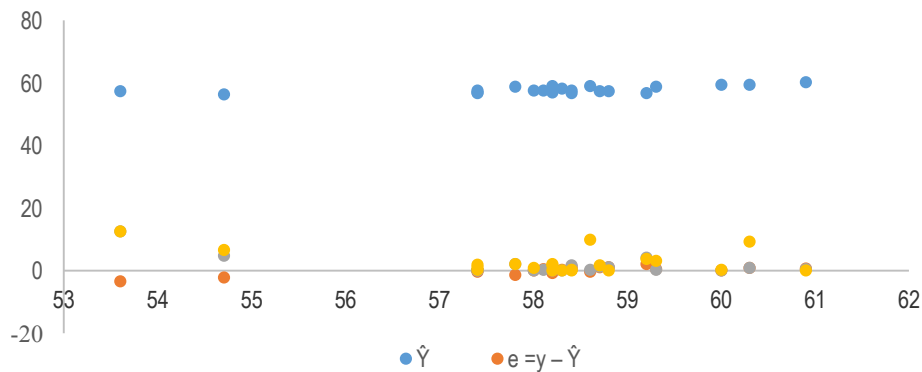
$$\hat{y}_i = \bar{y} + \sigma_y \times M_i \tag{2}$$

$$i = \overline{1, n} \tag{3}$$

where:  $M = G^T \times (G \times G^T)^{-1} G \times Y^*$

The random deviations of the theoretical values of the resulting variable (using the principal components method) from the actual ones are given in Figure 2.

Figure 2. Random deviations of the theoretical values of the resulting variable from actual



Correlation coefficient  $R=0.762$  characterizes a moderate relationship between the level of employment of the population and the factors presented. The coefficient of multiple determination  $R^2 = 0.581$  shows that, on average, the variation in the employment rate of the population due to the change in the presented factors is 58.1%.

To determine the randomness of the existing relationships, the F-criterion (4.68), which is higher than the tabulated value for the degree of freedom  $\alpha=0.05$  ( $k_1=3, k_2=18$ ), was calculated in the model. Thus, this model can be used to further assess labor market trends. To study the significance of factor attributes, let us compute t-statistics. The tabulated value of the t-criterion of the normal distribution for a given level of confidence in the probability of 0.95 is  $t_{tab}=1.734$ . The corresponding actual values of the t-criterion are higher than all those three factors, which indicate that all the selected factors significantly affect the performance indicator.

Assumptions that were made during the estimation of model parameters may be violated in practice. In addition to the multicollinearity problem discussed above, the condition of homoscedasticity of excesses may be violated, in which the variance of the excesses becomes for each observation. To test the sample of heteroscedasticity, when the variance of the residues changes for each observation or group of observations, the Goldfeld-Quandt parametric test is applied. To do this, you first sort the elements of each independent variable in ascending order. The data of the dependent variable  $Y$  are divided into two sets of observations with a volume of 8 elements, rejecting 6 observations that are contained in the center of the ordered series. This procedure will allow us to compare the variance of the remainders for the smallest and largest values of the explanatory variable. The value of the variance ratio of the  $S_2/S_1$  excesses for each variable does not exceed the critical value of the F-criterion, from which the conclusion is made that the initial data are homoscedastic.

Another assumption of classical regression analysis is the assumption that the random variables  $e_i = Y_i - \hat{Y}_i, i = 1, 2, \dots, n$  are independent. If this assumption is violated, autocorrelation of the residues is observed. To test the sample for autocorrelation by the Durbin-Watson statistic, the DW statistics are calculated. Using the data in Figure 2, we find the calculated value:

$$DW = \frac{\sum_{i=2}^n (e_i - e_{i-1})^2}{\sum_{i=1}^n e_i^2} = 1,875$$

Using the Durbin-Watson statistical tables for the sample size  $n = 22$ , the number of independent variables  $k = 3$  and the given significance level of 5%, we find the value of  $d_1 = 1.05$  and  $d_u = 1.54$ . The calculated value lies in the interval (1.66; 2.34), which indicates the absence of autocorrelation of the excesses.

### Conclusions

The development of the economy, the increase in production efficiency associated with the reproduction of labor, are trends in the development of employment of the population of Uzbekistan and its regions. One of the

important prerequisites for regulating the economy is the development of labor market development models. The economic and mathematical modeling of the labor market, which connects various models of economic development (demographic, educational, labor movement of the population), is a necessary condition for the formation of an information base for the adoption of effective management decisions by various branches of government today.

At the present stage, Uzbekistan does not have a well-developed methodology for modeling and forecasting the dynamic processes of development of the social and labor services sector on the basis of econometric tools. Carrying out scientific research in this direction will complement the analysis and will help determine the unique features of the labor market, help to formulate the measures of state social and economic policy more accurately, and forecast labor market trends. According to the Okun's law, an increase in the unemployment rate by one percent over the natural level yields 2-2.5% of the GNP loss compared to the potential one. From this law it follows that certain rates of GNP growth are necessary in order to keep the unemployment rate at the same level. Consequently, the development of the service sector is a prerequisite for reducing the level of unemployment, resulting in an increase in the material condition and social security of society. Annually a certain part of the domestic product should be used to create new jobs that can contain unemployment.

The paper suggests a multi-factor model of the dependence of the employment level in the service sector on labor productivity, the number of economically active population and the average monthly salary of full-time employees. Therefore, it is proposed to use it for cluster modeling and forecasting of regional labor markets in Uzbekistan in the future.

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## How Change Management Affects the Quality of Management Accounting Information Systems and its impact on User Satisfaction. Survey on State Owned Enterprises in Indonesia

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### Abstract:

Previous researchers have conducting research on management accounting information systems and user satisfaction. This study aimed to examine the effect of change management on the quality of management accounting information system and its impact on user satisfaction at State Owned Enterprise in Indonesia. Survey conducted on 345 respondents i.e. operational managers of state-owned enterprises. Data is collected using questionnaires. The variance based SEM used to data analysis, to test hypothesis testing used t-test. The results show that change management has a significant effect on the quality of management accounting information system. In addition, the quality of management accounting information system has a significant effect on user satisfaction.

**Keywords:** change management; quality; accounting information systems management; user satisfaction

**JEL Classification:** C02; C12; C83; M41

### Introduction

Development of information systems is one factor that can improve performance improvement. With an integrated system, management objectives will be easily realized (Wilkinson 1989). The user involvement is influenced key criteria such as system quality, user satisfaction and system usage (Ives and Olson 1984). They believe that user involvement in the process of system development has a positive effect on satisfaction on Computerize Based (Ives, Olson and Baroudi 1983). Required quality of good information system would improve the user satisfaction. Information system user satisfaction can be used as one measure of the success of an information system (Doll and Torkzadeh 1988). User satisfaction can be measured based on user relationship problems with the information system staff, the quality of information generated by the system, and the reliability of the system (Weber 1999).

What factors can affect the quality of management accounting information systems, and how their impact on user satisfaction, is interesting to investigate. According to the Ministry of State Owned Enterprises (SOEs) noted that there are still dozens of SOEs whose performance is not satisfactory. This is caused by the weakness of information systems that make the management decision is not optimal. Thus user satisfaction information is not achieved. User satisfaction of information systems depends on the quality of information generated for decision-making (Stair Reynolds 2012). This is indicated by the weak competitiveness of SOEs in the global market, SOE business processes are mostly irregular and not well organized, structures are not based on competence and limited resources such as human resources that are not committed (Rini Soemarno 2018).



Have not been able to compete with competitors from the same business process and are not well organized, it also affects the effectiveness of the slower interdepartmental working process because much time is needed in the work process so that decisions are taken slowly. A slow decision will certainly hamper future corporate growth. It needs change management to build a successful system (Laudon and Laudon 2016). Change management integrates the various variables that contribute to the success of the project (new system) Thomas Lauer (2014). Management accounting information system can be said to be qualified if it can be used as an integrated framework for decision making in achieving company goals (Wilkinson 1989 and Hansen Mowen 2007).

## 1. Literature review

### 1.1. Change management

Changes are necessary for the survival of an organization. Without change, it is certain that the age of the organization will not last long. Change management includes organizational change control and flexible adaptation for constant change (Laudon and Laudon 2012). Change management is the application of a set of tools, processes, skills and principles, to managing people in change that involve stakeholders to achieve the expected results of change projects (Mukkamala 2013). Change management is the act of switching management, from the current conditions to a better condition in an effort to achieve the goal (Winardi 2013). Management changes in this study, aimed at providing business solutions, namely the implementation of information systems, through the management of the impact of changes on the people involved. From some opinions it can be concluded that change management is a management effort in achieving better performance, to overcome the problems arising from the changes. (Laudon and Laudon 2012, Mukkamala 2013, Winardi 2013)

Kurt Lewin proposed the concept of the pore file model, the father of change management. According to him, change occurs because of the emergence of pressure on organizations, individuals or groups. He concluded that the strength of power would be faced with resistance to change. The concept of Change management is the effort made by management in overcoming problems arising from the changes (Laudon and Laudon 2012, Mukkamala 2013, Winardi 2013, Kurt Lewin 1951). Dimensions change management and indicators in this study, referring to (Gibson 1994 and Laudon 2012), are as follows:

- a. *Structural*: redesigned work, workflow is made in detail and explained, the organizational structure;
- b. *Behaviour*: solid working team, training, skills, leadership, supervision;
- c. *Technology*: hardware, there are an Internet network, availability of technology infrastructure, the development of information technology.

Effective change management is not merely a matter of over-promotion or a set of theories but more than that, organizations are required to be ready to use new technology and reduce the risk of failure to maximize return on serious investment, in this effort to succeed the information system management accounting.

### 1.2. Quality Management Accounting Information System

Management accounting information system is the integration of various components/subsystems in harmony to process data into management accounting information (Susanto Azhar 2013). How the information system is said to be qualified, *i.e.* when there is a match between the required specifications compared with the specifications used by the company (Susanto Azhar 2013). Quality is also an indicator of how well the end result of the information system meets the goals set by management (Laudon and Laudon 2012).

The quality of management accounting information systems is measured by the ability to provide correct information as needed by managers in a timely manner (Anderson 2003). Based on the above definition of the concept of quality management accounting information system in this study is a specification that can be used as an integrated framework to provide relevant information in decision making. The measurement of quality information system is easy to use reliably and integrated (Bocij 2015). In particular, to measure the quality of management accounting information systems use the dimensions of Integration, Flexibility, Accessibility, Formalization and Media wealth (Heidman 2008). From the measurement of information systems disclosed by (Bocij 2015, Chang 2012 and Heidman 2008), the measurement of accounting management information system quality in this study, using integration, flexible, reliability, and efficient.

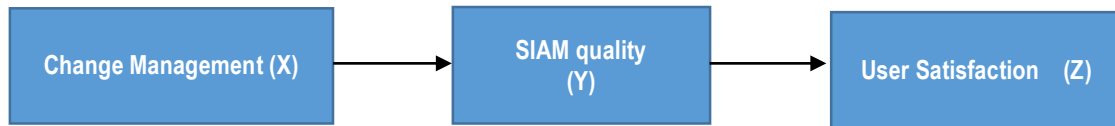
### 1.3. User satisfaction

Information system user satisfaction viewed from the user's point of view is meeting user expectations (Fisher 2001). This is consistent with the theory of expectations, which is developed specifically in the practice of

motivation by Vroom (1964). A person will be motivated if there is a strong link between effort, performance and outcomes (Vroom 1964). Measurement of user satisfaction information refers to (Weber 1999, Fisher 2001, Ong 2009, Fleischman 2010 and Delone McLeand 1992), then in this study, measurement indicators of the dimensions of user satisfaction information using:

- a. fun/enjoyment, indicators are: user interface design, dependence on information systems, effectiveness and usefulness of the system and customize user workflow and system design;
- b. decision making satisfaction, indicators are: timeliness generated for decision making, and relevance and output in decision making.

Figure 1. The study model



#### 1.4. Framework

##### The effect of change management on the quality of management accounting information system

In the Change Management model, (Kurt Lewin 1951) says that change occurs because of the emergence of pressures on organizations, individuals or groups. He concluded that the driving force would be faced with the refusal to change. It needs change management to respond and manage resistance and how to make effective change. Internal organizational change creates resistance and opposition that can lead to a failure of the system properly, therefore building a successful system requires change management (Laudon and Laudon 2016). Change management explains the systematic process of introducing new structures, behaviours and technologies to achieve goals (Gibson 2012). Revealing the factors of technology have an influence is very important to ensure the successful implementation of accounting information systems (Hussein 2007). Change management is a systematic approach in system development (Christian 2013)

Effective change management is not just a matter of over-promotion or a set of theories but more than that, organizations are demanding to be ready to use new technology and reduce the risk of failure to maximize return on serious investment, in this case managing changes in successful implementation management accounting information system. The main purpose of management of information technology organization is to improve the effectiveness of operational activities of information systems (Blanton 1992). Change is needed for the survival of an organization in the face of the times. Organizations are required to be ready to use new technology, manage changes in the implementation of successful management accounting information systems.

##### 1.5. The Influence of quality management accounting information system to user satisfaction

The link between the successful application of accounting information systems and the theory of expectations is explained by (Burton 1992), according to him intrinsically based on the expectations theory of an accounting information system user will always evaluate the impact of the use of accounting information system, such as increased efficiency and effectiveness of decision making, decisions, and increased understanding of work. To measure the information system user satisfaction can be seen from the quality of information generated by the information system, and reliability of the information system itself to assist users in completing the work (Weber 1997).

User satisfaction is a measure that explains the quality of information systems and the quality of information (Seddon and Kiew 1996). Survey conducted on the type of organization that is health care, consumer goods, financial services and government, found that the quality of information systems significantly influence the user satisfaction of information systems (Wixom and Todd 2005). It can be concluded that user satisfaction information is the fulfilment of individual expectations of information generated by the system. Based on the description in the above framework, this research model can be seen as:

Follows the Figure 1, furthermore, the hypothesis proposed in this study are as:

- organizational commitment has an effect on quality management accounting information system;
- quality management accounting information system effect on user satisfaction.

## 2. Material and methods

This research uses explanation, survey method. The population in this study is all state-owned enterprises in Indonesia. The target respondents in this research are operational manager. Fifty questions were distributed to a

sample number of 574 respondents from 115 State-Owned Enterprises; further questions would be used in statistical analysis. The instruments used for data collection are questions. The question covers 9 dimensions of 3 variables: change management, quality management accounting information system and user satisfaction. The study used a five-point average scale of "strongly disagree" with "strongly agree" to examine participants responding to the questionnaire statement. Questionnaires to be used previously tested the validity and reliability. Furthermore, the analysis method uses sums PLS analysis while hypothesis testing uses t-test. All analyses were performed using product statistics and service solutions.

### 3. Finding and discussion

Recapitulation validity test results on research instrument (questionnaire) can be seen in Table 1.

#### 3.1. Convergent validity

Table 1. Recapitulation validity of test results

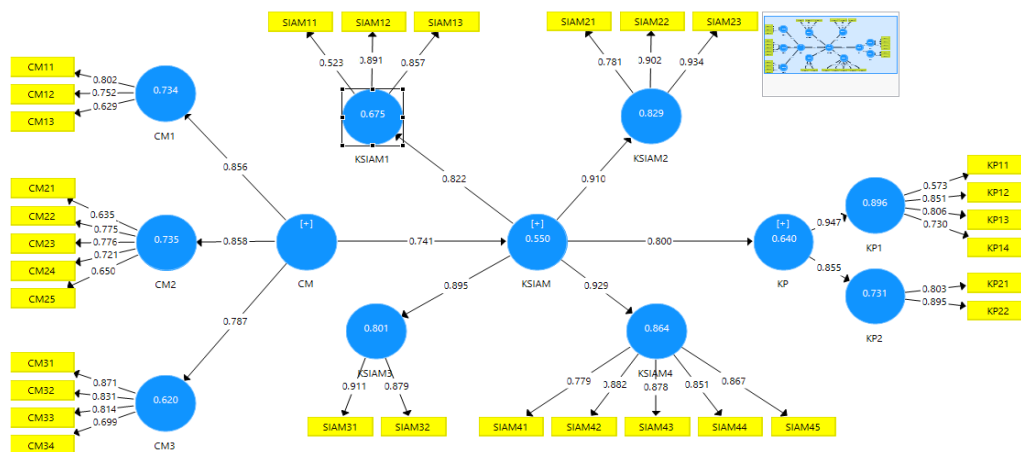
Corrected item			
Variables/Items	total correlation	critical R	Explanation
Change Management			
CM11	0,802	0,105	Valid
CM12	0,752	0,112	Valid
CM13	0,629	0,115	Valid
CM21	0,635	0,144	Valid
CM22	0,775	0,089	Valid
CM23	0,776	0,117	Valid
CM24	0,721	0,093	Valid
CM25	0,650	0,108	Valid
CM31	0,871	0,057	Valid
CM32	0,831	0,064	Valid
CM33	0,814	0,049	Valid
CM34	0,699	0,092	Valid
Quality SIAM			
KSIAM11	0,523	0,143	Valid
KSIAM12	0,891	0,023	Valid
KSIAM13	0,857	0,036	Valid
KSIAM21	0,781	0,050	Valid
KSIAM22	0,902	0,025	Valid
KSIAM23	0,933	0,018	Valid
KSIAM31	0,911	0,017	Valid
KSIAM32	0,879	0,036	Valid
KSIAM41	0,779	0,055	Valid
KSIAM42	0,882	0,031	Valid
KSIAM43	0,878	0,027	Valid
KSIAM44	0,851	0,041	Valid
KSIAM45	0,866	0,065	Valid
User Satisfaction			
KP11	0,573	0,138	Valid
KP12	0,851	0,031	Valid
KP13	0,806	0,064	Valid
KP14	0,730	0,089	Valid
KP21	0,803	0,195	Valid
KP22	0,895	0,029	Valid
Convergent Validity			

The validity test shown in Figure 2 diagram of the full model line shows that factor under 0.7 is KSIAM11 (a set of related components) of the integration dimension and KP11 (user interface design) of the pleasure dimension and CM13, CM21, CM34 respectively-presenting the factor value is 0.52; 0.57; 0.629; 0.635 and 0.699 but retained are not excluded from the model because (Chin 1991), said that the loading factor of 0.50-0.60 can be considered quite valid. Based on the result of convergence validity test, it can be concluded that all measurement tools of change management variable can be used in making questionnaire. The appropriate construct gauges for measuring the quality variables of a management accounting system are integrated, flexible, reliable, and efficient. Appropriate constructor steps to measure user satisfaction variables are pleasure and Decision Making Satisfaction. Appropriate constructor measures to measure changes in management variables are structural, behavioural and technological.

### 3.2. Discriminant validity

Discriminant validity test is assessed based on measurement cross measurement scale with variable construct. If the value of cross loading has a correlation greater than 0.7 to construct variables, the construct gauges have high discriminant validity (Chin 1991). To see the results of the calculation of discriminant validity shown by Figure 2 below:

Figure 2. The study model



From the calculation results can be explained that the value of cross loading constructor gauges for construct variables as follows:

1. construction change variable constructs are: work redesign, organizational structure, training, skills, leadership, hardware, internet network, availability of technology infrastructure, has a value of cross loading greater than 0.7 in the variable construct, that is 0.802; 0.752; 0.775; 0.776; 0.721; 0.871; 831 and 0.814. The construct gauges have the highest correlation to the variable constructs, so they are said to have high discriminant validity except for organizational structure, solid team supervision and development of information technology has a value below 0.7 i.e. 0.629; 0.635; 0.650 and 0.699 but according to (Chin 1991), said that the loading factor 0.50 to 0.60 can be considered valid enough;
2. measurers of quality management accounting information system variables are related to each other, simplification of business processes, centralized data master, according to user needs, there are input options, there are output options, available to users, generate reliable information, the number of inputs generates number of outputs, fast response time, efficient data storage, efficient data back up, and determine the amount of time the completion of the work. Has a cross loading value greater than 0.7 except KSIAM 11 which is a set of interconnected components with each other having a value of 0.523 below 0.7 but retained because (Chin 1991), said that the loading factor 0.50 to 0.60 can be considered valid enough;
3. measurers of constructs of user satisfaction variables are user interface design, dependency using management accounting information system, effectiveness of system usability, system design according to workflow, timely in decision making, and relevance and output of decision making. All have a cross loading value greater than 0.7 in the variable construct, unless the user interface design has a value of 0.57 below 0.7. According to (Chin 1991), an indicator is said to have good validity if its value is greater than 0.70, although Chin says that the loading factor of 0.50 to 0.60 can be considered sufficient. If there is a loading factor below 0.50, but still greater than 0.4 it should be considered to remain used as a measuring tool as long

as if disposed not cause-increased reliability (Hair 2017). Therefore, construct gauges that still have values above 0.5 are still used as a measuring tool.

Table 2. Recapitulation reliability of test results

Variable	Cronbach's alpha	Critical point	Explanation
Change Management	0,855	0,037	Reliable
SIAM Quality	0,935	0,050	Reliable
User Satisfaction (KP)	0,795	0,012	Reliable

Using composite reliability and Cronbachs Alpha that aims to test the reliability of the instrument in a research model does reliability testing. If all values of latent variables have composite reliability or Cronbachs alpha  $\geq 0.7$  it means that the construct has good reliability or the questionnaire used as the tool in this research has been reliable or consistent. From the calculation results, the results obtained that each variable construct has reliability value both Cronbachs alpha and composite reliability greater than 0.7. This can be interpreted that all constructor measures used are reliable and accountable.

To assess the goodness-fit model by looking at the R-square values found in the PLS Algorithm report, as shown in Table 3.

Table 3 - R-square values found in the PLS algorithm report

**R Square**

	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
CM1	0.734	0.740	0.066	11.170	0.000
CM2	0.735	0.747	0.066	11.108	0.000
CM3	0.620	0.626	0.103	6.035	0.000
KP	0.640	0.628	0.109	5.889	0.000
KP1	0.896	0.900	0.033	27.069	0.000
KP2	0.731	0.747	0.063	11.701	0.000
KSIAM	0.550	0.550	0.102	5.383	0.000
KSIAM1	0.675	0.683	0.062	10.967	0.000
KSIAM2	0.829	0.830	0.034	24.600	0.000
KSIAM3	0.801	0.800	0.077	10.382	0.000
KSIAM4	0.864	0.863	0.034	25.690	0.000

R Square	
KSIAM (Quality of Management Accounting Information System)	0,074
KP (User Satisfaction)	0,640

Furthermore, because in this study there are mediation variables, then testing the goodness of fit structural model in inner model, added using predictive-relevance (Q2). A larger Q-square value of 0 (zero) indicates that the model has a predictive relevance value. The predictive-relevance value is obtained by the formula:

$$Q2 = 1 - (1 - R21) (1 - R22)$$

$$Q2 = 1 - (1 - 0.0742) (1 - 0.6402) \tag{1}$$

$$Q2 = 0.4123303$$

The value of Q2 of 0.412 means that 41.23% of the overall model is capable of contributing; the remainder is explained by other variables that are not analysed. This means that the model has a predictive value of relevance.

To know significant or not significant, seen from T-table at alpha 0,05 (5%) = 1,96, then t-table compared with t-hitung (T-statistic). If t arithmetic is greater than t table, then the hypothesis is accepted. If the opposite happens, then the hypothesis is rejected. In addition, it can also compare the significance value that occurs with the level of uncertainty of 0.05. If the value of significance that occurs (indicated by the value of P Value) is smaller than the 0.05 level of uncertainty, then the hypothesis is accepted. If the opposite happens, then the hypothesis is rejected. From the result of the path coefficient as shown in Table 4 below, it can be seen that all relationships between variables turned out to have a significant effect, where the resulting statistical t value is greater than 1.96, or the value of P Value is smaller than the level of uncertainty of 0.05.

Table 4. Hypothesis Testing results

**Path Coefficients**

	Original Sampl...	Sample Mean (...)	Standard Devia...	T Statistics ( O...	P Values
CM -> CM1	0.856	0.859	0.039	22.081	0.000
CM -> CM2	0.858	0.863	0.039	21.768	0.000
CM -> CM3	0.787	0.788	0.069	11.445	0.000
CM -> KSIAM	0.741	0.737	0.078	9.556	0.000
KP -> KP1	0.947	0.948	0.018	53.946	0.000
KP -> KP2	0.855	0.864	0.037	23.235	0.000
KSIAM -> KP	0.800	0.789	0.073	10.954	0.000
KSIAM -> KSIA...	0.822	0.825	0.038	21.875	0.000
KSIAM -> KSIA...	0.910	0.911	0.019	48.993	0.000
KSIAM -> KSIA...	0.895	0.894	0.044	20.300	0.000
KSIAM -> KSIA...	0.929	0.929	0.018	51.012	0.000

	Original Sample(O)	Standard Error(STERR)	T Statistics	P Values
Change Management → SIAM Quality	0,741	0,078	9,556	0,000
SIAM Quality → KP (User Satisfaction)	0,800	0,073	12,483	0,000

3.3. Hypothesis testing 1

H1: Change management has a significant effect on the quality of management accounting information system

Table 5. Result of Testing Hypothesis of the influence of change management on the quality of management accounting information system

Path Coefficient	t count	t critical	Hypothesis Ha1
0,741	9,556	1,96	Accepted

The results of statistical tests showed that the value of t-statistics was  $9,556 > 1,96$  and p-value  $0,000 < 0,05$  (see Table 5). Based on the test results, then H1 accepted. In Table 5 is known result of coefficient calculation of change management path to SIAM quality equal to 0,741 with positive value. This means that the higher the management of change, then the quality of SIAM is increasing. Furthermore, the path coefficient is tested to determine whether there is any effect of change management on the quality of management accounting information system. Based on Table 5, the obtained value of *t* arithmetic for change management is  $9.556 > 1.96$  or greater than *t* table 1.96. Because the value of *t* arithmetic is greater *t* table, then Ho is rejected and Ha accepted. This means that management changes affect the quality of management accounting information systems. This study proves empirically that the more successful management of change in the organization the more quality management accounting information system. This means that the management of changes in each SOE cause the level of quality of accounting information systems is increasing.

3.4. Hypothesis testing 2

H2: The quality of SIAM has a positive effect on user satisfaction

Table 6. Results of tests user ethical hypothesis on the quality of accounting information systems

Path Coefficient	t count	t critical	Hypothesis Ha2
0,800	12,483	0,064	Accepted

The result of statistical test shows that the *t*-statistic value is  $12,483 > 1,96$  and p-value  $0,000 < 0,05$  (see Table 6). Based on the test results, then H1 accepted.

Furthermore, the path coefficient is tested to determine whether there is influence of SIAM quality to user satisfaction. Based on Table 6 obtained *t* count value for SIAM quality is  $12.483 > 1.96$  or greater than *t* table 1.96. Because the value of *t* arithmetic is greater *t* table, then Ho is rejected and Ha accepted. This means that SIAM quality has a significant effect on user satisfaction. The results of this study provide empirical evidence that the quality of management accounting information systems can support increasing user satisfaction in SOE companies. It can be interpreted also that the quality of management accounting information can be improved if



the SOE company supports the improvement by performing / implementing quality management accounting information system itself which consists of integration, flexible, reliable, and efficient.

#### 4. Discussion

##### 4.1. Effect of change management on quality management accounting information system

The results of this study answer the problems that arise, especially the problem of user satisfaction over information systems used in the company of Bandan State Owned Enterprises. Management of change is expected to seek management in achieving better performance, in overcoming the problems arising from the changes. This study provides empirical evidence that change management can support improving the quality of management accounting information systems in SOE companies. It can also be interpreted that change management can be implemented properly if a SOE company manifests it by performing/implementing change management itself including technology, structural and behaviour.

Judging from the range of values given by respondents to change management variables, which consists of structural dimensions, behaviour and technology, the most reflective indicator on change management is the indicator of the availability of technology infrastructure and information technology development indicators, is in the technological dimension. However, there are still respondents who are not satisfied with the technology infrastructure provided by the company. Changes in the organizational structure also require special attention. Competent and committed personnel should support the organizational structure. In addition, some respondents felt that the work flows was made less detailed and less explanatory. The respondent answer value for the pre-enclosed dimension is quite "good" but there are still respondents who feel less attention and support from the leader at the request of facilities that facilitate the work, such as the demand for new systems.

##### 4.2. The influence of quality management accounting information system to user satisfaction

The results of this study answer the problems that arise, especially the problem of user satisfaction over information systems at State-Owned Enterprises. This study provides empirical evidence that the quality of management accounting information systems can support increased user satisfaction in state-owned enterprises. Based on the value of respondents' answers as a whole, state-owned enterprises have quality management accounting information systems categorized "good" but there are still some state-owned enterprises that have quality management accounting information system "less good". Quality management accounting information system can be seen from the dimensions of measurement used *i.e.*, dimensions integration, flexible, reliable, and efficient. The value of respondents' answers to the quality of management accounting information entered in the category of "good", but the value of the influence given the quality of management accounting information system to user satisfaction is quite small. The small influence of the quality of management accounting information system to user satisfaction is an indication that state-owned enterprises have not yet integrated, flexible, reliable, and efficient system. The results of this study answer the problems that arise, especially the problem of quality information systems.

There are still dozens of SOEs whose performance is not satisfactory. This is caused by the weakness of information systems that make the management decision is not optimal. Inadequate information systems also result in SIAM not being able to process integrated information. An integrated accounting management information system is required for data from all relevant parts to be processed in a balanced way so that management in making decisions can cover all aspects of the organization. In an uncertain environment of course management must have various alternatives in decision-making. Thus, if there is a change in the management environment can immediately implement mitigation against other alternatives. Decision-making is always about the future. Thus required reliable accounting management information. Reliable information is generated by the right assumptions. Data generated by inadequate information systems will result in not optimal decision made because the data processed SIAM little or maybe even excessive. If this happens, decision makers are dissatisfied with the information they get and decision-making can be wrong.

#### Conclusion

This study aims to determine the effect of change management on the quality of management accounting information system and its impact on user satisfaction at State-Owned Enterprises in Indonesia. The result of hypothesis testing shows that management of change has a significant effect on the quality of management accounting information system and quality of management accounting information system that influence the user satisfaction. These results can be interpreted that change management plays an important role to realize the

quality of management accounting information system, which gives satisfaction to the user.

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## Reengineering Approach: A Model for Providing the Effectiveness of Investment Potential Management in the Republic of Dagestan

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### Abstract:

The great importance is attached to the problem of effective investment potential management in the Republic of Dagestan (RD), as well as throughout Russia as a whole, as to one of the tools of the country's socioeconomic development. The difficult economic situation and the delayed utilization of the republic's investment potential require the development of an understandable innovative model for providing effective investment potential management in the RD. Consequently, the relevance of the research problem is determined by the need to develop such a model for managing the region's investment potential, which through new approaches and methods could provide a solution to this problem. The purpose of the article is to substantiate and give reasons for the need to apply a reengineering approach in the investment activity of the Republic of Dagestan and present one-and-only, new innovation model for providing the effectiveness of the investment potential management in the republic, which can be used for other regions of Russia.

The study has proved the theoretical significance of the effectiveness of applying the reengineering approach in investment activities and using the presented new innovative model for providing the effectiveness of investment potential management in the practice of investment management. The findings of this research could be used by various management bodies in the process of improving and developing the management system and intensifying investment activities at the regional level. The research materials can also be used in the educational processes at higher education institutions.

**Keywords:** reengineering; model; investment; management; effectiveness; tools; potential; region

**JEL Classification:** E2; H80; H12

### Introduction

The reengineering approach is used as a theoretical research method that is based on a deep, comprehensive and radical transformation, rethinking and redesigning of investment management processes in the republic to ensure high investment effectiveness. And also the simulation is applied in the form of a semantic model as the most acceptable for ensuring the effectiveness of the republic's investment potential management, with substantiation of the necessity to use it for complex systems. The research is also based on a general scientific methodology that involves the application of a systematic approach to problem solving.

The fundamental works of domestic and foreign scholars on the problems of managing the innovative development of the enterprise make the basis of the study. A wide range of components providing effective investment potential management is considered at the regional level, in particular: the participation of the region in federal targeted programs; management entities and management assets at the regional level; key areas of investment development; perspective and attractive sectors for investors; the main factors of investment activity attractiveness; measures to increase innovation activity; information support; legislative, political and economic measures of investment activity; principles and methods of management. It is substantiated that the presented new model enables to develop in the long term a more detailed mechanism for ensuring its implementation to effectively manage innovation activities at the regional level, and the reengineering approach will allow achieving the following results: improved investment attractiveness, reduced investment risks, provided economic growth and improved living standards of the population.

The problem of effective investment potential management, especially in the regions, is of particular importance today in the view of modern dynamic development in all spheres of industrial and innovative activities. The relevance of the problem in the Russian regions is so obvious that fundamentally new methods and approaches, solutions to this problem are required. In our opinion, the use of reengineering approach, taking into account regional peculiarities, foreign and Russian experience can become one of such cardinal approaches.

The hypothesis of the present study was to prove the effective use of the region's investment potential

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applying the reengineering approach and develop such a model for ensuring the region's investment potential management, which could provide a solution to this problem through new approaches and methods.

The purpose of the study is to develop, through reengineering approach, such an investment model for ensuring the effectiveness of investment potential management in the region, justifying its need and to use this semantic model for complex management systems at the regional level, as evidenced by the obtained scientific results.

The statistical data given below which characterize the bad trends in the development of innovation activity argue for the relevance of the topic both for the region and for the country.

The originality of the research lies in the fact that the proposed approach and the model of innovative activity have not previously taken place and are distinguished by their theoretical and practical significance. During the research, the reengineering approach was used as a scientific method with the simultaneous use of the simulation method and in particular the semantic method for ensuring the effective use of the region's investment potential in a practical aspect with a variety of necessary tools and mechanisms for its implementation.

The main research results prove the effective use of the reengineering approach in terms of theory and demonstrate the viability of using the proposed innovation model to ensure the effective use of the region's investment potential in practical terms. The latter sections of the paper provide an overview of the scientific literature, describe the research procedures and its results, and present practical recommendations in the framework of the discussion, followed by the appropriate conclusions.

## 1. Literature review

The process-based management manifested in the reengineering approach seems to be one of the essential investment ways to improve the system of ensuring the effectiveness of investment potential management in the region. It should be emphasized that this research relied on a great contribution to the development of the concept of reengineering made by such modern scholars as: Blinov *et al.* (2015), Ostroukhova (2015), Klavsuts and Rusin (2017), Abdullaeva *et al.* (2016), Parakhina and Solomina (2015), Gamidullaev (2014), Balashov (2016).

As stated by foreign and domestic researchers, in its essence and content the reengineering approach already provides for the investment potential management and introduction of innovative technologies (Radzhabova *et al.* 2017, Baranov *et al.* 2015, Gracheva 2013, Vilensky *et al.* 2012, Ilyina 2012, Igoshin 2012, Guskova *et al.* 2010, Shanin 2012, Bondarenko *et al.* 2018, Romanova *et al.* 2018, Osipov and Kuzubov 2018, Folom'ev 2017, Khan and Panarina 2017, Kuznetsov and Kuznetsova 2016, Gerasimov and Novikova 2015, Sukharev 2015, Rozhdestvensky and Golov 2015, Andreeva and Nechaev 2014, Akatov and Panarina 2014, OECD 2014, Tsymbalov and Degtyareva 2014, Pertsev 2013, Allen 2011).

This research is designed to fill the gap that exists in scientific knowledge in terms of using the reengineering approach and simulation for managing the investment potential at the regional level.

The practical importance and incomplete picture of this problem determined the necessity to develop a new practical and effective model using the reengineering approach to provide the effectiveness of investment potential management in the region, while using appropriate tools, fundamental managing principles and methods, the recommendations of the management process, as well as legislative, political and economic measures of investment activity.

Appropriateness of the proposed reengineering approach is confirmed by numerous researchers, for example, Stefanescu *et al.* (2007) stress the need of "rethinking business through reengineering and demonstrate how reengineering can be carried out in various corporate settings and that it involves making major changes that are likely to cut across traditional organizational boundaries".

Also, Nestor Shpak, Oleg Sorochak, Maryana Hvozd, Włodzimierz Sroka (2018) consider the issues of reengineering approach in terms of risk classification and evaluation and propose the method for assessing the impact of these risks on the effectiveness of reengineering projects. Arun Sundararajan (2001) also justified the need to design a reengineering process and indicated characteristics or functionality of information systems that are most desirable for a particular modeling process or organizational structure.

Considering the reengineering approach from a strategic position, Bhaskar and Singh (2014) indicate "Business process reengineering (BPR) is a tool to help organizations to improve Quality, customer services, cut operational costs and become leaders in their domain. BPR could act as an important strategic tool for sustained competitive advantage for foreign or Indian manufacturing companies (public and private) in the present context".



## 2. Materials and methods

The effectiveness of the region's investment potential management as a significant problem can be ensured by various methods. In this regard, this problem should be studied precisely from the standpoint of the effective use of all the determining resources (investment components) and, most importantly, by maximum use of the most effective tools for ensuring reengineering of management processes.

In modern dynamic and innovative conditions, the investment policy is no doubt an important component of ensuring successful economic development in a crisis. Therefore, the priority task is to accelerate investment activities with simultaneous involvement of mechanisms for attracting and searching for investment sources and also to develop normative and legal and other acts with the mechanisms for ensuring guarantees and effective use of funds.

Many foreign and domestic scholars and experts believe that the Russian problems of attracting investments lie behind the inefficiency of market mechanisms with the weakening of the public administration system and its role in the development of the country, as well as the low level of managing both internal and external investment flows due to little experience in the framework of the change of the previous model of economic development to market conditions of development (Radzhabova *et al.* 2017, Baranov *et al.* 2015)

The analysis of various methods used in the implementation of innovative activities at the regional level confirmed our assumptions, enabling to verify the need for a more progressive reengineering approach in terms of theory, with simultaneous use of the simulation method and in particular the semantic method for providing the effective use of the region's investment potential as more optimal one in the practical aspect with a variety of necessary tools, and mechanisms for its implementation.

Other researchers confirm our assumptions, e.g., Nekrasov *et al.* (2017) describe the model of reengineering measures developed by them as a managerial innovation with ways to improve its procedures and management principles.

Gunasekaran and Kobu (2002) also emphasize the importance of modelling and analysing business processes along with business strategies and organizational structures for studying the consequences of reengineering business processes. They analyse in detail the tools and methods used for modelling.

The statistical data of Table 1 suggest a conclusion that investments in fixed assets in most regions of the North Caucasus Federal District, including in the Republic of Dagestan, are not sustainable and began to decline over the recent 5 years in relation to those of 2013, and this trend may continue in the subsequent years, as well. The same unsustainable trend can be traced in Russia with the exception of 2017. A very low level of participation of our regional enterprises in the investment activities has led to the fact that today our private investors are unable to completely compensate for the reduction in budget financing of investments. Moreover, the concentration of private capital is not on the scale that could be used to finance significant sectoral and other projects. In addition, the unformed market infrastructure and underdevelopment of many other investment tools contribute to this result.

Table 1. Dynamics of fixed investments by subjects of the Russian Federation for 2013-2017 (in comparable prices: as a percentage over the previous year)

Regions	2013	2014	2015	2016	2017
Russian Federation	100.8	98.5	89.9	99.8	104.4
North Caucasian Federal District	107.8	104.2	87.5	96.4	100.2
The Republic of Dagestan	109.7	105.2	87.3	95.8	94.6
The Republic of Ingushetia	138.0	55.1	114.5	100.6	65.1
The Kabardino-Balkarian Republic	80.5	103.0	109.8	112.6	111.8
The Karachay-Cherkess Republic	115.8	101.4	84.9	99.7	86.7
The Republic of North Ossetia-Alania	127.6	102.1	73.8	94.6	99.6
The Chechen Republic	99.6	127.2	97.3	100.0	105.3
Stavropol Territory	106.5	103.3	80.9	91.3	111.7

To identify the trend, let us present a mean-value analysis of the fixed investment structure by the forms of ownership over the past 5 years, which also indicates (Figure 1) that in the Republic of Dagestan public and municipal participation in the total volume of investments in fixed assets is scanty. Thus, 85.9% of the total fixed capital account for private investments, government investments amounting only to 8.1% of and municipal investments making only 3.7%. Mixed investment totals to 1.6%, and joint investment with foreign participation is even less 0.7%.



In the Republic of Dagestan, most of the mean-value direct investment is carried out from different levels at the expense of budgetary funds over the recent 5 years (Figure 2). The republican share of the budget is 23.5%, the municipal share is 1.35%. The share of the federal budget is 44.5% of the total direct investments in the republic. Own funds of companies account for 12.5% of total investment as the sources of financing. It is surprising that in the formation of investments the share of bank loans is very small and amounts to 0.4%, which is significantly lower than the general Russian practice. Investors prefer loans of various organizations (3.3%) and other sources (14.4%).

The trend of recent years and mean-value data show (Table 2) that most of all investment in the Republic of Dagestan are concentrated in such large industries as construction (33.1% of total fixed investments), as well as in the production and distribution of electricity, gas, and water (23.5%). Small share of investments accounts for transport (7.1%), education (8.8%), as well as rent and services (9%). Almost the same amount of investments fall on such areas as telecommunications (4.4%), health and social services (3.8%), public administration and military security, and compulsory health insurance (3.3%), as well as various communal, social and personal services (3.1%). The minimum part of fixed investment accounts for agriculture (1.0%), slightly larger part is directed to the extraction of minerals (1.1%), and manufacturing (1.8%).

The analysis of the statistical data presented above allows drawing the following conclusions on the development of the innovation process in the Republic of Dagestan:

- in most regions of the North Caucasus Federal District, including the Republic of Dagestan, fixed investments are not sustainable and have started to decline over the recent 5 years since 2013 and this trend may continue in the subsequent years;
- the mean-value analysis of the fixed investment structure by forms of ownership of organizations over the past 5 years also indicates a regularity concerning scanty public and municipal participation in the total fixed investment in capital in the Republic of Dagestan;
- the analysis shows that the major part of mean-value direct investment over the recent 5 years is carried out from different levels at the expense of budget funds, and the share of companies' own funds in the form of sources of financing as a rule makes small amounts of the total investment;
- there is a trend in recent years when most of fixed investment in the Republic of Dagestan is concentrated in such large sectors as construction, production and distribution of electricity, gas, and water, which limits the development of other industries.

Figure 1. Structure analysis of the investment in fixed assets by forms of ownership in organizations of Republic of Dagestan

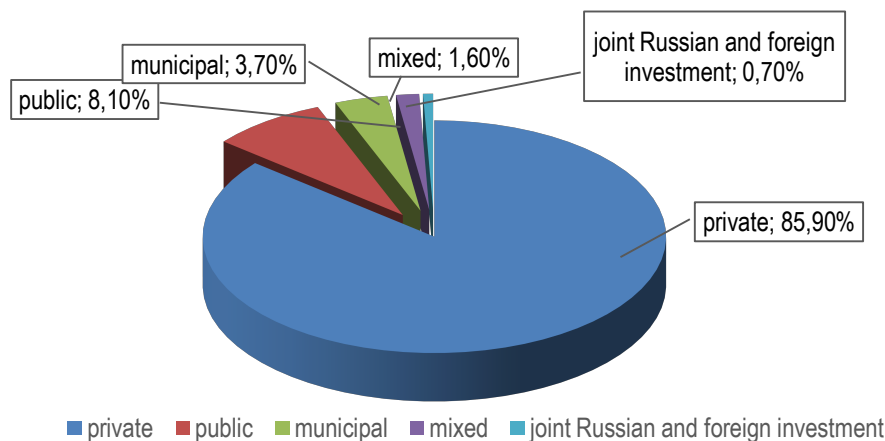


Figure 2. Analysis of the fixed investment structure by the sources of financing for the Republic of Dagestan

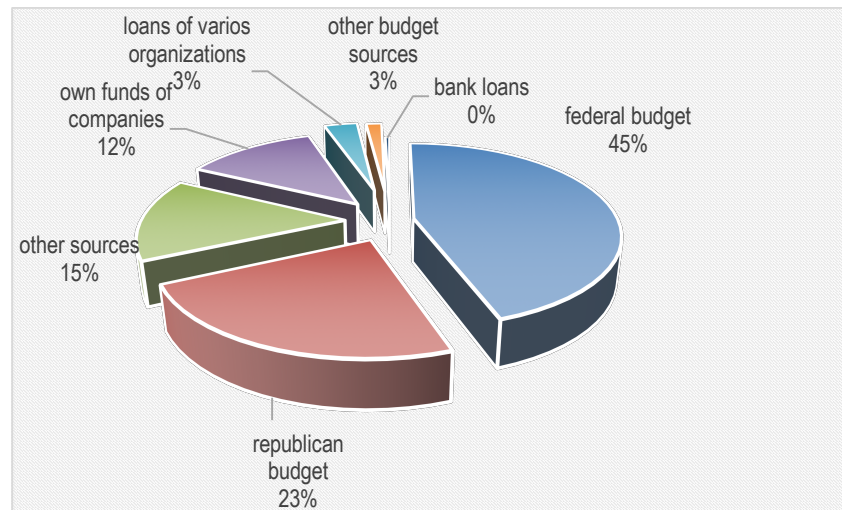


Table 2. Structure of fixed investment by types of economic activity

Types of economic activity	Share in %
Construction	33.1
Production and distribution of electricity, gas and water	23.5
Rental and services	9
Education	8.8
Transport	7.1
Communications	4.4
Health care and social services	3.8
Public administration and military security; compulsory social security	3.3
Other communal, social and personal services	3.1
Manufacturing	1.8
Mining	1.1
Agriculture	1.0

Recently, a number of investment projects that are at different stages of implementation have been adopted in the Republic of Dagestan. At the end of 2015, the Register of investment projects of the Republic of Dagestan included 62 projects worth more than 202 billion rubles. The register of business ideas includes 110 investment proposals worth 207 billion rubles. As a whole, in 2015 the register of RD investment projects was supplemented with 9 projects, and the register of investment proposals with 9 business ideas. In 2015, more than 1,000 jobs were created within the framework of investment projects; 2.5 billion rubles were utilized, the volume of tax revenues to the budgets of all levels amounted to 129.321 million rubles. Within 12 months of 2015, 11 investment projects totaling 17,158.9 million rubles were put into operation (Radzhabova *et al.* 2017).

But this is only a small part of the employed real potential of the Republic. Making no pretense to the indisputability of the investment potential, we consider the presence of the main production resources (infrastructure, labor, mineral resources, fixed assets, *etc.*) in the territory as objective opportunities (prerequisites) of the region for the real attraction of investments, which may be involved in the production process.

It is obvious that the process of investment involvement in the region is accelerated if the region has all the main specific components of the potential: labor, production, infrastructure, innovation, natural, financial, institutional and consumer ones. The Republic of Dagestan has such opportunities.

### 3. Results

Everything the authors offered above combined with the viewpoints of some other researchers (Stefanescu *et al.* 2007, Shpak *et al.* 201, Sundararajan 2001, Bhaskar and Singh 2014, Nekrasov *et al.* 2017, Gunasekaran and Kobu 2002) invariably justify the authors' statement that the investment activity can be activated using the reengineering approach, which is based on the deep, comprehensive and radical transformation, rethinking and

redesigning of investment management processes in the republic to ensure high investment effectiveness. They also validate the use of the suggested model in the context of innovations as one of the determinative ways to ensure the fulfilment of the region's potential and the high effectiveness of innovative activity.

To facilitate effective management of any complex systems, including region's investment, it makes sense to support research with such important analysis and design tool as modelling.

The existing investment system working throughout the republic is hardly efficient and needs to be revised. According to the opinions of many experts, the Republic of Dagestan has low investment appeal largely due to its adverse economic and socio-political situation, lack of trust for the republic's high officials, high risks for investors, poor state of infrastructure and the underdeveloped entrepreneurial sector. On top of that, the republic's available investment potential, as inherently high as it may be, is focused in the shadow economy, which remained idle out of well-known reasons.

In this context, the authors believe that the Republic of Dagestan's investment policy calls for a different approach, and they suggest pursuing it by taking the following main lines of efforts:

- Engage in mechanisms of attracting new investors;
- Create regulatory environment and incentives for the existing business to come out of the shadow and get involved in investment.

The authors endeavored to develop a new reengineering model for ensuring the effectiveness of the republic's investment potential management in the form of a semantic model. Since complex systems are hard to formalize, the most reasonable method for their description is to use semantic models which retain the semantic of the object, *e.g.* as a goal tree, organization chart model, *etc.*

The main point of a semantic model is to describe objects (elements, subsystems, systems, *etc.*), object properties (parameters and characteristics), their condition and object relations. These models can be both static and dynamic, describing a flow of events, and their description can take place graphically, through diagrams, tables, charts, *etc.*

Such models are especially convenient at the early design stages of concept formulation, as in the case of this study. The use of a semantic model does not, by any means, indicate the lack of formalization, as such integrated model allows drawing a broad picture where clarity and brevity are at the center. Such model can serve as a basis for building many others, including mathematical models.

Since an enterprise is a complex system, it cannot be described with a single formal model that covers every detail; so in such case, several integrated models can be used, with one of them acting as a basis for more detailed models.

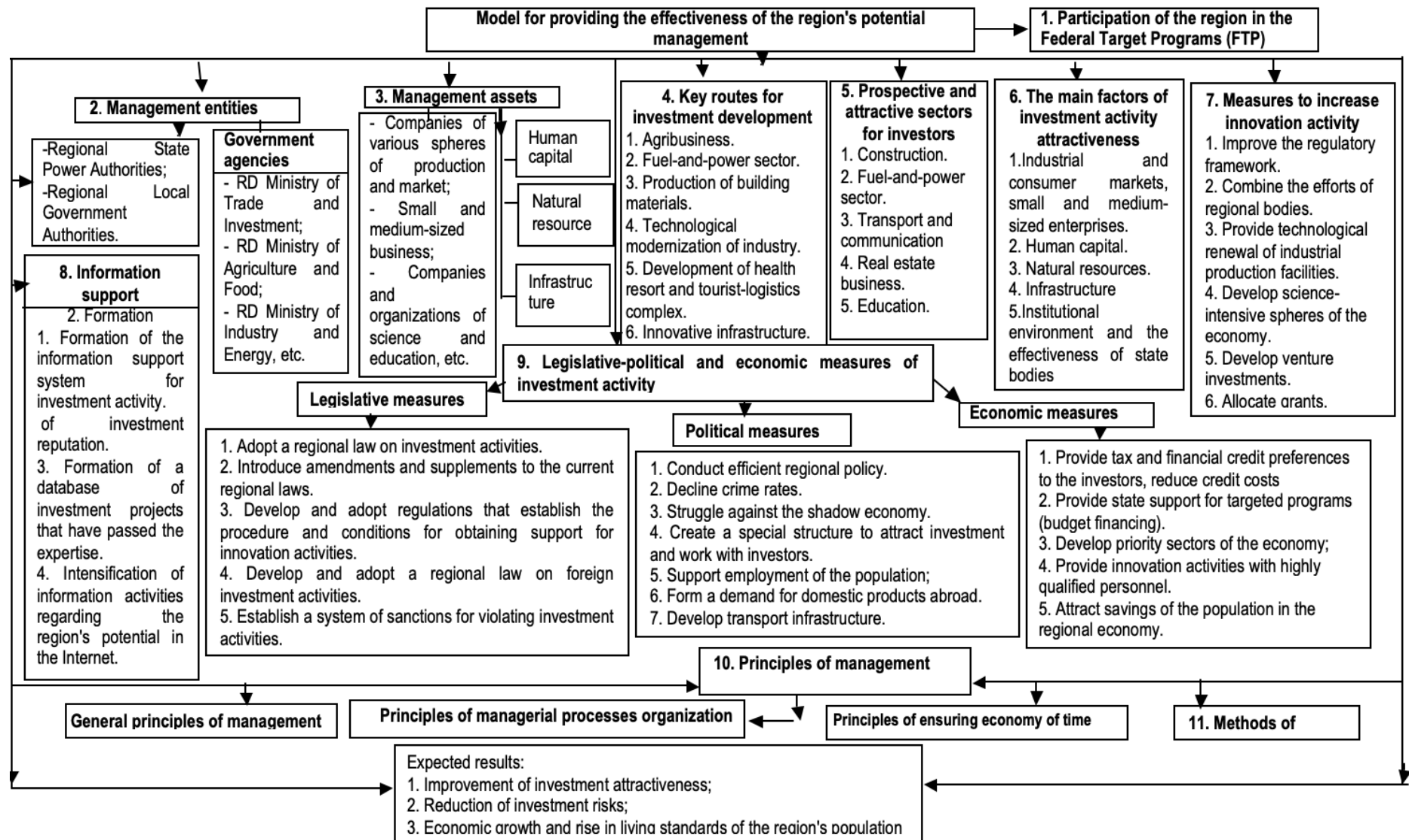
The study undertaken by the authors enabled the development of a new innovation model for providing the effectiveness of investment potential management in the region. It should be pointed out that the planning of regional investment activity should be treated with utmost responsibility, taking into account all specifics of the region's development (Figure 3).

As part of the suggested model, the authors examined a broad range of components that provide the effectiveness of investment potential management in the region, such as: the region's participation in Federal Targeted Programs, region-level management entities; region-level management assets; key routes for investment development; promising and appealing investment sectors; key factors of investment attractiveness; actions taken to drive innovations; information support; legislative, political and economic incentives for investment activity; management principles; management methods.

Special attention should be paid to the mechanism through which this model is put to practice. Unlike other methods, the main point and implementation algorithm of the authors' approach and suggested model are about strict and consistent adherence to and use of all the tools presented within the scope of the model. Experience has proven that, say, incomplete use or implementation of regulatory, political and economic incentives for investment activity or failure to follow the fundamental management principles and methods can become an important cause of the ineffective development of innovations.

In modern conditions, the use of innovative approaches for economic growth, including the reengineering one, is caused by their inexhaustible multifaceted modern and progressive ideas, knowledge, *etc.*

Figure 3. The model for providing the effectiveness of the region's investment potential management



#### 4. Discussion

The economic condition of our country, in the face of certain restrictions on the part of European countries, requires to intensify the role of the state both in the formation of the regulatory and legal system for the activity of private investors and in the direct investment of the state in the real sector to achieve the necessary structural proportions of the reproduction process. Moreover, the government should only participate in such a way that it should not interfere with the market mechanism, supplementing and strengthening its effectiveness.

The studies show that the Republic of Dagestan, having a sufficiently high potential for the effective development of investment activities, practically does not use this potential at the proper level.

In general, such a situation and current approaches to attracting investment in the republic are counterproductive and do not contribute to the development of potential rates and its opportunities.

The Strategy for socio-economic development of the Republic of Dagestan until 2025, defines the social and innovation complex as one of the main directions for the development of the republic. Unfortunately, the main shortcoming of the existing infrastructure is the lack of integration between production, science and the state, as well as the fragmentation of the innovative actors, which is emphasized by many researchers. Obviously, all this does not lead to an effective involvement of the available scientific potential in production.

Many Russian regions possess a huge investment potential and a lot of competitive advantages, where the main task is to use them effectively. Dagestan has significant explored reserves of oil and gas, other minerals, it is well provided with energy, has a developed transport infrastructure and a high scientific potential. The interest from both domestic and foreign investors is an indicator of a favorable investment climate in the republic.

To date, the Republic has adopted an extensive regulatory framework aimed at creating a favorable investment environment and attracting investors. There are a number of republican programs and a regulatory framework that creates favorable conditions for attracting investment in the economy of the Republic of Dagestan. At the same time, the volumes of attracted investments are still far from sufficient for the successful development of the economy of the republic.

Obviously, it is required to stimulate innovation activity in all sectors or spheres of activity and give a special importance to the innovative approach as the most important vector of successful provision of the region's economic development.

#### Conclusion

Thus, in our opinion, the proposed reengineering approach and the developed innovative model for ensuring the effective management of the region-level investment potential take into account the shortcomings that currently exist in the republic, and mainly encompasses the determining directions, measures and tools that enable to intensify the region's investment activity. Such approach allows achieving the following results: improvement of investment attractiveness, reduction of investment risks, economic growth and improvement of living standards of the population.

The presented approach and model have both theoretical and practical significance for the science and practice of managing investment systems. This approach can be applied to other regions of our country, and it enables to develop a more detailed mechanism for providing its implementation in the long term for the purposes of effective management of innovation activities at the regional level.

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## Improvement of Innovative Economic Policy

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### Abstract:

As the world experience shows, stable economic growth can be achieved only on an innovative basis, with the active use of modern scientific and technological achievements. Only in this case chances are realized for high quality of growth, resource saving, production efficiency, production of competitive products on domestic and world markets. However, the number of domestic investment-innovation-active enterprises is small, especially in the small and medium-sized businesses, traditionally differing from large high innovative activity. In addition, it is not surprising that there are few samples of new technology in the country using licenses, patents and other means of legal protection of intellectual property. It should also be noted that many of these objects do not find application in production; they are morally aging and depreciating.

**Keywords:** economic; innovation; economic model; economic growth

**JEL Classification:** O31; O38; O39

### Introduction

At the moment, the issue of building an integral financial mechanism for implementing the priorities of innovation policy in Kazakhstan is of particular importance. Without a reliable financial base, stable sources and effective financial incentives, innovative projects and programs will remain at the level of "paper projects". By and large, in modern Kazakhstan, as such, there is still no innovation strategy and tactics, not to mention the financial side of innovation policy. It is time to develop and implement a long-term scientifically grounded innovation policy and an effective financial mechanism for its implementation.

As the President of the Republic of Kazakhstan Nursultan Nazarbayev noted in his annual Address to the People of Kazakhstan "New Decade - New Economic Growth - New Opportunities of Kazakhstan". I would like to separately highlight the sectors of the "future economy". Its basis should be an effective and effectively functioning national innovation system. It is necessary for the Government to develop an intersectoral plan for scientific and technological development of the country until 2020, taking into account the priorities of our industry in 2010", which directly indicates the need to implement the institutionalized economic mechanism of involving the small and medium-sized businesses (Nazarbayev 2014).

In the work authors substantiated the necessity of developing a system of financing and stimulating innovations in the sphere of the economy of the Republic of Kazakhstan. Also, the paper presents the economic and mathematical model of innovative economic development (based on materials from Karaganda region).

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## 1. Literature review

Theoretic and practice aspects of the formation and development of a financial mechanism of innovation activity in Kazakhstan, adequate for the requirements of industrial and innovative development, regarding the need for the development of a national innovation system were considered in the publications of Russian scientists (Yasin 2017, Gokhberg 2015) and Kazakhstan scientists (Baymuratov 2014, Kenzheguzin 2015, Dnishev 2015), but the financial mechanism of innovation activity was not directly proposed.

Without a reliable financial base, stable sources and effective financial incentives, innovative projects and programs will remain at the level of "paper projects". By and large, in modern Kazakhstan, as such, there is still no innovation strategy and tactics, not to mention the financial side of innovation policy. It is time to develop and implement a long-term scientifically grounded innovation policy and an effective financial mechanism for its implementation, since the existing system for financing domestic and investment (capital) costs of scientific and innovation activities does not meet the priorities of the State Program for Forced Industrial and Innovative Development of Kazakhstan.

However, these studies examined either individual elements or components of the innovation financing system, or only national models for its formation and development, which served as the reason for further development of the mechanisms for financing innovation at the national level and at the level of individual subjects of implementing state investment programs.

The existence of problems that require scientifically grounded solutions to improve the mechanisms for financing innovation in the current conditions of Kazakhstan, the objective need for their comprehension, comprehensive analysis and the development of appropriate recommendations for the improvement of its regulation predetermined the choice of the topic of this study.

## 2. Methodology

In recent years, as a result of the systemic measures taken by the government, innovations have been identified as a strategically important direction for the development of the Republic of Kazakhstan. Initially, issues of innovative development were reflected in the Strategic Plan until 2010, then in the Strategy for Industrial and Innovative Development for 2003-2015, the Program for the Formation and Development of the National Innovation System of the Republic of Kazakhstan for 2005-2015. The legal regulation of innovation activity was laid down with the adoption in 2006 of the Law of the Republic of Kazakhstan "On State Support of Innovative Activity".

In addition, during the period from 2001 to 2012, the basic elements of the national innovation system were formed: JSC "National Agency for Technological Development", 8 regional technology parks, special economic zone "Innovative Technologies Park", 4 design offices, 15 commercialization offices, 4 domestic venture funds.

In order to further promote Kazakhstan's entry into the list of 30 competitive countries in the world on the basis of the development of new technologies and services, in 2013 the President of the Republic of Kazakhstan adopted the Concept of Innovative Development of the Republic of Kazakhstan until 2020. Against this background, due to the measures taken, positive changes in the indicators of scientific and innovative development of the country took place during the past period.

According to the Agency of the Republic of Kazakhstan on Statistics, in Kazakhstan in 2017, 1622 economic entities of Kazakhstan are innovative - active out of 21,452 enterprises where statistical supervision of innovation activity was carried out. At the same time, the share of innovation activity reached its historical maximum in accordance with the figure of 3-7.6%.

The volume of innovative products increased significantly by 60.6% and amounted to 379 billion tenge (2017 - 235.9 billion tenge). At the same time, the volume of rendered services of innovative character increased by 46.8% and reached over 21 billion tenge.

Among the innovative products of industrial enterprises in 2017, the greatest share in innovative products continues to be occupied by products newly introduced or subjected to significant technological changes 81.2%, products subject to improvement amounted to 6.2% and other innovative products to 12.6%. The share of innovative products in GDP increased to 1.25%, while in 2016 it was 0.86%.

The current costs for technological innovation of enterprises increased to 325.6 billion tenge, which is 67% higher than in 2016. At the same time, there is also an increase in labour productivity in the manufacturing industry to 51.8 thousand dollars per employee. At the same time, despite the growth of innovative activity in recent years, the level of passivity in the field of innovations remains it is still quite high. This indicator for the end of 2017 was

92.4% (94.3% in 2016). Despite some growth, the share of innovative products in total industrial production is also still low - 2.3% (1.5% in 2016).

In general, as can be seen from the results of the analysis, innovation activity at industrial enterprises of the country is at a low level. For comparison: the share of innovation-active enterprises in Germany is 80%, in the USA, Sweden, Italy, France - about 50%, in Turkey - 33, Hungary - 47, Estonia - 36, Russia - 9.1%. Insufficient level of innovative activity is exacerbated by low returns from the implementation of technological innovations. As a result, one tenge of such costs in 2017 accounts for 1.16 tenge of innovation products (Table 1).

Table 1. The ratio of volumes and costs of innovative products, in billions tenge

Indicator	2009	2010	2011	2012	2013	2014	2015	2016	2017
Volume	74,70	120,40	156,00	152,50	111,50	82,60	142,20	236,00	379,00
Expenses	35,30	67,10	80,00	83,50	113,40	61,00	235,50	195,00	325,60
Efficiency of expenses	2,11	1,79	1,95	1,82	0,98	1,35	0,60	1,21	1,16

Source: compiled by authors

At the same time, in the dynamics of changes in the indices of innovative activity of enterprises within the country, a positive growth trend has been observed in recent years with the adoption of the State Program of Forced Industrial Innovative Development, which indicates an increase in the level of enterprise susceptibility to innovation. For example, according to the Committee on Statistics of the Republic of Kazakhstan, the number of innovative projects implemented by enterprises in 2017 increased by 2.9 times to 1135 units (387 units in 2016). The number of new technologies and equipment created and used increased from 1365 to 1608 units, and the number of enterprises that created and used these technologies increased from 562 to 713 units. This fact is a positive trend, especially since almost 90% of new or significantly changed technologies fall on the manufacturing industry.

The costs of research and development are one of the main indicators of innovation activity at the "entrance". There was an increase in the volume of domestic expenditures for research and development by 18.2%, which amounted to 51.2 billion tenge (43.3 billion tenge in 2016). At the same time, their share to GDP slightly increased to 0.17% (2016 - 0.16%), after a sharp decline in 2015 from 0.24%.

World experience shows that in developed countries, expenditures on research and development are constantly growing, reaching 2.5-3.7% of GDP in many of them, with the state's share in these expenditures averaging 25-34%. First of all, such countries include Israel (4.86% of GDP), Finland (4.01%), Sweden (3.75%), Japan (3.42%) and Korea (3.37%). The threshold value of spending on research and development in relation to GDP as one of the indicators of the country's economic security is considered to be equal to 2%. Recommended by the International Academic Council, the share of science expenditures for developing countries is 1 - 1.5% of GDP.

An analysis of the structure of domestic expenditure on research and development by sector of activity for 2017 indicates a continuing trend of the prevailing share of the business sector (39.7%) and an increase in the share of financing of the higher education sector from 16.4% to 23%. It should be noted that in the technologically advanced countries, the costs of the business sector for scientific research (60-70%) far outweigh the government spending on R&D. Kazakhstan still has a structure with a key role of the public sector for financing R&D. In addition, it should be noted that in most countries, basic research is traditionally conducted primarily in the public sector, and business - the sector is engaged in applied research.

From the experience of foreign countries, it can be concluded that the national innovation system will be effective and bring high incomes only if there is a developed business sector in the country that is characterized by a low level of innovative activity in Kazakhstan.

In recent years, there has been a tendency to increase the number of specialists employed in the sphere of scientific, technological and technological development. In 2017, this indicator reached a historic high and amounted to 13,494 people with growth by 2016 by 17.5%. This is due to the active involvement of a large number of young scientists in research activities. At the same time, the share of scientists under 35 in 2017 increased by 38%. And scientists under the age of 45 already make up the majority, today they are 56%.

In general, this sphere is still not attractive for long-term career growth due to the characteristic features of the Kazakhstan labor market in the scientific sphere, which, first of all, is manifested in the low level of wages and insufficient social security of scientists. Thus, innovative development in Kazakhstan, along with other factors, is constrained by a shortage of personnel able to manage innovative processes and projects. In this regard, work is

currently underway to develop a special set of measures to attract scientists and managers with a worldwide reputation and to promote the return of scientists - compatriots working abroad.

In international practice, the indicators of patent activity, the number of scientific publications and the level of their citation also assess the results of scientific and technical activities. One of the most important indicators of the effectiveness of research and development is patent activity.

Intellectual property in the modern world becomes the determining factor of social progress, and the results of intellectual labour are the main object of economic turnover that ensures the welfare of society. Modern analysts state a clear, directly proportional relationship between the magnitude of the gross national product and the number of patents for inventions per capita of countries. At the same time, in the most economically developed countries the highest patent activity of the population is recorded.

According to the National Institute of Intellectual Property in 2017, 1503 applications for the issuance of protection documents for inventions were received, 9.3% less than in 2016 (1600 applications), of which 91.3% of applications from national applicants were received and from foreign applicants 8.7% of applications (Table 2).

In 2017, the number of issued protection documents was 1,400 and decreased by 25.8% from 2016. There is also a decrease in the number of registered licensing agreements for the use of industrial property from 153 units in 2016 to 69 in 2017.

Table 2. Issue of protection documents for inventions by years

Security documents	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total	2009-2017
Issued, total	1542	1672	1671	1009	1755	1687	1868	1887	1400	14491	29657
National patent holders											
Preliminary patents	1287	1435	1328	789	1126	234	21	5	3	6228	15840
Patents	128	101	202	129	132	162	295	245	155	1549	4256
Innovative patents	-	-	-	5	354	1167	1326	1358	1090	5300	5300
Foreign patent holders											
Preliminary patents	72	89	75	64	104	47	18	-	-	469	1405
Patents	55	47	66	22	39	63	187	256	139	874	2785
Innovative patents	-	-	-	-	-	14	21	23	13	71	71

Source: compiled by authors

At the same time, the number of applications for invention filed under the EPO procedure (the Eurasian Patent Office) is increasing. In 2017, according to the EPO procedure, 57 applications were submitted, which is 11 applications more than in 2016. Weak competitiveness of the country in technological terms is explained, among other things, by the practical lack of world-class developments in the country. The main reasons for the backlog of Kazakhstan in terms of indicators of patent activity are, as limited financial resources, so insufficient legal literacy in the field of intellectual property.

In general, the analysis of innovative processes in the country according to the results of 2017 testifies to the growth of the main domestic indicators of innovation activity, the volumes of innovative products, the costs of research and development, the number of researchers and others.

This was reflected positively in Kazakhstan and in the rating of the Global Competitiveness Index of the World Economic Forum. In particular, according to the "Innovation" factor, our country rose by 19 positions up to 84 places. According to the subfactors "Ability to innovate", the country also rose by 18 positions to 74 places, "Expenses of companies for research and development" by 17 positions to 77 places, "Cooperation of universities and business in the field of research and development" by 11 positions up to 79 places.

Such growth is conditioned, first of all, by the implementation of the State Program of Industrial and Innovative Development of the Republic of Kazakhstan for 2010-2014.

However, in the global comparison, Kazakhstan still shows modest results of the transition to an innovative type of economy. So, as of 2017, the share of innovative products in the gross domestic product was less than 1.3%, the share of domestic expenditure on research and development to GDP is 0.17%, the share in the total number of publications of international citation bases is 0.028%.



Undoubtedly, such low impact indicators on the country's economy require a more coordinated policy for the development of regional innovation systems, strengthening the region-center interaction, creating an innovative environment and increasing competencies in the implementation of research and innovation projects.

One of the main tasks in the implementation of the Concept of Innovative Development until 2020 is to strengthen the regional innovation systems, taking into account the processes of regional economic integration and internal decentralization of management.

Innovative potential of the region is an accumulated aggregate innovative resource that ensures intensive development of economic entities in the region and contributes to the receipt of their income and competencies. At the same time, there are very significant differences in the innovation activity of economic entities, depending on their regional affiliation, which is due to the heterogeneity of the innovation infrastructure of the regions, as well as the existing differences in the provision of the latter with scientific, technical, financial, labor and other resources.

The degree of innovative activity of the regions could be characterized by the following indicators:

- level of innovative activity of enterprises; volume of innovative products;
- share of innovative products in the gross regional product; internal costs of research and development;
- costs of technological innovation in industry.

The largest share of innovation-active enterprises, taking into account management technologies, is observed in Kostanay, Kyzylorda and North-Kazakhstan regions (14.1%, 12.8 and 11%, respectively). The lowest level is registered in Atyrau (4.8%) and Mangistau (1.6) regions (see Table 3).

The city of Almaty (243 enterprises in 2017), the city of Astana (122), the East Kazakhstan (108) and the South Kazakhstan (104) regions are leading by the number of innovatively active enterprises (excluding management technologies). The least number of innovatively active enterprises following the results of 2012 is observed in Mangistau (11 enterprises), Atyrau (27) and Kyzylorda (28) regions.

The highest level of innovative activity of enterprises (excluding management technologies) is observed in the North-Kazakhstan oblast (10.4%), Zhambyl oblast (7.9%), West Kazakhstan region (7.5%), Kostanai (7.1%) and Astana (6.8%), the City of Almaty (6.7%). The lowest index of innovation activity is registered in Mangistau oblast (1.1%).

Table 3. Innovation activity in 2017, in%

Region	Share, in %	Amount, units
North Kazakhstan	11,0	104
Zhambyl	9,7	64
West Kazakhstan	9,5	53
Kostanay	14,1	189
Astana	7,5	134
Almaty	7,3	265
East Kazakhstan	6,8	117
Almaty region	8,8	108
Kyzylordinskaya oblast	12,8	68
South Kazakhstan	5,4	112
Akmolinskaya	5,8	68
Atyrausskaya	4,8	29
Pavlodar	5,5	60
Aktyubinskaya	5,9	61
Karaganda	8,5	173
Mangystau	1,6	17
Total	7,6	1622

Source: compiled by authors

As can be seen from the Table 3, a significant increase in innovation activity in the dynamics following the results of 2017 is observed in the North-Kazakhstan region from 2.4 to 10.4%, in the Kostanay region from 4.8 to 7.1%, in the Akmola region from 1 to 4.6% and in Astana from 4.1% to 6.8%. A small increase was noted in Almaty from 5.7 to 6.7% and Almaty oblast from 4.6 to 5.4%. In other regions there was a decline in innovation activity, including a decrease in the Zhambyl oblast from 10.2 to 7.9%, West Kazakhstan from 12.7 to 7.5%, Kyzylorda from 8 to 5.3% in Aktobe from 8.5 to 4%, Karaganda from 7.2 to 3.8%.



This indicates the instability of production at enterprises and the inadequacy of government support measures provided by state bodies and development institutions in most regions of the country.

With the exception of West Kazakhstan and Aktyubinsk oblasts, in all regions there is an increase in the production of innovative products, which in the country as a whole amounted to KZT 379 billion with an increase of 160.6% compared to the level of 2017. The largest contribution continues to be made by the East Kazakhstan and Pavlodar oblasts with the volume of innovative products of 99.3 and 97.6 billion tenge respectively (Table 4).

Table 4. Dynamics of changes in the volume of innovative products, in mln. tenge

Region	2016	2017	%
North Kazakhstan	1 469,5	6 098,3	415,0
Zhambyl	11 251,8	19 181,2	170,5
West Kazakhstan	24 804,9	4 399,3	17,7
Kostanay	12 453,0	29 769,7	239,0
Astana city	1 818,6	4 787,0	263,2
Almaty city	10 601,4	12 579,1	118,6
East Kazakhstan	33 592,5	99 332,1	295,7
Almaty	5 498,1	13 288,0	241,7
Kyzylorda	2 281,3	3 645,0	159,8
South Kazakhstan	15 374,0	22 588,7	146,9
Akmola	9 822,5	19 902,1	202,6
Atyrau	1 828,1	4 772,2	261,0
Pavlodar	73 279,0	97 620,0	133,2
Aktobe	16 880,9	6 542,4	38,8
Karaganda	14 388,6	30 891,5	214,7
Mangistau	618,6	3 609,0	583,4

Source: compiled by authors

The Mangistau region (by 5.8 times), the North-Kazakhstan oblast (4.1 times), East Kazakhstan, Atyrau, Kostanay, Almaty, Akmola and Karaganda regions and Astana city demonstrate the high dynamics of growth by the results of 2017 (more than in 2 times).

Absolute leaders in the share of innovative products in the gross regional product are Pavlodar and East Kazakhstan regions with indicators of 6.66% and 5.64% respectively. This is due to the availability of industrial production, which determines the great potential for development in the field of various innovative products.

The following regions are relatively low in terms of the share of output of innovative products in GRP: Kostanay (2.68%), Zhambyl (2.46%), Akmola (2.44%), South Kazakhstan (1.34%) and Karaganda (1.2%) of the region. All other areas have very low shares (less than 1%), thereby showing low innovative activity on a regional scale and their weak effect on the gross regional product.

Zhambyl, East Kazakhstan, Pavlodar, Akmola, North Kazakhstan and Kostanay regions demonstrate a relatively high share of innovative products in the total volume of their own industrial production (from 5.9 to 11.9%). The average indicator is observed in South Kazakhstan, Karaganda, Almaty oblasts and cities in Almaty and Astana (from 1.7 to 4.9%). In other regions less than 1% was recorded.

The next indicator that characterizes the innovation activity of the regions is the level of internal expenditures for research and development, which in the republic in 2017 increased by 18.2% and amounted to 51.2 billion tenge. As a result of 2017, a sharp decrease in the cost of technological innovation in industry in such industrialized regions as: West Kazakhstan, Karaganda, South Kazakhstan, Pavlodar and East Kazakhstan regions. This is due to a certain reduction in investments in the modernization of existing production facilities and the creation of new industries during this period. In this regard, the planning of regional development and infrastructure should be substantially strengthened to form additional "points" for innovative growth.

At the same time, significant growth is noted in North Kazakhstan (120.5 times), Mangistau (21.8 times), Astana (10.4 times) and other regions, which indicates a high potential and investment attractiveness regions. In this connection, it can be concluded that at present in Kazakhstan there is still a clear imbalance in the innovative development of regions, a low level of innovation in industrial enterprises and is characterized by a relatively small contribution of innovations to gross regional products.

There is also a low activity of participation in republican contests "NIF\$50K" and "Rationalizer.kz", according to which out of more than 500 applications-projects in the republic, only 5 applications were submitted from Mangistau oblast, only 11 applications from Atyrau.

In addition, there is a significant decline in the production of innovative products in the West Kazakhstan region - 5.6 times to the level of 2016. In this region is also quite low is the indicator for the distribution of innovative products in the total volume of own production of industrial enterprises in 2017 - 0.3%. This testifies to the need to strengthen the work of the akimat on the development of innovations in the enterprises of the region.

In general, a systematic problem, including the above-mentioned regions, is the practical lack of funding for activities to develop innovations from the local budget in the regions. There is no support from local executive bodies to promote initiatives of entrepreneurs and innovators of the region, to ensure interaction between business, research institutes, universities, search for investments and technologies for regional enterprises, *etc.*

It is necessary to note the regions that demonstrate high activity and stable dynamics in the development of innovations. This is the Kostanay region, which has the best indicator in the republic for the share of innovative active enterprises - 14.1%. Annually, stable results are shown in the East Kazakhstan region, which accounts for more than 26% of all manufactured innovative products in the country.

The North-Kazakhstan oblast was marked by high rates of growth in indicators for costs of technological innovation in industry - 120.5 times in 2017, more than 4 times the volume of innovative products produced. At present, in all regions of the country, in the framework of the Program for the Development of Innovation and the Promotion of Technological Modernization in the Republic of Kazakhstan, plans have been developed for the development and introduction of innovations.

It should be noted that the activities of the above-mentioned Plans are not backed by funding from the local budget, with the exception of Astana, Kostanay, Pavlodar, Kyzylorda and South Kazakhstan oblasts. At the same time, in Kostanay oblast, funding is allocated exclusively for the creation of a Center for Investment and Innovation Support, in South Kazakhstan Oblast for the creation of Shymkent Innovation LLP and participation in the authorized capital of LLP Regional Technopark in South Kazakhstan Oblast.

It is necessary to recognize that the majority of regions are engaged in questions of financing activities to increase innovation activity on a residual principle in the context of misunderstandings of the mechanisms for allocating budgetary funds, the definition of regional operators and measures for the development of innovations, and the lack of a common methodology for the formation of regional innovation systems. Full-fledged operators of innovation development in the regions at the expense of the local budget were created only in Astana (Astana-Innovations JSC) and Shymkent (Shymkent Innovation LLP).

JSC "Astana-Innovations", which in 2017 within the framework of the budget program 012 formed the authorized capital of the Company, can be cited as an example of successful development of financing from the local budget. At the same time, through the Administrator of the Free Economic Zone "Astana - New City", in agreement with the Ministry of Finance, provided annual funding for current activities to support innovation within the 004 budget program in the region "Services to ensure the development of innovation in the city of Astana."

As a result, JSC "Astana - Innovations" is currently working to implement mechanisms of state support for the subjects of industrial and innovative activity of the city of Astana by:

- technological business incubation; transfer of technology; technological forecasting;
- information and advocacy support;
- other mechanisms that promote the development of innovations in the city of Astana.

Another successful example is the elaboration of the issue of creating Shymkent Innovation LLP in the South Kazakhstan region on the basis of the social business corporations (hereinafter - the SEC) "Ontustik". Currently, the issue of financing current activities for the development of industrial and innovative activities is under consideration.

In addition, there are 8 technoparks in Kazakhstan with the participation of JSC "National Agency for Technological Development", which have a program of technological business incubation, however, they cover only 6 regions.

In all regions, the Centers for the Servicing of Investors (hereinafter referred to as the "Center") of 2-3 people are established and are functioning. The resources of the authorized capital of the SEC limit many of them with SPK. The current program for the operation of the PIC is absent, and accordingly there are problems in the content of the PIC staff. As for the SEC, they operate in all regions, but a number of them carry out loss-making activities and also do not have current financing programs from the budget for the development of innovations.

Also, in 12 regions there are about 20 business incubators in various forms of ownership, of which only the most successful are the ones. At the same time, their main activity is connected with renting premises, incubation of startup companies is not carried out, there are no current state support program.

In all regions, with the support of the "Damu" Entrepreneurship Development Fund, Business Service Centers have been established, and Enterprise Support Centers are being established at the service centers of the population, providing consulting assistance to start-up businesses.

The activity of these centers, business incubators, created industrial zones and special economic zones and other elements of the industrial and innovation infrastructure is proposed to be interconnected in the framework of the policy of building regional innovation systems. That is, the regional operator of innovation development needs to work closely with them in the implementation of innovation policy in the region.

In turn, the overall coordination of innovative development in the regions is carried out by the department of industrial and innovative development of the business and industry departments of the region, whose efforts are mainly focused on monitoring the selection and implementation of industrial and innovative projects within the Industrialization Map.

In general, the main sources of financing innovative activity in the regions are the funds of enterprises, STB, development institutions, and the republican budget within the framework of the Business Road Map 2020 program. The restraining factor for allocating funds from the local budget to support innovative activities, according to some regions, is the lack of legislative consolidation of the competence of the akimats.

Thus, in accordance with the Decree of the Head of State No. 827 of June 18, 2009, "On the State Planning System", regional programs at the akimat level are not being developed. For this reason, in the absence of a legislative basis in most regions, departmental plans have not been approved by a resolution of the akimat.

In this issue, an additional explanation of the regions is required. Thus, the consolidation of the competence of Akimats in the current legislation to stimulate industrial and innovative activities is sufficient, but it can be strengthened in the conditions of a phased decentralization of financial support for the business sector envisaged in the Concept of Innovative Development until 2020.

It should be noted that the majority of local executive bodies, in the absence of funding, do not perform the basic functions in accordance with the law of the Republic of Kazakhstan "On state support of industrial and innovative activities".

In particular, Akimats according to the Law:

- participate in the formation and implementation of state policy in the sphere of state support of industrial and innovative activities in the relevant territory;
- the right to provide methodical, consultative, practical and other assistance to elements of the industrial and innovative infrastructure;
- the right to create and (or) participate in the authorized capital of legal entities, whose main activity is aimed at the development of innovations.

In addition, in accordance with Article 8 of the Budget Code, the regional budget is a centralized monetary fund designed to provide financial support for the tasks of local government functions at the oblast level, state institutions subordinate to them and the implementation of state policy in the relevant administrative and territorial unit. Appropriate funding could already be implemented within the framework of the current unified budget classification:

- 001 budget program "Services for implementation of state policy at the local level in the field of entrepreneurship development";
- 007 budget program - Realization of the strategy of industrial and innovative development ";
- a number of budget programs within the framework of the "Development of the Regions" Program, incl. targeted transfers from the republican budget.

Great opportunities exist in the implementation of the mono-city development program. If necessary, it is possible to work out the issue of creating a separate budget program for the regions to support industrial and innovative activities, including taking into account the possibility of transfer from the republican budget. In this regard, in accordance with the Concept of Innovative Development of the Republic of Kazakhstan until 2020, the formation of regional innovation systems will be ensured at the legislative level.

For these purposes, a methodology will be developed for the formation of regional innovation systems, including both existing and new instruments of state support at the national and regional levels. Also in each region of Kazakhstan, to support innovation, regional development institutions (innovation offices) will be established, including on the basis of technology parks.

At the same time, close cooperation of national development institutions with regional innovation offices will be ensured by gradual expansion of the possibility of obtaining instruments of state support for innovation



Table 5. Calculation of new variables

Year	Volume of GRP, mln. tenge	Volume of investments in fixed assets, mln. tenge	Z <sub>0</sub>	Z <sub>1</sub>	Z <sub>2</sub>
2001	200.649,8	22.080	-	-	-
2002	235.372,0	23.876	-	-	-
2003	299.947,3	33.192	-	-	-
2004	337.702,5	55.153	134.301	147.184	327.416
2005	370.493,6	62.584	174.805	193.165	402.805
2006	444.418,8	67.157	218.086	272.466	581.924
2007	508.970,6	96.650	281.544	357.784	813.870
2008	679.805,9	153.438	379.829	418.716	928.534
2009	922.634,5	134.157	451.402	548.209	1.144.451
2010	1.144.309,4	151.887	536.132	730.983	1.617.759
2011	1.463.026,7	210.247	649.729	880.515	2.069.457
2012	1.515.792,0	214.076	710.367	916.492	2.025.208
2013	1.872.842,3	211.085	787.295	1.090.231	2.422.047
2014	2.397.919,6	253.048	888.456	1.269.978	2.959.612
2015	2.458.966,9	323.816	1.002.025	1.317.446	3.024.072
2016	2.634.259,8	405.015	1.192.964	1.463.167	3.235.773
2017	2.968.537,7	411.852	1.393.731	1.811.791	3.977.711

Source: calculated by authors

Next, we estimated the parameters of the regression equation by the ordinary least squares method. The GRP volume is the dependent variable. Calculated by the formulas  $z_0$ ,  $z_1$ ,  $z_2$  are independent variables. We obtained a three-factor linear regression model:

$$GDP_t = -24457,4 + 0,77904z_0 - 1,64355z_1 + 1,25231z_2 \quad (6)$$

Further, the coefficients of the original model were determined from the formulas:

$$\begin{aligned} \beta_0 &= a_0 = 0,779; \\ \beta_1 &= a_0 + a_1 + a_2 = 0,388; \\ \beta_2 &= a_0 + 2a_1 + 4a_2 = 2,501; \\ \beta_3 &= a_0 + 3a_1 + 9a_2 = 7,119. \end{aligned} \quad (7)$$

Thus, the initial model with a distributed lag is as follows:

$$GDP_t = -24457,4 + 0,779Inv_t + 0,388Inv_{t-1} + 2,501Inv_{t-2} + 7,119Inv_{t-3} \quad (8)$$

The analysis of the model shows that an increase in investments in fixed assets by KZT 1 million will lead to an average growth of GRP by 0.779 million tenge in the current period. When investing in fixed assets in a year, one can expect an increase in GRP by KZT 1,167 million, in two years by KZT 3,668 million.

The growth of investments in the main capital by KZT 1 million in the current period will result in three years' growth in GRP volumes by KZT 10,787 million. We calculate the contribution of each lag:

$$\begin{aligned} w_0 &= \frac{\beta_0}{\beta} = \frac{0,779}{10,787} = 0,072 \\ w_1 &= \frac{\beta_1}{\beta} = \frac{0,388}{10,787} = 0,035 \\ w_2 &= \frac{\beta_2}{\beta} = \frac{2,501}{10,787} = 0,232 \\ w_3 &= \frac{\beta_3}{\beta} = \frac{7,119}{10,787} = 0,661 \end{aligned} \quad (9)$$



Consequently, 7.2% of the total increase in GRP, caused by the growth of investment in fixed assets, occurs at the current time; 3,5% - in a year; 23.2% - in two years; 66,1% - in three years. The average lag of the model is:

$$\bar{I} = 0 \cdot 0,072 + 1 \cdot 0,035 + 2 \cdot 0,232 + 3 \cdot 0,661 = 2,48 \text{ (years)} \quad (10)$$

The lag value of 2.48 years confirms that most of the GRP growth effect is manifested after three years. Thus, we can argue that investments in fixed assets do have a long-term positive effect on the dynamics of the region's GRP as one of the main indicators of economic sustainability.

Moreover, according to the constructed lag model, we can expect an increase in the gross regional product of the Karaganda region in the next three years. The forecast value of GRP will be:

$$GDP_{2018}=3751296.71 \text{ mln tenge}; \quad GDP_{2019}=4353626.68 \text{ mln tenge}; \quad GDP_{2020}=4356004.64 \text{ mln tenge}.$$

*Social model.* To predict the social stability of the Karaganda region, we built a multiple regression model. As a result, the total population of the region (Pop) was chosen. To select the factors that have the greatest impact on the result, we considered the variables: UP - unemployed population, thousand people, ANS - average monthly nominal wage, tenge, MG - migration increase, thousand people, PG - natural increase in population, people, NUS - number of students in universities, people, HB - number of hospital beds, CPO - the number of permanent preschool organizations.

The source was the statistical data of the Department of Statistics of the Karaganda region. Next, a correlation analysis is made and the correlation coefficients are calculated to select the factors that have the greatest correlation dependence with the resulting index-the total population. The results of estimating the correlation relationship are presented by the correlation matrix (Table 6).

Table 6. Results of correlation correlation estimation

	Pop	UP	ANS	MG	PG	NUS	HB	CPO
Pop	1							
UP	-0,23	1						
ANS	-0,58	-0,28	1					
MG	-0,71	-0,29	0,63	1				
PG	0,39	-0,84	0,40	0,14	1			
NUS	-0,74	-0,18	0,25	0,70	-0,22	1		
HB	0,92	-0,37	-0,60	-0,60	0,40	-0,49	1	
CPO	0,78	-0,59	-0,02	-0,35	0,78	-0,56	0,76	1

Source: calculated by authors

Judging by the correlation coefficients, all the factors considered, except for the number of the unemployed population ( $r = -0.23$ ), have a close correlation with the resulting sign. Based on the above, we did not include the mentioned factor in the model.

With the remaining factors, regression analysis was performed and the least-squares coefficients of the equation were estimated. As a result, a multiple regression equation was obtained:

$$Pop = 1536,8 - 0,00197ANS - 0,00015MG + 0,0066PG - 0,0033NUS + 0,0029HB + 0,148CPO, \quad R^2 = 0,99. \quad (11)$$

The regression equation is statistically significant, since the observed value of the Fisher criterion is significantly higher than its critical value at a significance level of 0.05 ( $F_{abset} = 429.3 > F_{crit} = 2.69$ ), hence the model adequately describes the interrelation between the variables and can be used for further analysis and forecast.

To obtain predictive estimates of social sustainability in the future, we have identified trends in the development of indicators included in the model. Trends of the change and the forecast obtained by the trend models for the next three years are presented in Table 7.



Table 7. Forecast values of targeted indicators for sustainable development of the region

Factors of social sustainability	Trend model	Forecast of the target indicator		
		2018	2019	2020
Average monthly nominal wage, tenge	$ANS = 274,85t^2 - 2.503,7t + 8.971,1$ $R^2 = 0,99$	118.160	129.674	141.737
Migration growth, thousand people	$MG = 10.868\ln(t) - 38.578$ $R^2 = 0,39$	-3.595	-3.169	-2.759
Natural increase in population, people	$PG = 100,03t^2 - 2.423,4t + 14.993$ $R^2 = 0,84$	16.927	19.605	22.483
Number of students in universities, people	$NUS = -157,1t^2 + 4.905,1t + 22.054$ $R^2 = 0,56$	46.492	43.384	39.963
Number of hospital beds, units	$HB = 24.690e^{-0,04t}$ $R^2 = 0,65$	9.083	8.727	8.385
No of permanent preschool organizations, units	$CPO = 11,164\ln(t) + 487,63$ $R^2 = 0,97$	506	508	509

Source: compiled and calculated by authors

Using the obtained predictive estimates of social stability factors, we obtained a forecast of the total population of the Karaganda region in 2018-2020:

$Pop_{2018}=1364,7$  thousand people;  $Pop_{2019}=1369,0$  thousand people;  $Pop_{2020}=1374,6$  thousand people.

Compared to 2017, in 2018, we can expect a decrease in the total population of the Karaganda region, which is caused by a significant outflow of population from the region. In subsequent years, the trend again has a positive trend.

Ecological model. To predict the environmental sustainability of the Karaganda Oblast, we have built a multi-factor regression model in which the amount of pollutant emissions (Emis, thousand tons) will depend on variables such as GRP (GDP, KZT million), Population's total population (Pop, thousand people), the number of enterprises that have emissions of harmful substances into the atmosphere (Manuf, units) and vehicles (Avto, thousand units).

The relationship between the emissions of pollutants and the volume of GRP is described by a polynomial of the second degree (Reinert 2016). This type of connection between these indicators was described by Grossman and Krüger (2014), who suggested that the economic recovery leads first to an increase, and then to a decrease in emissions.

That is, with the growth of GNP in the beginning, the ecology worsens: the factories are smoky, the forests are cut down. But then there is a turning point, which many scientists explain: "With the increase in incomes, the demand for improving the environment rises and there are more resources that can be invested in it" (Buletova 2013).

In other words, wealthy citizens, firstly, are keenly interested in living in an environmentally friendly environment, thereby preserving their health and thinking about future generations, and secondly, they can afford to invest free money in the environment.

Thus, in order to save the environment, it is necessary not to limit economic development, but, on the contrary, to develop it as intensively as possible, without being exchanged for ecology.

However, in our opinion, the number of emissions into the atmosphere is affected by a number of other factors that we have included in the ecological model:

$$Emis = b_0 + b_1GDP^2 + b_2GDP + b_4Pop + b_5Manuf + b_6Avto + u_t. \quad (12)$$

The coefficients of the regression equation were estimated by the method of least squares. As a result of approximation of statistical data for the Karaganda region for the period from 2001 to 2017, the following equation was obtained:

$$Emis = -711,7 + (-6,2E - 11)GDP^2 + 0,0009GDP + 2,075Pop + +0,029Manuf + 9,85Avto, \quad R^2 = 0,7 \quad (13)$$

Since the coefficient  $b_1 = -6,2E-11 < 0$ , and the coefficient  $b_2 = 0.0009 > 0$ , we obtained a convex upward ( $\cap$ -shaped) curve that changes its direction with respect to the point of inflection from growth to fall.

Having differentiated the equality in terms of GDP, and equating the result to zero, we calculated the volume of the gross regional product in the average for the Karaganda region, for which the pollution reaches its maximum value. We received that the peak of pollution occurs at the level of GDP = 7258064.5 million tenge. A further increase in this indicator in the region leads to a reduction in air emissions of pollutants.

The forecast of the environmental situation, according to the constructed regression model, will be as follows for the next three years:

$$Emis_{2018}=750,6 \text{ thousand tons}; \quad Emis_{2019}=841,6 \text{ thousand tons}; \quad Emis_{2020}=627,6 \text{ thousand tons}.$$

This forecast was calculated based on the predicted values of the indicators participating in the model, which are indicated in the following table.

Table 8. Forecast of target indicators of development of the Karaganda region for 2018-2020

Factors of social sustainability	Model	Indicator forecast		
		2018	2019	2020
Gross regional product, million tenge	Economic model	3.751.296,7	4.353.626,7	4.356.004,6
Total population, thousand people	Social model	1.364,7	1.369,0	1.374,6
Number of enterprises that have emissions of harmful substances into the atmosphere, units	Trend model $Manuf = 116,2t + 264,8$ $R^2 = 0,83$	1.078,2	1.194,4	1.310,6
Number of vehicles, thousand units	Trend model $Avto = 28,644t + 110,21$ $R^2 = 0,98$	425	454	483

Source: compiled and calculated by authors

Thus, the developed economic and mathematical model for forecasting the targeted economic indicators of the Regional Development Program in the context of the paradigm of its innovative development will allow improving the quality of state planning in terms of developing regional development programs, its innovative component and forecasting the values of target indicators.

## Conclusion

In general, the analysis of innovative processes in the country according to the results of 2017 testifies to the growth of the main domestic indicators of innovation activity, the volumes of innovative products, the costs of research and development, the number of researchers and others.

This was reflected positively in Kazakhstan and in the rating of the Global Competitiveness Index of the World Economic Forum. In particular, according to the "Innovation" factor, our country rose by 19 positions up to 84 places. According to the subfactors "Ability to innovate", the country also rose by 18 positions to 74 places, "Expenses of companies for research and development" by 17 positions to 77 places, "Cooperation of universities and business in the field of research and development" by 11 positions up to 79 places.

Such growth is due, first of all, to the implementation of the State Program of Industrial and Innovative Development of the Republic of Kazakhstan for 2010-2014. However, in the global comparison, Kazakhstan still shows modest results of the transition to an innovative type of economy. So, as of 2012, the share of innovative products in the gross domestic product was less than 1.3%, the share of domestic expenditure on research and development to GDP is 0.17%, the share in the total number of publications of international citation bases is 0.028%.

Undoubtedly, such low impact indicators on the country's economy require a more coordinated policy for the development of regional innovation systems, strengthening the region-center interaction, creating an innovative environment and increasing competencies in the implementation of research and innovation projects.

In this connection, it can be concluded that at present in Kazakhstan there is still a clear imbalance in the innovative development of regions, a low level of innovation in industrial enterprises and is characterized by a relatively small contribution of innovations to gross regional products.

Based on the results of the comparative analysis, it is necessary to note the low activity of the following regions.

In Mangistau and Atyrau oblasts - in aggregate, one of the lowest in the country indicators for:

- innovation activity (1.6% and 4.8% respectively, 1.1% and 4.4% without management technologies), for comparison, the nationwide figure is 7.6% (5.7% without management technology);
- volume of manufactured innovative products (KZT6.6 billion and KZT 4.7 billion, respectively), on

- average in the country this figure is equal to - 23.7 billion KZT;
- the share of innovative products in the GRP of the region (0.18% and 0.15%, respectively), the republican figure is 1.25%;
- distribution of innovative products in the total volume of own production of industrial enterprises in the region (0.2% and 0.1% respectively), for comparison in the whole country this figure is 2.3%.

There is also a low activity of participation in republican competitions "NIF\$50K" and "Rationalizer.kz", according to which out of more than 500 applications - projects in the country, only 5 applications have been submitted from Mangistau oblast, only 11 applications from Atyrau.

In addition, there is a significant decline in the production of innovative products in the West Kazakhstan region - 5.6 times to the level of 2016. In this region is also quite low is the indicator for the distribution of innovative products in the total volume of own production of industrial enterprises in 2017 - 0.3%. This testifies to the need to strengthen the work of the akimat on the development of innovations in the enterprises of the region.

In general, a systematic problem, including the above-mentioned regions, is the practical lack of funding for activities to develop innovations from the local budget in the regions. There is no support from local executive bodies to promote initiatives of entrepreneurs and innovators of the region, to ensure interaction between business, research institutes, universities, search for investments and technologies for regional enterprises, etc.

It is necessary to recognize that the majority of regions are engaged in questions of financing activities to increase innovation activity on a residual principle in the context of misunderstandings of the mechanisms for allocating budgetary funds, the definition of regional operators and measures for the development of innovations, and the lack of a common methodology for the formation of regional innovation systems. Full-fledged operators of innovation development in the regions at the expense of the local budget were created only in Astana (Astana-Innovations JSC) and Shymkent (Shymkent Innovation LLP).

JSC "Astana-Innovations", which in 2011, within the framework of the budget program 012, formed the Authorized Capital of the Company as an example of successful development of financing from the local budget. At the same time, through the Administrator of the Free Economic Zone "Astana - New City", in agreement with the Ministry of Finance, provided annual funding for current activities to support innovation within the 004 budget program in the region "Services to ensure the development of innovation in the city of Astana."

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## Analysing Customer Behaviour in Mobile App Usage Among the Representatives of Generation X and Generation Y

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### Abstract:

The main objective of this study is to survey the consumer habits mobile app users among the participants of Generation X (born between 1965 and 1980) and Generation Y (born between 1981 and 1995). This paper contains 3 figures and 2 tables. We formulated 3 hypotheses. The first part includes the introduction. The first chapter focuses on the theoretical overview of the researched issue. This part deals with generational marketing (1.1). It also presents the characteristics of the target generations in general and describes their consumer habits (1.2). The next subchapter (1.3) is about mobile marketing and mobile applications. The research methodology is described in the second chapter. The third chapter contains the results of the questionnaire research. The first subchapter (3.1) summarizes the main results. The next subchapter (3.2) contains the result of our hypotheses testing. The closing part summarizes the findings and recommendations.

**Keywords:** generation X; generation Y; consumer habits; mobile marketing; generational marketing.

**JEL Classification:** D12; M31; M39

### Introduction

The attitude of people towards the phone usage has changed completely during last years. The introduction of Internet access on smart devices provided new opportunities for everyday users and businesses as well. Nowadays, not only clothing, electronic devices and other traditional products are purchased via mobile applications, but also increasing demand is detected for softwares and other virtual contents.

Our study will focus on mobile application stores, the virtual products and services (applications) offered by companies. Asadi *et al.* (2014) emphasized that the use of these applications has become essential part of the everyday routine of those using smart phones. Only a small number of domestic and Central-European researchers have dealt with the habits of buyers realising their purchase via their smartphones. This is the reason why we would like to contribute to the issue. According to Nieradka (2016), growth-oriented companies are important to track the behaviour of individuals, especially the behaviour of the younger generation, since the Internet is the main source for information access and purchasing goods and services. According to Popirlan and Stefanescu (2009), the intelligent data analysis techniques *e.g.* mobile agent systems play an essential role in the field of management. The innovations are natural part of the life of the younger generation, but not only they as a target group are interesting for companies and the marketing professionals. It is also necessary to take into consideration the older generation, since they have a high percentage of representation on the market.

### 1. Literature review

#### 1.1. Generational marketing

According to Törőcsik (2009): “*The generational marketing is examining the active age groups based on their determining experience, values, needs and expectations.*” and to Smith and Clurman (2003) 3 factors need to be considered to understand the consumer behaviour:

- age of the consumer – how old is the consumer, what stage of life the consumers are in (physiological, psychological). Our responsibilities and needs vary in different stages of our life, so we need different products and services;
- current circumstances – certain situations (job losses, economic crisis, state measures);
- cohort experience - common experiences (war, elections, disasters).

According to Töröcsik (2009) and Smith and Clurman (2003) the cohort experience is the most important since these determine the values, the habits and the attitude of different generations. These experiences will affect the representatives of different generations in different field of their lives, including their consumption and purchasing habits. Different generations experience the same stages of life (getting qualifications, obtaining driving license, becoming a parent, retiring, etc.); all the generations experience certain type of economic recession, but the set of experiences will differentiate them from other generations. The fundamentals of cohort experiences can be the political, economic and innovation events. Each generation has its favourite movie, music performers and literary works.

According to Smith and Clurman (2003): “*The generational marketing does not provide an answer for everything but makes it easier to understand why individuals provide different reactions on the same markets.*”

## 1.2. Characteristics of Generation X and Y

The members of Generation X were born between 1965 and 1980. They were introduced the Internet in their adulthood and had to use at their workplaces on daily basis. Later they were introduced the smartphones, tablets and other electronic devices, often with the help of their children. They still favour using handwriting and conducting phone calls. They prefer face-to-face communication, especially in case of informal relationships. They rather meet their friends face-to-face. The representatives of Generation X are rather sceptical when it goes about purchasing products and services. They are familiar with marketing techniques and have become more conscious consumers than their predecessors. They are critical about the adverts, products and services. They are trying to hide their purchasing habits in online environment. It is difficult to influence their opinion. They are brand loyal customers. Their purchasing decisions are made alone and cannot be influenced by others. They consider the value they get for their money during the purchases. We cannot describe them as price-sensitive. If they like the product, they show willingness to pay even for the expensive ones. They expect trust from the sales staff and like to be treated as family members. Before and during the purchase they gather information about the product, why is it worth to purchase the certain product or service. This is why the marketing experts have a task to convince them about the unique features of the product or service and motivate them to buy. The sales staff should “sell” themselves as experts, advisors rather than a sales staff. They do not like the companies and salesmen trying to force the purchase of their products and services. The marketing professionals can approach them with honesty and trust. It is worth to use the tools of online advertising. They have positive reaction on e-mail and multimedia adverts. It is also easy to approach them by sponsoring events (PR tool). Sometimes success can be achieved with word-of-mouth advertising, they rather believe in what they can see. (Berkup 2014, Page and Williams 2011, Siddiqua 2016, Smith and Clurman 2003)

The representatives of Generation Y were born between 1981 and 1995. This generation was influenced more by the Internet than TV. They are better in technology than their parents or older bosses. The members of this generation are registered on social networking sites. They can multitask and use different communication channels simultaneously. They practice this form of communication on different online portals, blogs or even strategic games and other online communities. They prefer online communication to face-to-face interaction. The representatives of Generation Y are less brands loyal, since the Internet is providing them a wide range of products. They gather most of the information via social media and social networking sites. It is difficult to fool them, since they are well-informed. They are selfish and spend a lot on themselves. They like advertising and marketing solutions based on unique and true stories. They highly appreciate humour, uniqueness and honesty. The product they would like to purchase must be modern and trendy. According to Cui (2003), they enjoy shopping and considered to be a relevant purchasing power. They purchase more than their predecessors, but they focus on sales and spend less. They prefer to use mobile applications. According to Hawk Incentives (2015), 89% of Generation Y own smartphones and use it for surfing on the Internet on daily basis. It enables them to compare prices and purchase products and services at the lowest price. They also use their smart devices while visiting brick-and-mortar stores to get more and detailed information about the products. Usually they compare the prices and check the feedback of other customers to gain further information about products on their smart devices. The product designers have to keep in mind that this generation is sensitive to fashion and music. The



companies should refresh their product portfolio frequently, since the generation gets easily bored and want to change their products to something new or fascinating. It is necessary to change the product portfolio on the shelves of the shops (Berkup 2014, Page and Williams 2011, Poliačiková 2017, Siddiqua 2016, Smith and Clurman 2003)

### 1.3. Mobile marketing

Mobile marketing – wireless marketing – includes all the marketing activities conducted via smartphone. According to Fehér (2012), we refer to it as m-marketing, enabled by the widespread use of smartphones. Based on the scientific literature, we can talk about a “mobile behavior” closely connected to the usage of a mobile device. Their mobile devices heavily influence the everyday activities of the users. The mobile marketing is considered to be the most dynamically growing segment of the marketing communication. The mobile marketing communication does not target the main function of mobile phones – conducting phone calls. The most important tools of the mobile marketing communication are: SMS, MMS, advergaming, logos, pictures, ringtones, cell-broadcasting techniques, applications, special graphics codes, social media, networks, viral videos and viral marketing (De Pelsmacker *et al.* 2010, Fehér 2012, Příkladová and Jahodová 2010, Moreau 2017, Mura and Lincényi 2015).

The mobile applications are softwares and programs that can perform certain tasks based on the request of the user. It is important to be informed about different types of applications. The scientific literature distinguishes 3 types of applications. These differ in terms of technology and realization. The most widespread can be considered the native applications. These are downloadable applications (Apple AppStore, Play Store). The native applications are fast, advanced and have built-in features (camera, GPS, touchscreen) to be used. They often send notifications to users (sales, a message from a friend on a social network site). They can also be used offline. Their disadvantage is that require a heavy investment, they should be developed separately for each operating system, they can only be accessed from marketplaces, in case of change or development the approval is required. The applications are developed for two operations systems (iOS, Android) since they dominate more than 99% of the market. The approval of developments is a good idea, because the company can provide a certain level of guarantee. The second type is the web application. These cannot be downloaded from app stores, but from the websites of companies. After downloading, a bookmark is created on the screen of the device. If it is opened by the user, the mobile website of the company is opened with the help of the browser. The web apps are cheap enough but should be designed separately for different platforms. As a further disadvantage, they are slow and cannot be found on the marketplaces, only on the websites of the companies. The third type is the hybrid application. This combines the features of the previously mentioned applications. They can be downloaded from the marketplace, can be adapted to any platform, therefore it is the most cost-effective solution. The disadvantage is the poor performance. The native applications are the most widespread nowadays. (Budiu 2013, Hew *et al.* 2015, Islam *et al.* 2010, Magrath and McCormick 2013, Vincent 2017)

According to Mohammadi *et al.* (2015) the mobile applications and technologies will play an important role also in the healthcare. This is not negligible in economic terms.

## 2. Methodology

The survey focused on the examination of consumption habits of the representatives of Generation X (1965-1980) and generation Y (1981-1995). The sample is represented by the members of Generation X and Generation Y born between 1965 and 1995. Based on the age difference between the representatives of the groups, it may be assumed that their taste and consumption habits are different.

A questionnaire survey was applied for the collection of primary data. It is considered to be a quantitative research technique. Our questionnaire contained a total of 31 questions. Our goal was to describe the habits of a larger target group, and we found this research method the most appropriate. The questionnaire was prepared in online format using Google Forms, since the research activity is closely related to online activities. The printed version of the questionnaire was also prepared both in Hungarian and Slovak languages. The questionnaires were received by the recipients' offline and online. They were distributed using the snowball method to the target group to be surveyed. This method is a non-random sampling technique. Non-random sampling techniques work well in research with no standardized list of individuals, groups or organizations. We decided to conduct our research among the individuals of Generation X and Y. In this case we cannot rely on lists.

Data obtained was processed electronically with the help of Excel programme. For transparency and processing data it was necessary to encode the questions. Different indicators were used to evaluate the questions. We set the following 2 hypotheses:



*H1: The members of younger generation find mobile applications more important than the members of older generation.*

Independence testing was conducted, so in all cases the “null hypothesis” had to be set, which assumes that there is no correlation between the variables tested. The H1 hypothesis was also defined as the opposite of the H0 hypothesis. According to this:

Hypothesis H0: There is no correlation between the relevance of belonging to certain age group and the significance of mobile applications

Hypothesis H1: There is correlation between the relevance of belonging to certain age group and the significance of mobile applications.

Our hypothesis is based on the Hawk Incentives survey (2015) about the online purchasing preferences of the Generation Y. The research has shown that mobile phone is the No1 device for Generation Y, about 90% of them use their smartphones for surfing on the net. Based on the results obtained, it can be assumed that the members of this generation use mobile applications frequently and find those applications important.

*H2: The online communication applications are used more frequently by the members of the younger generation*

Hypothesis H0: There is no correlation between the relevance of belonging to certain age group and the frequency in use of mobile applications.

Hypothesis H1: There is correlation between the relevance belonging to a certain age group and the frequency in use of mobile applications.

Our hypothesis was based on Berkup (2014), Page and Williams (2011). The experts in these surveys argued that the members of Generation Y are more familiar with new technological solutions. They are checking their smartphones often and have online messaging applications active all day. The members of younger generation are more likely to use online communication applications.

### 3. Empirical results

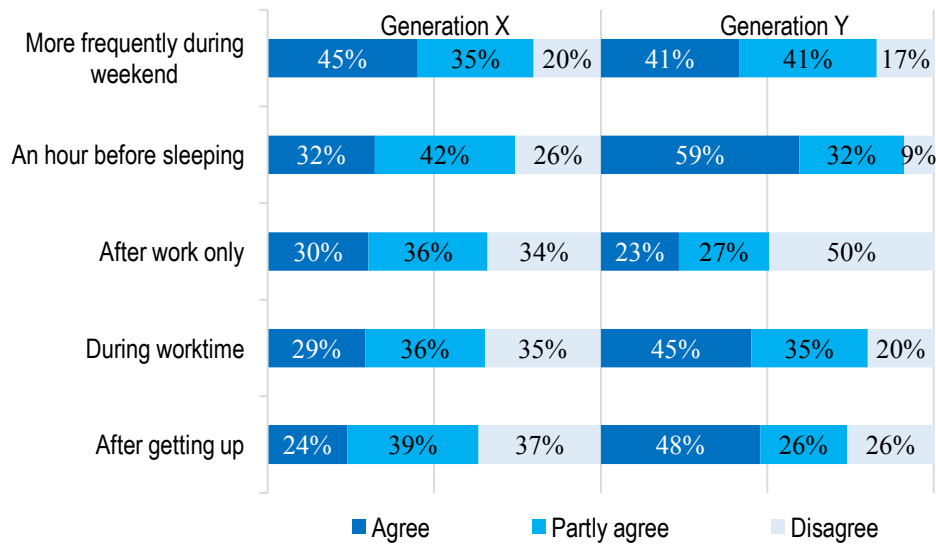
#### 3.1. Main results

This part of the article is describing the results of the primary research. We have analysed the results of the questionnaire survey. 238 respondents filled the questionnaire. After the unfinished and faulty questionnaires were excluded, we examined the answers of 224 respondents. In the analysis the representatives of both generations (Generation X and Y) were tested and compared equally (112-112 respondents).

The proportion of women (55%) filling the questionnaire was higher than the proportion of men (45%). Those living in a town represent 56% of the respondents, while the ratio of respondents living in village is 44%. The majority of respondents (68%) work as employees, 14% are students, which is not surprising, since the majority of representatives in Generation Y are still university students. The ratio of unemployed (4%) is also low. It can be explained by the fact that Slovakia has a high employment ratio. Also, those on maternity leave fall into this category. The net monthly income of respondents can be presented on a wide scale. In terms of qualification, most of the respondents (46%) have a high school degree. This is followed by those with university degree (43%). This is not a surprising result, because the career path and the appropriate workplace gain high importance.

Majority of the respondents own smartphone (99%), and not only they are familiar with the term of mobile applications, but they have already used at least one online mobile application (99%). The majority of our respondents (80%) use mobile applications on a daily basis. Most of the respondents use different applications (80%) on daily basis and use them for less than a half an hour (55%). The use of Android operation system is more widespread among the respondents (82%).

Figure 1. Assessment of the statements related to the use of applications



Source: own processing

Our analysis revealed that the representatives of the younger generation use mobile applications more during the worktime resp. in school (45%) than the respondents of older generation (29%). The respondents of Generation Y agreed with the statement that an hour before sleeping (59%) and an hour after getting up (48%) use a mobile application.

Both of the generations found the mobile applications useful (Generation X – 68%, Generation Y- 70%). The members of Generation X use it for quick information access (53%) and save time by apps (52%), while members of Generation Y use their smart devices for socializing (66%). While the members of older generation (88%) rather use traditional functions (SMS, phone call), the members of younger generation prefer the online forms of communication (86%). The most preferred forms of online communication applications are Messenger, FB, Viber etc. Most of the respondents of both generation groups (80 and 81%) use the function of alarm clock on their devices.

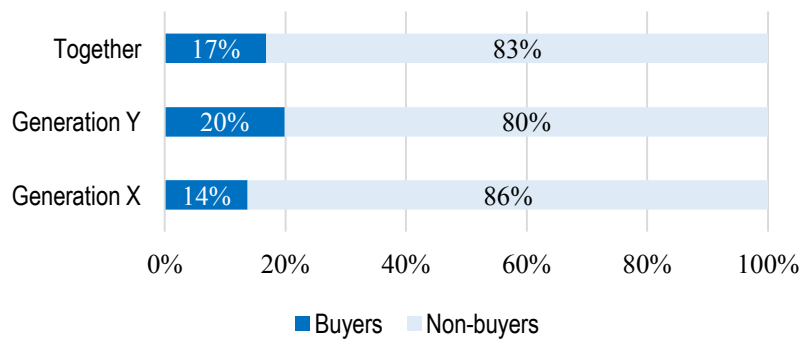
Low is the ratio of respondents regularly buying highway vignettes resp. tickets (72 and 75% has never bought) via application. Relatively low is the ratio of those respondents (68 and 48% never) who have used applications supporting sport and healthy lifestyle or used QR code readers (69 and 53% never). Apps supporting online purchases – apps of online stores (AliExpress, Wish) can be found also on the list of rarely used applications (54% and 37% have never used them). It was not expected that there would be a high number of those realizing daily purchase.

The word-of-mouth advertising plays an important role when trying new applications in case of both generations (influenced more than 70% of the respondents). Most of the respondents (50 and 43%) feel that nothing had affected them. The online adverts proved to be more effective with the younger generation (50 vs 43%) than the older one. Only few respondents were disappointed with any of the applications (15% of the respondents). The main reason of dissatisfaction was the improperly functioning application. The assessment of online apps proved that low is the ratio of those evaluating apps in the app stores (14 and 20%).

Many of the respondents cannot make a difference between paid and free application. More than a quarter of respondents (26%) think that paid apps have more functions. Only a small ratio of the respondents purchased an app from application store.

Figure 2 shows that less than a fifth of the respondents (18%) have already bought any kind of mobile application. Buying mobile apps is more popular among the respondents of the younger generation. The reason might be that technology tools have surrounded members of this generation since their early ages. They are innovative, creative and open to technological innovations. We believe that this ratio will change in the future, and purchase of applications will be more popular among the members of both generations. While the younger generation showed willingness to purchase apps supporting music (13 respondents), the representatives of older generation purchased navigation systems or maps (13-13 respondents).

Figure 2. Buyers vs non-buyers of applications



Source: own processing

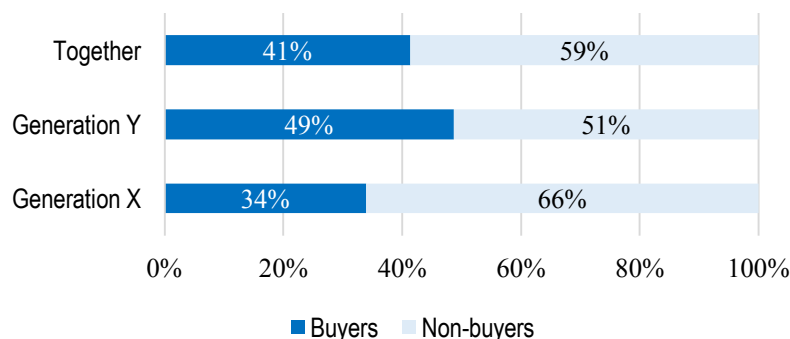
The ratio of those realizing purchase via mobile applications is higher in case of Generation Y.

It is clearly presented that 41% of the respondents have already bought some kind of product via smartphone. It is interesting to observe the difference between the generations. It is clearly presented that roughly half (49%) of the representatives of Generation Y have already bought some kind of product via app. It has reached only 34% among the representatives of Generation X.

The results are not surprising, since the members of younger generation show higher willingness trying new products, even the products that cannot be purchased in brick-and-mortar stores. The widespread use of smartphones determined the increase of online purchase. There are online shopping malls offering certain products cheaper, if those are purchased online or via mobile apps – most of the products of AliExpress fall into this category.

According to our opinion, the achieved numbers can be considered high. We can conclude that the users find mobile apps trustworthy. In case the product is ordered online, the customer is provided no possibility to check the product physically. The customer should make decision based on product description, pictures and reviews provided by other potential customers. There is always the risk the product will be different than the description provided. It can happen that the product is not delivered, defected or damaged during the delivery. It may also happen that the customer is cheated on and does not get delivered the product. We also looked at how satisfied customers are with the process of ordering products and the quality of products delivered. It was also recognized that most of the customers spent small amount of money on different kind of products. The representatives of Generation X (24 respondents, 26% of total number of customers) have spent on clothing, (17 respondents, 19%) have spent on electronics, (17 respondents, 19%) have purchased auto parts and (16 respondents, 18%) purchased cosmetics. Film, DVD, music or CDs were bought by 3% (3 respondents) of the purchasers. Most of the spending went on travelling.

Figure 3. Customers realizing purchase via apps – own processing



Source: own processing

In case of the younger generation, higher was the ratio of those using online apps for purchasing products (Figure 3). The majority of respondents from Generation X (40 respondents, 44%) bought electronics. The second most popular product purchased was clothing (37 respondents, 41%), the third was the category of other

products (24 respondents, 26%). The least popular products purchased were films, music and gardening tools (13-13 respondents, 14-14%). The majority of respondents have spent a relatively smaller amount of money during their life, but for certain products and services the spending has increased. These are the following: travelling, wellness, electronics, cosmetics, furniture and products, services falling into other categories.

The majority of respondents were satisfied with the order of products resp. services (87%- Generation X, 85%- Generation Y). According to the answers submitted, most of the respondents do not feel purchase via mobile apps more advantageous than the purchase realized on PC.

As for the future outlook, most of the respondents feel that mobile apps will make our life easier (34%) and will be better and more developed (29%). According to respondents (27%), the applications should be more user-friendly and transparent in the future.

### 3.2. Hypotheses testing

The following subchapter shows the results of hypotheses testing. The data was encrypted using Excel, the calculations were prepared using two programmes (Excel, SPSS). The following hypothesis was set:

*H1: The representatives of younger generation find mobile apps more important than the representatives of the older generation.*

To examine our hypothesis, we considered the answers received on Question 1 and Question 9. During the analysis we examined Hypothesis H0. This assumed that between the variables – belonging to a certain generation group (independent variable) and considering the importance of applications (dependent variable) – there is no correlation. Both of the variables were ordinal. The Pearson Chi-Square Test ( $\chi^2$ ) was applied. To conduct the test, at least in case of 20% of all cells the expected frequency can be lower than 5. We prepared the table of the observed and expected values. The observed values are based on the questionnaire survey, while the expected values were determined with a help of formula (Excel), (Malhotra and Simon 2008).

Table 1. The importance of applications – observed and expected values

Generation Level of agreement	Observed			Expected		
	Generation X	Generation Y	Together	Generation X	Generation Y	Together
Agree strongly	26	32	58	28,74	29,26	58
Roughly agree	48	46	94	46,57	47,43	94
Cannot decide	19	12	31	15,36	15,64	31
Mostly disagree	9	17	26	12,88	13,12	26
Strongly disagree	7	4	11	5,45	5,55	11
Together	109	111	220	109	111	220

Source: own processing

It is clear from Table 1 that rules to conduct the test were met. Following this, we could calculate the Chi-Square value with the help of Excel. This value is 5,506. To find out what does it mean, further calculations had to be done. It was followed by the calculation of the degree of freedom (df), based on the formula: (number of lines-1) x (number of columns-1). Thus, the degree of freedom (df) was 4. It was also necessary to determine the level of significance ( $\alpha$ ). Since the significance level of 0,05 is a generally accepted value, we also used that. With the help of the calculated degree of freedom and the level of significance it is possible to determine the critical value of distribution  $\chi^2$ . This can be determined by using a table or an Excel formula (Chiinv). The critical value of Chi-Square distribution is 9,488 in case the level of freedom (fd) is 4 and the significance level is 0,05 (Malhotra 2002). According to calculations:

$$5,506 < 9,488 \quad \text{that is} \quad \chi^2 < \chi^2 \text{ crit.}$$

The results were verified with the help of SPSS programme. We received the same value (5,506) as well. The value of P (empirical significance level) is 0,239, that is higher than the level of significance ( $\alpha = 0,05$ ). It means that Hypothesis H0 cannot be rejected, so there is no reason to suppose differences between the generations in the usage of applications. There is no correlation between the age and how important different generations feel the usage of applications is – the alternative hypothesis (H1) can be rejected. Based on that, our main hypothesis can be rejected as well.

Table 2. Value calculated using SPSS programme

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5,506 <sup>a</sup>	4	,239
Likelihood Ratio	5,571	4	,234
Linear-by-Linear Association	,153	1	,695
N of Valid Cases	220		

Source: own processing

H2: The online communication applications are more frequently used by the members of the younger generation

We tested the hypothesis H0. The hypothesis assumes that there is no correlation (dependent, ordinal) how frequently the online communication applications are used based on the age group the respondents belong to (independent, ordinal). For the analysis we have used one of the categories of the 1<sup>st</sup> and 10<sup>th</sup> questions. The Pearson’s Chi-Square ( $\chi^2$ ) Test was applied. The observed and expected values were as the follows:

Table 3: How frequently online apps for communication are used in case of two generations – observed and expected values

Generation Frequency	Observed			Expected		
	Generation X	Generation Y	Together	Generation X	Generation Y	Together
Daily	64	96	160	79,27	80,73	160
Weekly 3-4x	16	5	21	10,40	10,60	21
Weekly 1-2x	9	6	15	7,43	7,57	15
Rarely	5	0	5	2,48	2,52	5
Never	15	4	19	9,41	9,59	19
Together	109	111	220	109	111	220

Source: own processing

In this case, the Chi-Square value is 24,114. The degree of freedom (df) is 4. The value of significance ( $\alpha$ ) is 0,05. The critical value of  $\chi^2$  (the degree of freedom 4 and the significance level of 0,05) based on Excel formula is 9,488. (Malhotra 2002) According to this:

$$24,114 > 9,488 \quad \text{that is} \quad \chi^2 > \chi^2_{crit.}$$

The accuracy of the result was calculated using the SPSS programme. According to Table 13, the Chi-Square value is 24,114. The value of P (empirical significance level) is 0,000, which is lower than the value of the significance level ( $\alpha = 0,05$ ). This means that we can discard the H0 hypothesis. The alternative hypothesis (H1) is approved. It means there is correlation between the frequency of using online communication applications and the age group the respondents belong to. Based on the results of the questionnaire survey (Table 12), hypothesis H2 is approved.

Table 4. Value calculated using SPSS programme – Hypothesis H2

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24,114 <sup>a</sup>	4	,000
Likelihood Ratio	26,803	4	,000
Linear-by-Linear Association	17,577	1	,000
N of Valid Cases	220		

	Value	Asymp. Std. Error <sup>a</sup>	Approx. T <sup>b</sup>	Approx. Sig.
Ordinal by Ordinal Gamma	,592	,101	4,878	,000
N of Valid Cases	220			

Source: own processing

Since there is significant correlation between the variables, the analysis of Gamma coefficient is necessary. This coefficient should be used in case we are interested in the correlation of two ordinal variables. These results were generated by using SPSS programme. The value in our case is 0,592 – a moderately strong value – that indicates a moderately strong, positive correlation between the variables.

## Conclusion

The research provided adequate information. The review of foreign and domestic literature forming the theoretical background of this work helped to be involved in the details of the researched issue. This served as a basis in formulating the questionnaire survey our research is based on.

All the respondents of the questionnaire survey own smartphones. Most of the respondents were familiar or used online applications, but majority of them did not know how paid applications differ from free apps. As we can see from the results, companies providing paid applications should inform their target customers about the benefits of paid apps. Moreover, paid application should be developed that differ from free ones not only because they do not use adverts. Success can be achieved by designing paid apps that have more features; higher quality, security and they are frequently updated by developers. Both free and paid apps are demanded on the market, which attract customers with completely new features.

The results show that word-of-mouth advertising has the biggest impact on the customer, while its impact is negligible for the companies. The second most effective advertising technique is the online advertising. Therefore, we think that companies introducing new apps should choose the form of online advertising to reach their target customers. The results prove that online communication channels (Messenger, Instagram) are the most appropriate tools to target the younger generation. The companies are advised to contact the representatives of Generation Y via these online communication channels. The easiest way to achieve this is creating an application. Increase in sales can be achieved (apps supporting online orders, apps for online shopping). It can also increase the popularity of the product and the company (game or apps related to products).

It would be important to continue the research, since Generation Z was not involved in the survey conducted. The representatives of Generation Z were born between 1996 and 2010. The oldest representatives of this generation have already entered the labour market, but younger representatives are attending primary education. They have a close connection with the Internet and different forms of online content. They deserve a particular attention, since the scientists, employees, inventors of the future can be found among them. This generation is preceded by Generation Alpha. The representatives of this generation were born after 2010. The alphas will have a digital footprint before they even understand the term. The consumer habits of this generation are difficult to forecast.

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## Balance of Trade Analysis Based on World Input-Output Database: Australian Economy 2000, 2005, 2010 and 2014

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### Abstract:

Based on the World Input-Output Database, this paper calculates trade balance in Australian economy for the year 2000, 2005, 2010 and 2014. The results showed that, firstly, Australian export had increased significantly during 2000, 2005, 2010 and 2014. Secondly, Australian import had also increased significantly during the period. Important sectors and countries' trade partners of Australian export and import were indicated. Thirdly, trade balances in Australian economy were surpluses in all years of study. Sectors and countries in which trade balances were deficits and surpluses have also been clearly indicated. There were 7 countries and 7 sectors in which Australian had experienced trade surpluses in all years; there were 7 countries and 17 sectors in which Australian had experienced trade deficits in all years of study.

**Keywords:** balance of trade; export-import; world input-output database.

**JEL Classification:** C67; D57.

### Introduction

The economy of Australia is highly developed and one of the largest mixed market economies in the world, with a GDP of AUD \$1.69 trillion as of 2017 (Australian Bureau of Statistics 2017). Australia is the second wealthiest nation in terms of wealth per adult after Switzerland (Department of Foreign Affairs and Trade 2017). Australia's total wealth was AUD \$8.9 trillion as of June 2016. In 2016, Australia was the 14<sup>th</sup> largest national economy by nominal GDP, 20<sup>th</sup> largest by PPP-adjusted GDP (World Bank 2017), and was the 25<sup>th</sup>-largest goods exporter and 20<sup>th</sup>-largest goods importer (CIA 2017). Australia took the record for the longest run of uninterrupted GDP growth in the developed world with the March 2017 financial quarter, the 103<sup>rd</sup> quarter and marked 26 years since the country had a technical recession (Bagshaw and Massola 2017).

East Asia (including ASEAN and other Northeast Asia Countries) is a top export destination, accounting by approximately 64% of exports in 2016 (Thirlwell 2017). Australia has the eighth highest total estimated value of natural resources, valued at US \$19.9 trillion in 2016 (Craig 2016). At the height of the mining boom in 2009–2010, the total value-added of the mining industry was 8.4% of GDP (Australian Bureau of Statistics, 2015). Despite of the recent decline in the mining sector, the Australian economy has remained hardy and stable (Reserve Bank of Australia 2017) and has not experienced a recession since July 1991.

## 1. Research background

One of the objectives of developing World Input-Output Database (WIOD) is to analyze the effect of globalization on trade pattern, environmental pressures and socio-economic development across a wide set of countries (Erumban *et al.* 2011, Timmer *et al.* 2012, Dietzenbacher *et al.* 2013, Timmer *et al.* 2015). WIOD 2016 release covers all trade between forty-three countries as well as with a rest-of-the-world region (Timmer *et al.* 2016). World Input-Output Database provides information on imported goods and services from another country. At the same time, it also explains information about exported goods and services to another country.

Export illustrates the goods and services that are produced in one country and sells to the citizens of another country. This does not matter what the good or service, how it is sent but the important things were produced by domestically and sold to someone from a foreign country. The seller of such goods and services is referred to as an exporter; the foreign buyer is referred to as an importer (Joshi 2005, 2009). Most countries would like to increase their exports and their companies want to sell more. If they have sold all they can to their own country's population, then they want to sell overseas as well. The more they export, the greater their competitive advantage. That is because they gain expertise in producing goods and services so that they gain knowledge about how to sell to foreign markets.

Imports consist of the transactions of goods and services to a resident of a jurisdiction such as a nation from non-residents (Lequiller and Blades 2006). An import of a good occurs when there is a change of ownership from a non-resident to a resident. Imports of services consist of all services rendered by non-residents to residents. In national accounts, import includes and excludes specific borderline cases. In macroeconomic theory, the value of imports can be modeled as a function of the domestic absorption and the real exchange rate Burda (2005). There are two basic types of import namely industrial and consumer goods and intermediate goods and services. The second, companies import goods and services to supply to the domestic market at affordable price and better quality than competing goods manufactured in the domestic market.

Trade balance is one important element in Balance of Payment, which is the record of all economic transactions between the residents of the country and of the world in a particular period (Levi 2009, Muchdie *et al.* 2018). Balance of trade is the difference between the monetary value of a nation's exports and imports over a certain period (O'Sullivan and Sheffrin 2003, Idrisov *et al.* 2016). If a country exports greater than it imports, it has a trade surplus. If a country imports greater than it exports, it has a trade deficit. The objective of this paper is to analysis balance of trade in Australian economy based on World Input-Output Database for the year 2000, 2005, 2010 and 2014.

## 2. Methodology

An input-output table is an excellent descriptive device and a powerful analytical technique (Jensen *et al.* 1979). It records the flows of products from each industrial sector considered as a producer to each of the sectors considered as consumers (Miller and Blair 1985). In the production process, each of these industries uses products that were produced by other industries and produces outputs that will be consumed by final users for private consumption, government consumption, investment and exports and also by other industries, as inputs for intermediate consumption (Oosterhaven and Stelder 2007, Timmer *et al.* 2015).

The columns of the input composition are the total supply of each product  $j$  ( $X_j$ ); this is comprised by the national production and also by imported products. The value of domestic production consists of intermediate consumption of several industrial inputs  $i$  plus value added. The interindustry transactions table is a nuclear part of this table, in the sense that it provides a detailed portrait of how the different economic activities are interrelated. Since intermediate consumption is of the total-flow type, this implies that true technological relationships are being considered. In fact, each column of the intermediate consumption table describes the total amount of each input  $i$  consumed in the production of output  $j$ , regardless of the geographical origin of that input. A simplified national World Input-Output Table is depicted in Table 1.

Table 1 - A simplified national World Input-Output Table

Country A Intermediate Input ( $^{AA}X_{ij}$ )	Output Exported to Country B ( $^{AB}X_j$ )	Output Exported to Country C ( $^{AC}X_j$ )	...	Output Exported to Country Z ( $^{AZ}X_j$ )	Other FD ( $^{AF}_j$ )	Total Output ( $^A X_j$ )
Input Imported from Country B ( $^{BA}X_i$ )						
Input Imported from Country C ( $^{CA}X_i$ )						
..						
Input Imported from Country Z ( $^{ZA}X_i$ )						
Other VA ( $^{AVA}_i$ )						
Total Input ( $^A X_i$ )						

Source: Modified from WIOT 2016.

The input-output interconnections can be translated analytically into accounting identities. On the demand perspective, if  $Z_{ij}$  denote the intermediate use of product  $i$  by industry  $j$  and  $y_i$  denote the final use of product  $i$ , we may write, to each of the  $n$  products:

$$X_i = Z_{i1} + Z_{i2} + \dots + Z_{ij} + \dots + Z_{in} + y_i \tag{1}$$

On the supply side, we know that:

$$X_j = Z_{1j} + Z_{2j} + \dots + Z_{ij} + \dots + Z_{nj} + w_j + m_j \tag{2}$$

in which  $w_j$  stands for value added in the production of  $j$  and  $m_j$  for total imports of product  $j$ . It is required that, for  $i = j$ ,  $x_i = x_j$ , i.e., for one specific product, the total output obtained in the use or demand perspective must equal the total output achieved by the supply perspective. These two equations can be easily related to the National Accounts' identities. In general term, equation (1) can be written as:

$$x = Ax + y \text{ or } x = (I - A)^{-1}y \tag{3}$$

National Input-Output Table of Australia for the year of 2000, 2005, 2010 and 2014 are available from World Input-Output Data Base (Timmer *et al.* 2016, 2015). Calculation on total input, output exported to other-countries, imported input from other-countries, and multipliers were based on 30 sectors classification of Australian National Tables.

The column consists of intermediate input that domestically produced, imported and other value-added. The row consists of intermediate demand that locally consumed, export and other final demand. Export is calculated as summation of output distributed to other-countries (row operation) and import is calculated as summation of input come from other-countries (column operation). Balance of trade is calculated as the different between export and import. Sector classifications and country abbreviations are available in Appendix 1 and Appendix 2.

### 3. Results and discussion

#### 3.1. Australian export

Table 2 presents the result of calculation of Australian export to countries of destination in the year 2000, 2005, 2010 and 2014. In the year 2000, total Australian export was US\$ 68,886 million. If exports to the Rest of the World are ignored as no specific country was referred, the highest export was to Japan (US\$ 12,315 million; 17.88%) and the lowest exports were to Lithuania (US\$ 1 million; 0.01%), Bulgaria (US\$ 4 million; 0.01%), Croatia (US\$ 7 million; 0.01%), and Latvia (US\$ 7 million; 0.01%). Some other important countries in Australian export were Korea (US\$ 6,563 million; 9.53%), USA (US\$ 4,221 million; 6.13%), China (US\$ 4,199 million; 6.10%), Taiwan (US\$ 2,857 million; 4.15%), Great Britain (US\$ 2,343 million; 3.40%) and Indonesia (US\$ 2,231 million; 3.24%).

In the year 2005, total Australian export was US\$ 115,188 million; increased almost twice compared to that in the year 2000. The highest export was to Japan (US\$ 22,565 million; 19.59%) and the lowest exports were to Lithuania (US\$ 3 million; 0.00%), and Latvia (US\$ 4 million; 0.00%). Some other important countries in

Australian export were China (US\$ 15,414 million; 13.38%), Korea (US\$ 9,080 million; 7.88%), India (US\$ 7,189 million; 6.24%), USA (US\$ 3,982 million; 3.46%), Taiwan (US\$ 3,850 million; 3.34%), and Indonesia (US\$ 3,531 million; 3.07%).

In the year 2010, total Australian export was US\$ 233,549 million; increased almost four times compared to that in the year 2000. The highest export was to China (US\$ 53,881 million; 23.07%) and the lowest exports were to Estonia (US\$ 2 million; 0.00%), Latvia (US\$ 2 million; 0.00%), and Lithuania (US\$ 4 million; 0.00%). Some other important countries in Australian export were Japan (US\$ 39,819 million; 17.05%), India (US\$ 23,627 million; 10.12%), Korea (US\$ 17,543 million; 7.51%), and Taiwan (US\$ 15,685 million; 6.72%). Indonesian position ranked only in 6<sup>th</sup> (US\$ 4,496; 1.93%).

In the year 2014, total Australian export was US\$ 242,448 million; increased a little bit compared to that in the year 2010. The highest export was to China (US\$ 70,793 million; 29.20%) and the lowest exports were to Cyprus (US\$ 4 million; 0.00%), Croatia (US\$ 4 million; 0.00%), and Latvia (US\$ 4 million; 0.00%). Some other important countries in Australian export were Japan (US\$ 42,141 million; 17.38%), Korea (US\$ 14,547 million; 6.00%), Taiwan (US\$ 10,659 million; 4.40%), and India (US\$ 7,461 million; 3.08%). Indonesian position ranked only in 7<sup>th</sup> (US\$ 5,279; 2.18%).

During the year of study, it is interesting to note that the role of China in Australian import. Market share of China in Australian export was only 6.10% in 2000, increased to 13.38% in 2005, 23.07% in 2010 and 29.20% in 2014. Australian exports to Great Britain (3.40% in 2000, 2.68% in 2005, 1.91% in 2010 and 0.096% in 2014), Korea (9.53% in 2000, 7.88% in 2005, 7.51% in 2010 and 6.00% in 2014) and the USA (6.13% in 2000, 3.46% in 2005, 1.86% in 2010 and 2.18% in 2014) have decreased. Australian export to Japan (17.88% in 2000, 19.59% in 2005, 17.05% in 2010 and 17.38% in 2014) was relatively stable.

Table 2. Australian export to county of destination, 2000, 2005, 2010, and 2014

Country	2000		2005		2010		2014	
	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%
AUT	34	0.05	103	0.09	135	0.06	157	0.06
BEL	233	0.34	501	0.43	651	0.28	592	0.24
BGR	4	0.01	60	0.05	7	0.00	185	0.08
BRA	395	0.57	761	0.66	2,256	0.97	1,533	0.63
CAN	1,098	1.59	1,749	1.52	1,105	0.47	798	0.33
CHE	124	0.18	253	0.22	706	0.30	785	0.32
CHN	4,199	6.10	15,414	13.38	53,881	23.07	70,793	29.20
CYP	10	0.01	5	0.00	11	0.00	4	0.00
CZE	66	0.10	86	0.07	93	0.04	128	0.05
DEU	966	1.40	1,295	1.12	1,861	0.80	1,067	0.44
DNK	432	0.63	339	0.29	337	0.14	251	0.10
ESP	310	0.45	668	0.58	740	0.32	511	0.21
EST	1	0.00	2	0.00	2	0.00	6	0.00
FIN	290	0.42	445	0.39	269	0.12	80	0.03
FRA	578	0.84	1,099	0.95	1,419	0.61	1,000	0.41
GBR	2,343	3.40	3,089	2.68	4,460	1.91	2,336	0.96
GRC	59	0.09	61	0.05	60	0.03	29	0.01
HRV	7	0.01	7	0.01	39	0.02	4	0.00
HUN	12	0.02	24	0.02	18	0.01	21	0.01
IDN	2,231	3.24	3,531	3.07	4,496	1.93	5,279	0.18
IND	861	1.25	7,189	6.24	23,627	10.12	7,461	3.08
IRL	79	0.11	130	0.11	275	0.12	179	0.07
ITA	1,541	2.24	1,591	1.38	967	0.41	667	0.28
JPN	12,315	17.88	22,565	19.59	39,819	17.05	42,141	17.38
KOR	6,563	9.53	9,080	7.88	17,543	7.51	14,547	6.00
LTU	1	0.00	3	0.00	4	0.00	6	0.00
LUX	9	0.01	23	0.02	23	0.01	63	0.03
LVA	7	0.01	4	0.00	2	0.00	4	0.00
MEX	223	0.32	786	0.68	463	0.20	352	0.15
MLT	44	0.06	42	0.04	14	0.01	2	0.00
NLD	238	0.34	1,007	0.87	1,297	0.56	619	0.26

Country	2000		2005		2010		2014	
	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%
NOR	51	0.07	101	0.09	117	0.05	138	0.06
POL	30	0.04	56	0.05	72	0.03	389	0.16
PRT	23	0.03	15	0.01	14	0.01	14	0.01
ROU	72	0.10	38	0.03	11	0.00	10	0.00
RUS	113	0.16	193	0.17	243	0.10	159	0.07
SVK	10	0.02	19	0.02	37	0.02	38	0.02
SVN	8	0.01	7	0.01	12	0.00	28	0.01
SWE	151	0.22	398	0.35	472	0.20	292	0.12
TUR	245	0.36	444	0.39	434	0.19	634	0.26
TWN	2,857	4.15	3,850	3.34	15,685	6.72	10,659	4.40
USA	4,221	6.13	3,982	3.46	4,340	1.86	5,275	2.18
ROW	25,830	37.50	34,174	29.67	55,533	23.78	73,208	30.20
Total	68,886	100.00	115,188	100.00	233,549	100.0	242,448	100.00

Source: Calculated from WIOT 2016.

Table 3. Australian export by sector 2000, 2005, 2010 and 2014

Sector	2000		2005		2010		2014	
	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%
S-1	5,743	8.34	6,552	5.69	9,216	3.95	10,119	4.17
S-2	41	0.06	55	0.05	140	0.06	225	0.09
S-3	103	0.15	62	0.05	53	0.02	24	0.01
S-4	19,387	28.14	47,426	41.17	127,160	54.45	124,625	51.40
S-5	2,259	3.28	2,784	2.42	3,553	1.52	4,632	1.91
S-6	1,685	2.45	1,349	1.17	1,310	0.56	1,403	0.58
S-7	549	0.80	879	0.76	918	0.39	1,416	0.58
S-8	405	0.59	634	0.55	962	0.41	991	0.41
S-9	69	0.10	89	0.08	196	0.08	282	0.12
S-10	1,723	2.50	2,228	1.93	2,062	0.88	2,021	0.83
S-11	1,278	1.86	1,743	1.51	3,391	1.45	3,606	1.49
S-12	148	0.21	393	0.34	389	0.17	313	0.13
S-13	469	0.68	737	0.64	992	0.42	931	0.38
S-14	313	0.45	393	0.34	415	0.18	395	0.16
S-15	13,327	19.35	18,933	16.44	33,333	14.27	26,395	10.89
S-16	722	1.05	1,156	1.00	2,101	0.90	2,201	0.91
S-17	657	0.95	666	0.58	748	0.32	588	0.24
S-18	458	0.66	510	0.44	598	0.26	445	0.18
S-19	505	0.73	678	0.59	1,004	0.43	883	0.36
S-20	896	1.30	962	0.84	930	0.40	699	0.29
S-21	260	0.38	538	0.47	584	0.25	892	0.37
S-22	156	0.23	198	0.17	272	0.12	355	0.15
S-23	0	0.00	0	0.00	0	0.00	0	0.00
S-24	135	0.20	184	0.16	254	0.11	465	0.19
S-25	113	0.16	236	0.20	551	0.24	848	0.35
S-26	5,900	8.57	9,129	7.93	17,575	7.53	22,208	9.16
S-27	6,467	9.39	9,167	7.96	12,788	5.48	18,876	7.79
S-28	2,611	3.79	4,202	3.65	7,567	3.24	10,268	4.24
S-29	2,072	3.01	2,858	2.48	4,026	1.72	5,623	2.32
S-30	434	0.63	446	0.39	462	0.20	718	0.30
Total	68,886	100.00	115,188	100.00	233,549	100.00	242,448	100.00

Source: Calculated from WIOT, 2016.

Table 3 provides information about the results of calculation on Australian export by sector for the year 2000, 2005, 2010 and 2014. In the year 2000, the most important sectors in Australian export were Sector-4 (US\$ 19,387 million; 28.14%), Sector-15 (US\$ 13,327 million; 19.35%), Sector-27 (US\$ 6,467 million; 9.39%),



Sector-26 (US\$ 5,900 million; 8.57%), Sector-1 (US\$ 5,743 million; 8.34%), Sector-28 (US\$ 2,611 million; 3.79%), Sector-5 (US\$ 2,259 million; 3.28%) and Sector-29 (US\$ 2,072 million; 3.01%).

In the year 2005, the most important sectors in Australian export were Sector-4 (US\$ 47,426 million; 41.17%), Sector-15 (US\$ 18,933 million; 16.44%), Sector-27 (US\$ 9,167 million; 7.96%), Sector-26 (US\$ 9,129 million; 9.93%), and Sector-1 (US\$ 6,552 million; 5.69%). In the year 2010, the most important sectors in Australian export were Sector-4 (US\$ 127,160 million; 54.45%), Sector-15 (US\$ 33,333 million; 14.27%), Sector-26 (US\$ 17,575 million; 7.53%), Sector-1 (US\$ 9,216 million; 3.95%), and Sector-28 (US\$ 7,567 million; 3.24%). In the year 2014, the most important sectors in Australian export were Sector-4 (US\$ 124,625 million; 51.40%), Sector-15 (US\$ 26,395 million; 10.89%), Sector-26 (US\$ 22,208 million; 9.16%), Sector-27 (US\$ 18,876; 7.79%), Sector-28 (US\$ 10,268 million; 4.24%), and Sector-1 (US\$ 10,119 million; 4.82%).

During the period, the contributions of three sectors that tend to increase in Australian export namely Sector-4 (28.14% in 2000, 41.17% in 2005, 54.45% in 2010 and 51.40% in 2014), Sector-26 (8.57% in 2000, 7.93% in 2005, 7.53% in 2010 and 9.16% in 2014) and Sector-28 (3.79% in 2000, 3.65% in 2005, 3.24% in 2010 and 4.44% in 2014). The contributions of three sectors that tend to decrease in Australian export were Sector-1 (8.34% in 2000, 5.69% in 2005, 3.95% in 2010 and 4.17% in 2014), Sector-15 (19.35% in 2000, 16.44% in 2005, 14.27% in 2010 and 10.89% in 2014) and Sector-27 (9.39% in 2000, 7.96% in 2005, 5.48% in 2010 and 7.79% in 2014).

### 3.2. Australian Import

Table 4 presents the result of calculation of Australian import from countries of origin in the year 2000, 2005, 2010 and 2014. In the year 2000, total Australian import was US\$ 42,267 million. If import from the Rest of the World was ignored, the highest import was an import from the USA (US\$ 7,706 million; 16.30%) and the lowest import were from Bulgaria (US\$ 0 million; 0.00%), and Cyprus (US\$ 0 million; 0.00%). Some other important countries in Australian import were Japan (US\$ 3,482 million; 7.37%), Great Britain (US\$ 2,487 million; 5.26%), China (US\$ 2,006 million; 4.24%), Germany (US\$ 1,823; 3.86%), and Indonesia (US\$ 1,581 million; 3.35%).

In the year 2005, total Australian import was US\$ 80,358 million. The highest import was an import from the USA (US\$ 9,243 million; 11.50%) and the lowest import was from Cyprus (US\$ 1 million; 0.00%), and Latvia (US\$ 2 million; 0.00%). Some other important countries in Australian import were China (US\$ 6,379 million; 7.94%), Japan (US\$ 4,742 million; 5.90%), Great Britain (US\$ 3,521 million; 4.38%), Germany (US\$ 3,258; 4.05%), and Indonesia (US\$ 2,926 million; 3.64%).

In the year 2010, total Australian import was US\$ 130,290 million. The highest import was import from China (US\$ 16,548 million; 12.70%) and the lowest import was from Latvia (US\$ 2 million; 0.00%). Some other important countries in Australian import were Japan (US\$ 5,738 million; 4.40%), Germany (US\$ 4,920 million; 3.78%), Indonesia (US\$ 4,837 million; 3.71%), and Great Britain (US\$ 4,285 million; 3.29%). In the year 2014, total Australian import was US\$ 162,257 million. The highest import was import from China (US\$ 23,385 million; 14.41%) and the lowest import was from Latvia (US\$ 4 million; 0.00%) and Cyprus (US\$ 4 million; 0.00%). Some other important countries in Australian import were Korea (US\$ 6,746 million; 4.160%), Japan (US\$ 6,667 million; 4.11%), Germany (US\$ 5,264 million; 3.24%), Indonesia (US\$ 4,481 million; 2.76%) and Great Britain (US\$ 4,406 million; 2.72%).

During the year of study, the trends of Australian increasing import were import from China (4.24% in 2000, 7.94% in 2005, 12.70% in 2010 and 14.41% in 2014) and Korea (2.55% in 2000, 2.24% in 2005, 2.77% in 2010 and 4.16% in 2014). The trends of Australian decreasing import were import from Great Britain (5.26% in 2000, 4.38% in 2005, 3.29% in 2010 and 2.72% in 2014), and Japan (7.37% in 2000, 5.90% in 2005, 4.40% in 2010 and 4.11% in 2014), and the USA (16.30% in 2000, 11.50% in 2005, 9.26% in 2010 and 8.90% in 2014).

Table 4. Australian Import by country of origin 2000, 2005, 2010, and 2014

Country	2000		2005		2010		2014	
	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%
AUT	169	0.36	307	0.38	481	0.37	553	0.34
BEL	251	0.53	470	0.59	736	0.56	1,686	1.04
BGR	0	0.00	7	0.01	8	0.01	18	0.01
BRA	190	0.40	460	0.57	698	0.54	697	0.43
CAN	908	1.92	1,346	1.67	1,287	0.99	1,295	0.80
CHE	550	1.16	794	0.99	1,353	1.04	1,446	0.89
CHN	2,006	4.24	6,379	7.94	16,548	12.70	23,385	14.41

Country	2000		2005		2010		2014	
	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%
CYP	0	0.00	1	0.00	5	0.00	4	0.00
CZE	21	0.05	92	0.11	165	0.13	198	0.12
DEU	1,823	3.86	3,258	4.05	4,920	3.78	5,264	3.24
DNK	188	0.40	358	0.44	470	0.36	464	0.29
ESP	215	0.46	452	0.56	759	0.58	942	0.58
EST	1	0.00	12	0.01	46	0.04	79	0.05
FIN	281	0.59	353	0.44	642	0.49	517	0.32
FRA	816	1.73	1,404	1.75	1,773	1.36	2,040	1.26
GBR	2,487	5.26	3,521	4.38	4,285	3.29	4,406	2.72
GRC	32	0.07	50	0.06	44	0.03	63	0.04
HRV	1	0.00	5	0.01	4	0.00	20	0.01
HUN	18	0.04	80	0.10	121	0.09	165	0.10
IDN	1,581	3.35	2,926	3.64	4,837	3.71	4,481	2.76
IND	304	0.64	664	0.83	1,159	0.89	1,686	1.04
IRL	280	0.59	344	0.43	755	0.58	731	0.45
ITA	869	1.84	1,520	1.89	1,788	1.37	2,518	1.55
JPN	3,482	7.37	4,742	5.90	5,738	4.40	6,667	4.11
KOR	1,204	2.55	1,799	2.24	3,606	2.77	6,746	4.16
LTU	1	0.00	7	0.01	14	0.01	34	0.02
LUX	4	0.01	15	0.02	36	0.03	45	0.03
LVA	1	0.00	2	0.00	2	0.00	4	0.00
MEX	154	0.33	333	0.41	584	0.45	753	0.46
MLT	4	0.01	7	0.01	4	0.00	5	0.00
NLD	524	1.11	951	1.18	1,281	0.98	1,808	1.11
NOR	88	0.19	188	0.23	171	0.13	304	0.19
POL	22	0.05	59	0.07	163	0.13	361	0.22
PRT	66	0.14	91	0.11	76	0.06	124	0.08
ROU	5	0.01	12	0.01	20	0.02	43	0.03
RUS	6	0.01	26	0.03	315	0.24	1,042	0.64
SVK	5	0.01	12	0.01	23	0.02	196	0.12
SVN	7	0.01	25	0.03	22	0.02	50	0.03
SWE	475	1.01	861	1.07	1,230	0.94	1,122	0.69
TUR	76	0.16	145	0.18	224	0.17	512	0.32
TWN	1,373	2.91	2,167	2.70	2,467	1.89	3,630	2.24
USA	7,706	16.30	9,243	11.50	12,065	9.26	14,449	8.90
ROW	19,073	40.35	34,870	43.39	59,364	45.56	71,702	44.19
Total	47,267	100.00	80,358	100.00	130,290	100.00	162,257	100.0

Source: Calculated from WIOT 2016

Table 5 provides results of calculation on Australian import by sector for the year 2000, 2005, 2010 and 2014. In the year 2000, sectorally the most important sectors in Australian import were Sector-27 (US\$ 5,743 million; 12.15%), Sector-28 (US\$ 5,660 million; 11.97%), Sector-26 (US\$ 4,833 million; 10.22%), Sector-15 (US\$ 4,110 million; 8.70%), Sector-25 (US\$ 3,71 million; 7.13%), Sector-10 (US\$ 3,147 million; 6.66%), Sector-4 (US\$ 1,879 million; 3.98%), Sector-20 (US\$ 1,659 million; 3.51%) and Sector-5 (US\$ 1,458 million; 3.08%).

In the year 2005, the most important sectors in Australian import were Sector-27 (US\$ 9,713 million; 12.09%), Sector-28 (US\$ 9,529 million; 11.86%), Sector-26 (US\$ 7,859 million; 9.78%), Sector-25 (US\$ 7,691 million; 9.57%), Sector-15 (US\$ 7,204 million; 8.97%), Sector-4 (US\$ 5,228 million; 6.51%), Sector-10 (US\$ 5,093 million; 6.34%), Sector-29 (US\$ 3,195 million; 3.98%) and Sector-30 (US\$ 2,754 million; 3.43%). In the year 2010, the most important sectors in Australian import were Sector-25 (US\$ 18,955 million; 14.55%), Sector-28 (US\$ 14,541 million; 11.16%), Sector-27 (US\$ 13,933 million; 10.69%), Sector-4 (US\$ 13,047 million; 10.01%), Sector-26 (US\$ 11,970 million; 9.19%), Sector-15 (US\$ 10,781 million; 8.27%), Sector-29 (US\$ 5,948 million; 4.57%), Sector-10 (US\$ 4,465 million; 3.43%) and Sector-30 (US\$ 4,253 million; 3.26%).

Table 5. Australian import by sector 2000, 2005, 2010, and 2014

Sector	2000		2005		2010		2014	
	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%	US \$ (Million)	%
S-1	1,256	2.66	1,836	2.28	2,630	2.02	3,713	2.29
S-2	152	0.32	222	0.28	236	0.18	265	0.16
S-3	114	0.24	153	0.19	225	0.17	301	0.19
S-4	1,879	3.98	5,228	6.51	13,047	10.01	12,046	7.42
S-5	1,458	3.08	2,248	2.80	3,452	2.65	3,780	2.33
S-6	817	1.73	637	0.79	1,261	0.97	702	0.43
S-7	277	0.59	405	0.50	480	0.37	445	0.27
S-8	472	1.00	683	0.85	932	0.71	1,021	0.63
S-9	394	0.83	579	0.72	755	0.58	856	0.53
S-10	3,147	6.66	5,093	6.34	4,465	3.43	6,795	4.19
S-11	1,392	2.94	2,291	2.85	3,079	2.36	2,934	1.81
S-12	245	0.52	342	0.43	865	0.66	1,317	0.81
S-13	1,002	2.12	1,589	1.98	2,190	1.68	2,218	1.37
S-14	561	1.19	949	1.18	1,315	1.01	1,665	1.03
S-15	4,110	8.70	7,204	8.97	10,781	8.27	10,649	6.56
S-16	828	1.75	1,457	1.81	2,745	2.11	3,511	2.16
S-17	551	1.17	791	0.98	1,160	0.89	999	0.62
S-18	534	1.13	826	1.03	1,260	0.97	1,252	0.77
S-19	689	1.46	1,110	1.38	2,134	1.64	2,708	1.67
S-20	1,659	3.51	2,405	2.99	2,834	2.18	3,880	2.39
S-21	703	1.49	1,002	1.25	1,565	1.20	2,042	1.26
S-22	342	0.72	469	0.58	851	0.65	844	0.52
S-23	9	0.02	0	0.00	0	0.00	0	0.00
S-24	1,136	2.40	2,096	2.61	2,428	1.86	3,117	1.92
S-25	3,371	7.13	7,691	9.57	18,955	14.55	30,457	18.77
S-26	4,833	10.22	7,859	9.78	11,970	9.19	14,656	9.03
S-27	5,743	12.15	9,713	12.09	13,933	10.69	17,955	11.07
S-28	5,660	11.97	9,529	11.86	14,541	11.16	17,246	10.63
S-29	2,114	4.47	3,195	3.98	5,948	4.57	9,571	5.90
S-30	1,821	3.85	2,754	3.43	4,253	3.26	5,314	3.27
Total	47,267	100.00	80,358	100.00	130,290	100.00	162,257	100.00

Source: Calculated from WIOT 2016

In the year 2014, the most important sectors in the USA import were Sector-25 (US\$ 30,457 million; 18.77%), Sector-27 (US\$ 17,955 million; 11.07%), Sector-28 (US\$ 17,246 million; 10.63%), Sector-26 (US\$ 14,656 million; 9.03%), Sector-4 (US\$ 12,046 million; 7.42%), Sector-15 (US\$ 10,649 million; 6.56%), Sector-29 (US\$ 9,571 million; 5.90%), Sector-10 (US\$ 6,795 million; 4.19%) and Sector-30 (US\$ 5,314 million; 3.27%).

During the years of research, the contribution of some sectors that tend to increase in Australian import namely Sector-4 (3.98% in 2000, 6.51% in 2005, 10.01% in 2010 and 7.42% in 2014), Sector-25 (7.13% in 2000, 9.57% in 2005, 14.55% in 2010 and 18.77% in 2014), and Sector-29 (4.47% in 2000, 3.98% in 2005, 4.57% in 2010 and 5.90% in 2014). Some sectors that tend to decrease in Australian import were Sector-5 (3.08% in 2000, 2.80% in 2005, 2.65% in 2010 and 2.33% in 2014), Sector-10 (6.66% in 2000, 6.34% in 2005, 3.43% in 2010 and 4.19% in 2014), Sector-15 (8.70% in 2000, 8.97% in 2005, 8.27% in 2010 and 6.56% in 2014), Sector-20 (3.51% in 2000, 2.99% in 2005, 2.18% in 2010 and 2.39% in 2014), Sector-26 (10.22% in 2000, 9.78% in 2005, 9.19% in 2010 and 9.03% in 2014), Sector-27 (12.15% in 2000, 12.09% in 2005, 10.69% in 2010 and 11.07% in 2014), and Sector-30 (3.85% in 2000, 3.43% in 2005, 3.26% in 2010 and 3.27% in 2014).

### 3.3. Australian Balance of Trade

Table 6 illustrates the results of calculation on balance of trade by country in Australian economy by country for the year 2000, 2005, 2010 and 2014. In all years, balance of trade in Australian economy was surpluses. In the year 2000, trade balance in Australian economy was surplus by US\$ 21,619 million. The highest trade surplus was trading with Japan (US\$ 8,833 million) and the smallest trade surplus was trading with Slovenia (US\$ 1

million). Some other countries in which Australia had significant surpluses balance of trade were in trading with Korea (US\$ 5,359 million), China (US\$ 2,193 million), Taiwan (US\$ 1,484 million), Italy (US\$ 672 million), Indonesia (US\$ 650 million), India (US\$ 557 million), Denmark (US\$ 244 million), and Brazil (US\$ 205 million). There were 13 countries in which Australia experienced trade balance deficits. The highest balance deficit was trading with the USA (US\$ -3,484 million) and the smallest trade balance deficit was trading with Hungary (US\$ -6 million). Some other countries in which Australia had significant trade deficit were Germany (US\$ -856 million), Switzerland (US\$ -426 million), Sweden (US\$ -324 million), the Netherland (US\$ -286 million), France (US\$ -239 million), and Ireland (US\$ -201 million).

In the year 2005, trade balance in Australian economy was surplus by US\$ 34,830 million. The highest trade surplus was trading with Japan (US\$ 8,833 million) and the smallest trade surplus was trading with Slovenia (US\$ 1 million). Some other countries in which Australia had significant trade surpluses were China (US\$ 9,036 million), Korea (US\$ 7,281 million), India (US\$ 6,525 million), Taiwan (US\$ 1,683 million), Indonesia (US\$ 605 million), Mexico (US\$ 453 million), Canada (US\$ 404 million), Brazil (US\$ 301 million), Turkey (US\$ 298 million) and Spain (US\$ 216 million). There were 17 countries in which Australia experienced trade balance deficits. The highest trade deficit was trading with the USA (US\$ -5,260 million) and the smallest trade deficit was trading with Poland (US\$ -3 million). Some other countries in which Australia had significant trade deficit were Germany (US\$ -1,963 million), Switzerland (US\$ -541 million), Sweden (US\$ -463 million), Great Britain (US\$ -433 million), France (US\$ -305 million), Ireland (US\$ -215 million), and Austria (US\$ -204 million).

In the year 2010, trade balance in Australian economy was surplus by US\$ 103,259 million. The highest surplus was trading with China (US\$ 37,334 million) and the smallest surplus was trading with Cyprus (US\$ 6 million). Some other countries in which Australia had significant trade surpluses were Japan (US\$ 34,081 million), India (US\$ 22,468 million), Korea (US\$ 13,937 million), Taiwan (US\$ 13,217 million), Brazil (US\$ 1,558 million) and Turkey (US\$ 210 million). There were 26 countries in which Australia had trade balance deficits. The highest trade deficit was trading with the USA (US\$ -7,725 million) and the smallest trade deficit was trading with Bulgaria (US\$ -1 million). Some other countries in which Australia had significant trade deficits were Germany (US\$ -3,058 million), Italy (US\$ -821 million), Sweden (US\$ 758 million), Switzerland (US\$ -647 million), Ireland (US\$ -481 million), Finland (US\$ -374 million), France (US\$ -354 million) and Austria (US\$ -346 million).

In the year 2014, trade balance in the USA economy was surplus by US\$ 80,191 million. The highest surplus was trading with China (US\$ 47,407 million) and the smallest surplus was trading with Luxembourg (US\$ 18 million). Some other countries in which Australia had significant trade surpluses were Japan (US\$ 35,474 million), Korea (US\$ 7,801 million), Taiwan (US\$ 7,029 million), India (US\$ 5,776 million), Brazil (US\$ 836 million), and Indonesia (US\$ 798 million). There were 29 countries in which Australia had trade balance deficits. The highest deficit was trading with the USA (US\$ -9,173 million) and the smallest deficit was trading with Latvia (US\$ -1 million). Some other countries in which Australia had significant trade deficits were Germany (US\$ -4,197 million), Great Britain (US\$ -2,070 million), Italy (US\$ -1,852 million), the Netherland (US\$ -1,189 million), Belgium (US\$ -1,095 million), France (US\$ -1,041 million), Russia (US\$ -884 million), Sweden (US\$ -830 million), Ireland (US\$ -552 million), Canada (US\$ -497 million), Finland (US\$ -437 million), Spain (US\$ -432 million), Mexico (US\$ -401 million), Austria (US\$ -395 million), and Denmark (US\$ -212 million).

During the year of study, there were 7 countries in which trade surpluses occurred in all years, namely Brazil (US\$ 205 million in 2000, US\$ 301 million in 2005, US\$ 1,558 million in 2010 and US\$ 836 million in 2014), China (US\$ 2,193 million in 2000, US\$ 9,036 million in 2005, US\$ 37,334 million in 2010, US\$ 47,407 million in 2014), India (US\$ 557 million in 2000, US\$ 6,525 million in 2005, US\$ 22,468 million in 2010 and US\$ 5,776 million in 2014), Japan (US\$ 8,833 million in 2000, US\$ 17,823 million in 2005, US\$ 34,081 million in 2010 and US\$ 35,474 million in 2014), Korea (US\$ 5,359 million in 2000, US\$ 7,281 million in 2005, US\$ 13,937 million in 2010 and US\$ 7,801 million in 2014), Turkey (US\$ 169 million in 2000, US\$ 298 million in 2005, US\$ 210 million in 2010 and US\$ 122 million in 2014), and Taiwan (US\$ 1,484 million in 2000, US\$ 1,683 million in 2005, US\$ 13,217 million in 2010 and US\$ 7,029 million in 2014). There were 7 countries as well in which Australian had trade deficits in all years of study, namely Austria (US\$ -135 million in 2000, US\$ -204 million in 2005, US\$ -346 million in 2010 and US\$ -395 million in 2014), Switzerland (US\$ -426 million in 2000, US\$ -541 million in 2005, US\$ -647 million in 2010 and US\$ -395 million in 2014), Germany (US\$ -856 million in 2000, US\$ -1,963 million in 2005, US\$ -3,058 million in 2010 and US\$ -4,197 million in 2014), Norway (US\$ -37 million in 2000, US\$ -86 million in 2005, US\$ -55 million in 2010 and US\$ -166 million in 2014), Portugal (US\$ -43 million in 2000, US\$ -77 million in 2005, US\$ -62 million in 2010 and US\$ -110 million in 2014), Sweden (US\$ -324 million in 2000, US\$ -463 million in 2005, US\$ -758 million in 2010 and US\$ -830 million in 2014), and the USA (US\$ -3,484 million in 2000, US\$ -5,260 million in 2005, US\$ -7,725 million in 2010 and US\$ -9,173 million in 2014).

Table 6. Australian balance of trade by country (US\$ million), 2000, 2005, 2010, 2014

Country	2000	2005	2010	2014	Remark
AUT	-135	-204	-346	-395	Deficits in all years
BEL	-18	30	-85	-1,095	
BGR	4	53	-1	167	
BRA	205	301	1,558	836	Surpluses in all years
CAN	190	404	-182	-497	
CHE	-426	-541	-647	-661	Deficits in all years
CHN	2,193	9,036	37,334	47,407	Surpluses in all years
CYP	9	5	6	0	
CZE	45	-6	-72	-69	
DEU	-856	-1,963	-3,058	-4,197	Deficit in all years
DNK	244	-19	-133	-212	
ESP	95	216	-19	-432	
EST	0	-10	-44	-73	
FIN	9	93	-374	-437	
FRA	-239	-305	-354	-1,041	
GBR	-144	-433	175	-2,070	
GRC	27	11	16	-34	
HRV	6	1	35	-16	
HUN	-6	-55	-103	-144	
IDN	650	605	-341	798	
IND	557	6,525	22,468	5,776	Surpluses in all years
IRL	-201	-215	-481	-552	
ITA	672	71	-821	-1,852	
JPN	8,833	17,823	34,081	35,474	Surpluses in all years
KOR	5,359	7,281	13,937	7,801	Surpluses in all years
LTU	0	-4	-10	-28	
LUX	5	8	-13	18	
LVA	7	2	0	-1	
MEX	69	453	-121	-401	
MLT	41	35	10	-3	
NLD	-286	56	16	-1,189	
NOR	-37	-86	-55	-166	Deficit in all years
POL	8	-3	-91	28	
PRT	-43	-77	-62	-110	Deficit in all years
ROU	67	26	-9	-33	
RUS	107	166	-72	-884	
SVK	6	7	14	-158	
SVN	1	-18	-10	-21	
SWE	-324	-463	-758	-830	Deficit in all years
TUR	169	298	210	122	Surpluses in all years
TWN	1,484	1,683	13,217	7,029	Surpluses in all years
USA	-3,484	-5,260	-7,725	-9,173	Deficit in all years
ROW	6,757	-697	-3,831	1,507	
Total	21,619	34,830	103,259	80,191	

Source: Calculated from WIOT, 2016.

Table 7 provides results of calculation on trade balance in Australian economy by sector for the year 2000, 2005, 2010 and 2014. In the year 2000, trade balance in Australian economy was surplus by US\$ 21,619 million. The highest trade surplus occurred in Sector-4 (US\$ 17,507 million) and the smallest trade surplus occurred in Sector-17 (US\$ 106 million). Some other significant sectors in which Australian trade surplus were Sector-15 (US\$ 9,217 million), Sector-1 (US\$ 4,487 million), Sector-26 (US\$ 1,068 million), Sector-6 (US\$ 867 million), Sector-5 (US\$ 801 million), Sector-27 (US\$ 724 million) and Sector-7 (US\$ 271 million). There were 21 sectors in which Australian trade deficits. The highest trade deficit in Australian economy was in Sector-25 (US\$ -3,257 million) and the smallest trade deficit was in Sector-23 (US\$ -9 million). Some other significant sectors in which Australia experienced trade deficit were Sector-28 (US\$ -3,050 million), Sector-10 (US\$ -1,424 million), Sector-30



(US\$ -1,387 million), Sector-24 (US\$ -1,001 million), Sector-20 (US\$ -762 million), Sector-13 (US\$ -533 million), Sector-21 (US\$ -443 million), Sector-9 (US\$ -325 million), and Sector-14 (US\$ -248 million).

Table 7. Australian balance of trade by sector (US\$ million), 2000, 2005, 2010, 2014

Sector	2000	2005	2010	2014	Remarks
S-1	4,487	4,716	6,586	6,406	Surpluses in all years
S-2	-110	-167	-96	-40	Deficits in all years
S-3	-11	-92	-172	-276	Deficits in all years
S-4	17,507	42,198	114,113	112,578	Surpluses in all years
S-5	801	537	102	852	Surpluses in all years
S-6	867	712	49	701	Surpluses in all years
S-7	271	474	438	971	Surpluses in all years
S-8	-67	-49	31	-31	
S-9	-325	-490	-559	-574	Deficits in all years
S-10	-1,424	-2,865	-2,402	-4,774	Deficits in all years
S-11	-113	-548	312	673	
S-12	-97	51	-477	-1,004	
S-13	-533	-852	-1,198	-1,286	Deficits in all years
S-14	-248	-556	-901	-1,270	Deficits in all years
S-15	9,217	11,729	22,552	15,746	Surpluses in all years
S-16	-106	-301	-645	-1,310	Deficits in all years
S-17	106	-125	-413	-411	
S-18	-77	-316	-662	-806	Deficits in all years
S-19	-183	-432	-1,129	-1,825	Deficits in all years
S-20	-762	-1,443	-1,904	-3,181	Deficits in all years
S-21	-443	-464	-981	-1,150	Deficits in all years
S-22	-185	-271	-579	-489	Deficits in all years
S-23	-9	0	0	0	
S-24	-1,001	-1,912	-2,174	-2,652	Deficits in all years
S-25	-3,257	-7,455	-18,404	-29,608	Deficits in all years
S-26	1,068	1,270	5,605	7,552	Surpluses in all years
S-27	724	-546	-1,145	921	
S-28	-3,050	-5,327	-6,974	-6,978	Deficits in all years
S-29	-43	-336	-1,922	-3,948	Deficits in all years
S-30	-1,387	-2,309	-3,791	-4,595	Deficits in all years
Total	21,619	34,830	103,259	80,191	Surpluses in all years

Source: Calculated from WIOT, 2016

In the year 2005, trade balance in Australian economy was surplus by approximately US\$ 34,830 million. The highest trade surplus occurred in Sector-4 (US\$ 42,198 million) and the smallest trade surplus occurred in Sector-12 (US\$ 51 million). Some other significant sectors in which Australian trade surplus were Sector-15 (US\$ 11,729 million), Sector-1 (US\$ 4,716 million), Sector-26 (US\$ 1,270 million), Sector-6 (US\$ 712 million), Sector-5 (US\$ 537 million), and Sector-7 (US\$ 474 million). There were 20 sectors in which Australian had trade deficits. The highest trade deficit in Australian economy was in Sector-25 (US\$ -7,455 million) and the smallest trade deficit was in Sector-8 (US\$ -49 million). Some other significant sectors in which Australia experienced trade deficit were Sector-28 (US\$ -5,327 million), Sector-10 (US\$ -2,865 million), Sector-30 (US\$ -2,309 million), Sector-24 (US\$ -1,912 million), Sector-20 (US\$ -1,433 million), Sector-13 (US\$ -552 million), Sector-14 (US\$ -556 million), Sector-11 (US\$ -548 million), Sector-10 (US\$ -546 million), Sector-9 (US\$ -490 million), Sector-21 (US\$ -464 million), Sector-29 (US\$ -336 million), Sector-18 (US\$ -316 million), Sector-16 (US\$ -301 million), and Sector-22 (US\$ -271 million).

In the year 2010, trade balance in Australian economy was surplus by US\$ 103,259 million. The highest trade surplus occurred in Sector-4 (US\$ 114,113 million) and the smallest trade surplus occurred in Sector-8 (US\$ 31 million). Some other significant sectors in which Australian trade surplus were Sector-15 (US\$ 22,552 million), Sector-1 (US\$ 6,586 million), Sector-26 (US\$ 5,605 million), Sector-7 (US\$ 438 million), and Sector-11 (US\$ 312 million). There were 19 sectors in which Australian had trade deficits. The highest trade deficit in Australian economy was in Sector-25 (US\$ -18,404 million) and the smallest trade deficit was in Sector-2 (US\$ -96 million). Some other significant sectors in which Australia experienced trade deficit were Sector-28 (US\$ -



6,974 million), Sector-30 (US\$ -3,791 million), Sector-10 (US\$ -2,402 million), Sector-24 (US\$ -2,174 million), Sector-29 (US\$ -1,922 million), Sector-20 (US\$ -1,904 million), Sector-13 (US\$ -1,198 million), Sector-19 (US\$ -1,129 million), Sector-27 (US\$ -1,145 million), Sector-21 (US\$ -981 million), Sector-21 (US\$ -464 million), Sector-18 (US\$ -662 million), Sector-16 (US\$ -645 million), Sector-22 (US\$ -579 million), Sector-9 (US\$ -559 million), Sector-12 (US\$ -477 million), and Sector-17 (US\$ -413 million).

In the year 2014, trade balance in Australian economy was surplus by US\$ 80,191 million. The highest trade surplus occurred in Sector-4 (US\$ 112,578 million) and the smallest trade surplus occurred in Sector-11 (US\$ 673 million). Some other significant sectors in which Australian trade surplus were Sector-15 (US\$ 15,746 million), Sector-26 (US\$ 7,552 million), Sector-1 (US\$ 6,406 million), Sector-7 (US\$ 971 million), Sector-6 (US\$ 701 million) and Sector-11 (US\$ 673 million). There were 20 sectors in which Australian had trade deficits. The highest trade deficit in Australian economy was in Sector-25 (US\$ -29,608 million) and the smallest trade deficit was in Sector-8 (US\$ -31 million). Some other significant sectors in which Australia experienced trade deficit were Sector-28 (US\$ -6,978 million), Sector-30 (US\$ -4,595 million), Sector-10 (US\$ -4,774 million), Sector-29 (US\$ -3,948 million), Sector-20 (US\$ -3,181 million), Sector-24 (US\$ -2,652 million), Sector-19 (US\$ -1,825 million), Sector-16 (US\$ -1,310 million), Sector-13 (US\$ -1,286 million), Sector-14 (US\$ -1,270 million), Sector-21 (US\$ -1,150 million), Sector-12 (US\$ -1,004 million), Sector-18 (US\$ -806 million), Sector-9 (US\$ -574 million), Sector-22 (US\$ -489 million), Sector-17 (US\$ -411 million), and Sector-18 (US\$ -276 million).

During the year of study, there were 7 sectors in which trade surpluses occurred in all years, namely Sector-1 (US\$ 4,487 million in 2000, US\$ 4,716 million in 2005, US\$ 6,586 in 2010 and US\$ 6,406 million in 2014), Sector-4 (US\$ 17,507 million in 2000, US\$ 42,198 million in 2005, US\$ 11,113 million in 2010 and US\$ 112,578 million in 2014), Sector-5 (US\$ 801 million in 2000, US\$ 537 million in 2005, US\$ 102 million in 2010 and US\$ 852 million in 2014), Sector-6 (US\$ 867 million in 2000, US\$ 712 million in 2005, US\$ 49 million in 2010 and US\$ 701 million in 2014), Sector-7 (US\$ 271 million in 2000, US\$ 474 million in 2005, US\$ 438 million in 2010 and US\$ 971 million in 2014), Sector-15 (US\$ 9,217 million in 2000, US\$ 11,729 million in 2005, US\$ 22,552 million in 2010 and US\$ 15,746 million in 2014), and Sector-26 (US\$ 1,068 million in 2000, US\$ 1,270 million in 2005, US\$ 5,605 million in 2010 and US\$ 7,552 million in 2014). There were 17 sectors in which Australian had trade deficits in all years of study, namely Sector-2 (US\$ -110 million in 2000, US\$ -167 million in 2005, US\$ -96 million in 2010 and US\$ -40 in 2014), Sector-3 (US\$ -11 million in 2000, US\$ -92 million in 2005, US\$ -172 million in 2010 and US\$ -276 million in 2014), Sector-9 (US\$ -325 million in 2000, US\$ -490 million in 2005, US\$ -559 million in 2010, US\$ -574 million in 2014), Sector-10 (US\$ -1,424 million in 2000, US\$ -2,865 million in 2005, US\$ -2,402 million in 2010, and US\$ -4,774 million in 2014), Sector-13 (US\$ -533 million in 2000, US\$ -852 in 2005, US\$ -1,198 million in 2010 and US\$ -1,286 in 2014), Sector-14 (US\$ -248 million in 2000, US\$ -556 million in 2005, US\$ -901 million in 2010 and US\$ -1,270 million in 2014), Sector-16 (US\$ -106 million in 2000, US\$ -301 million in 2005, US\$ -645 million in 2010 and US\$ -1,310 in 2014), Sector-18 (US\$ -77 million in 2000, US\$ -316 million in 2005, US\$ -662 million in 2010, and US\$ -806 million in 2014), Sector-19 (US\$ -183 million in 2000, US\$ -432 million in 2010, US\$ -1,129 million in 2010 and US\$ -1,825 million in 2014), Sector-20 (US\$ -762 million in 2000, US\$ -1,143 million in 2005, US\$ -1,904 million in 2010 and US\$ -3,181 million in 2014), Sector-21 (US\$ -443 million in 2000, US\$ -464 million in 2005, US\$ -981 million in 2010 and US\$ -1,150 million in 2014), Sector-22 (US\$ -185 million in 2000, US\$ -271 million in 2005, US\$ -579 million in 2010 and US\$ -489 million in 2014), Sector-24 (US\$ -1,001 million in 2000, US\$ -1,912 million in 2005, US\$ -2,174 million in 2010 and US\$ -2,652 million in 2014), Sector-25 (US\$ -3,257 million in 2000, US\$ -7,455 million in 2005, US\$ -18,404 million in 2010 and US\$ -29,608 million in 2014), Sector-28 (US\$ -3,050 million in 2000, US\$ -5,327 million in 2005, US\$ -6,974 million in 2010 and US\$ -6,978 million in 2014), Sector-29 (US\$ -43 million in 2000, US\$ -336 million in 2005, US\$ -1,922 million in 2010 and US\$ -3,948 million in 2014) and Sector-30 (US\$ -1,387 million in 2000, US\$ -2,309 million in 2005, US\$ -3,791 million in 2010 and US\$ -4,595 million in 2014).

#### **4. Discussion**

This section highlights some important findings.

Firstly, Australian export had increased significantly from US\$ 68,886 million in the year of 2000 to US\$ 115,188 million in the year of 2005 to US\$ 233,549 million in the year of 2010 and to US\$ 242,448 million in the year of 2014. Spatially, in the year 2000, some important countries of destinations in Australian export included Japan, China, Korea, the USA, India, Taiwan, and Indonesia. The role of China in Australian export has increased significantly; ranked fourth in 2000, second in 2005, first in 2010 and 2014. Sectorally, some important sectors in Australian export were Sector-4, Sector-15, Sector-26, Sector-27, and Sector-1.

Secondly, Australian import had also increased during the year of study from US\$ 47,267 million in 2000 to US\$ 80,358 million in 2005 to US\$ 130,290 million in 2010 and to US\$ 162,257 million in the year of 2014. Spatially, some important countries in Australian import were the USA, China, Japan, Germany, Great Britain, and Indonesia. The role of China as an important country in Australian import ranked only fourth in 2000, second in 2005 and first in 2010 and 2014. The role of the USA and Great Britain tended to decrease in Australian import during the year of study. Sectorally, some important sectors in Australian import were Sector-27, Sector-25, Sector-28, and Sector-26.

Thirdly, trade balances in Australian economy were surpluses in all years of study. No specific pattern in the USA trade deficit during the year of study. Trade surplus in the year 2000 was US\$ 21,619 million, then increased to US\$ 34,830 million in the year 2005, to US\$ 103,259 million, then decreased to US\$ 80,191 million in the year 2014. There were 7 countries in which trade surpluses occurred in all years, namely Brazil, China, India, Japan, Korea, Turkey, and Taiwan. There were 7 countries as well in which Australian had trade deficits in all years of study, namely Austria, Switzerland, Germany, Norway, Portugal, Sweden, and the USA. Sectorally, there were 7 sectors in which trade surpluses occurred in all years, namely Sector-1, Sector-4, Sector-5, Sector-6, Sector-7, Sector-15, and Sector-26. There were 17 sectors in which Australian had trade deficits in all years of study, namely Sector-2, Sector-3, Sector-9, Sector-10, Sector-13, Sector-14, Sector-16, Sector-18, Sector-19, Sector-20, Sector-21, Sector-22, Sector-24, Sector-25, Sector-28, Sector-29, and Sector-30.

## Conclusion

World input-output database was very useful in providing export, import, and trade balance data. Three conclusions could be drawn from this study. Firstly, Australian export to other countries tends to increase during the year of study. Three important countries in Australian export were Japan, China, Korea, the USA, India, Taiwan, and Indonesia.

The role of China in Australian export has increased significantly. Sectorally, some important sectors in Australian export were Sector-4, Sector-15, Sector-26, Sector-27, and Sector-1. Australian import had also increased during the year of study. Spatially, some important countries in Australian import were the USA, China, Japan, Germany, Great Britain, and Indonesia. The role of China as an important country in Australian import increased significantly. The role of the USA and Great Britain tended to decrease in Australian import during the year of study. Sectorally, some important sectors in Australian import were Sector-27, Sector-25, Sector-28, and Sector-26. Thirdly, trade balances in the Australian economy were surpluses in all years of study. No specific pattern in the USA trade deficit during the year of study. There were 7 countries in which trade surpluses occurred in all years, and there were 17 sectors in which Australian had trade deficits in all years of study.

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Appendix 1. Sector classifications

Sector Code	Descriptions
Sector-1	Crop and animal production, forestry, fishing and aquaculture
Sector-2	Forestry and logging activities
Sector-3	Fishing and aquaculture
Sector-4	Mining and quarrying
Sector-5	Manufacture of wood and of products of wood and cork, except furniture
Sector-6	Manufacture of paper and paper products
Sector-7	Printing and reproduction of recorded media
Sector-8	Manufacture of coke and refined petroleum products
Sector-9	Manufacture of chemicals and chemical products
Sector-10	Manufacture of basic pharmaceutical products and pharmaceutical preparations
Sector-11	Manufacture of rubber and plastic products
Sector-12	Manufacture of other non-metallic mineral products
Sector-13	Manufacture of basic metals
Sector-14	Manufacture of fabricated metal products, except machinery and equipment
Sector-15	Manufacture of computer, electronic and optical products
Sector-16	Manufacture of electrical equipment
Sector-17	Manufacture of machinery and equipment n.e.c.,
Sector-18	Manufacture of motor vehicles, trailers and semi-trailers
Sector-19	Manufacture of other transport equipment
Sector-20	Manufacture of furniture; other manufacturing
Sector-21	Repair and installation of machinery and equipment
Sector-22	Electricity, gas, steam and air conditioning supply
Sector-23	Water collection, treatment and supply; Sewerage & waste: collection, treatment and disposal
Sector-24	Electricity, gas and drinking water
Sector-25	Construction
Sector-26	Wholesale and retail trade and repair, accommodation and food service activities
Sector-27	Transportation, telecommunication, information and publication
Sector-28	Real estate, financial and corporate services
Sector-29	Legal & management consultancy, architectures & engineering, scientific research & development
Sector-30	Other service activities

Source: Aggregated from WIOT, 2016.

Appendix 2. Country abbreviations

No.	Acronym	Country included	No.	Acronym	Country included
1.	AUS	Australia	23.	IRL	Ireland
2.	AUT	Austria	24.	ITA	Italy
3.	BEL	Belgium	25.	JPN	Japan
4.	BGR	Bulgaria	26.	KOR	Korea
5.	BRA	Brazil	27.	LTU	Lithuania
6.	CAN	Canada	28.	LUX	Luxembourg
7.	CHE	Switzerland	29.	LVA	Latvia
8.	CHN	China	30.	MEX	Mexico
9.	CYP	Cyprus	31.	MLT	Malta
10.	CZE	Czech Republic	32.	NLD	Netherlands
11.	DEU	Germany	33.	NOR	Norway
12.	DNK	Denmark	34.	POL	Poland
13.	ESP	Spain	35.	PRT	Portugal
14.	EST	Estonia	36.	ROU	Romania
15.	FIN	Finland	37.	RUS	Russia
16.	FRA	France	38.	SVK	Slovak Republic
17.	GBR	United Kingdom	39.	SVN	Slovenia
18.	GRC	Greece	40.	SWE	Sweden
19.	HRV	Croatia	41.	TUR	Turkey
20.	HUN	Hungary	42.	TWN	Taiwan
21.	IDN	Indonesia	43.	USA	United States
22.	IND	India	44.	ROW	Rest of the World

Source: Processed from WIOT, 2016.

## The Linkage of Physical and Human Investments in Affecting Gross Domestic Product in Indonesia

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### Abstract:

This study draws the influence between linkage of physical and human investments, to gross domestic product (GDP) in Indonesia. Therefore, the panel data regression model was used to explain this influence at the national level and in accordance with data classification into Java and Outside Java. The National and, Java and Outside Java classifications were clarified through a Chow test. As confirmed by the Hausman test, estimation results using the fixed-effect model indicated that direct domestic investment, direct foreign investment, and the human development index influence GDP at the national level and outside Java regions. By contrast, human development exerted no significant effect on GDP for regions located in Java Island. Thus, the contribution of this paper is to explain the role of regional development in examining the nexus among physical investment, human investments and gross domestic products.

**Keywords:** gross domestic product; direct domestic investment; direct foreign investment; human investment

**JEL Classification:** E22; F21; P45

### Introduction

Possible factors affecting economic growth include natural resources, capital accumulation, organization, technological progress, production scale, human resources, politics, and administration. Some economists have claimed that capital accumulation is the most important factor in explaining economic growth variability. Human capital investments in developing countries can increase economic growth by assuming the suitability between formal education and the labor market (Mehrra and Musai 2013, Mikhaylova 2016, Sumaryoto 2016, Whalley and Zhao 2013).

On the other hand, physical investment can take the form of direct domestic investment (DDI) and direct foreign investment (DFI), whereas human investment is measured by human development index (HDI). Through the Indonesia Investment Coordinating Board, the government of Indonesia seeks to promote direct investments, DDIs, and DFIs (Direct foreign investment) as economic growth drivers. Along with stable economic growth targets, efforts to attract direct investment are also pursued by the central and local governments. Such efforts were evident in the increase in total DDI and DFI realization during 2010–2015, in the midst of a weakening global economy. However, a disproportionate level of direct investments existed between regions located in Java and those outside it. For example, in 2014, the investment rate in Java was 131.1 trillion (58.8% of total direct investment in Indonesia), whereas that in regions outside Java was only 91.7 trillion (41.2% of total direct investment). In 2015, the rates were 55.6% for Java and 44.3% for regions outside Java. The same inequality appeared in HDI in Indonesia. In 2010–2015, the average HDI of the six provinces in Java was 70.29, whereas that for regions outside Java was only 65.45. Furthermore, the regional gross domestic product (RGDP) of the six provinces in Java was 60% of the national gross domestic product (GDP), whereas the 27 other provinces outside Java Island contributed to less than 40% of the national GDP.

Investment can be made through purchasing capital goods and production equipment to increase the ability to produce goods and services, which in turn will increase real GDP and economic growth. Foreign investment performs a pivotal role in economic performance in Ghana (Dj Julius 2017b, Kwakye 2013) and China (Jin, Yin, and Hamori 2012), respectively. Foreign investment is also complementary to DI in promoting economic growth in China (Tang, Selvanathan and Selvanathan 2008). Some Organization for Economic Cooperation and Development (OECD) reports (OECD 2002) and previous scientific research have acknowledged that DFI is useful to development and economic growth (Acaravci and Ilhan 2012, Liu and Sarfraz 2015, Reiter and Steensma 2010). However, other empirical evidence imply that DFI positively affects economic growth by triggering technological spillovers and physical capital accumulation in developing countries but not in developed countries (Johnson 2006).



Another research finding suggests that the impact of DFI on growth and development may differ between developed and developing countries because they have distinct institutional and economic structures. In addition, poor institutional quality may increase pressure on growth and development (Jude 2015). DFI and direct domestic investment (DDI) can complement each other and positively influence economic growth only if a sound macroeconomic policy is implemented (Dasgupta 2015, Mahmood 2016). Therefore, DFI will positively impact DDI and economic growth if foreign companies provide domestic companies with new investment opportunities (Salim, Bahattab and Gavrilu 2016, Ibrahim 2014).

Human capital can be viewed from perspectives of living standard, health, and education. The well-known measuring index for this composite is HDI that provides an assessment of achievements of a country in various areas of human development. Many economists have continually researched several determinants of economic growth. The Harrod–Domar model is based on the accumulation of physical capital stock (Azeez, Kolapo and Ajayi 2012). New growth theory developed in the 1990s, the initial prominence of which on the aggregation of physical capital turned to human capital (Javed *et al.* 2013, Maria Fedorovna Mizintseva, Anna Romanovna Sardarian and Tatiana Nikolaevna Yakubova 2016). Human and physical capital investments are significant determinants of growth in African countries (Oketch 2006).

Research has been conducted to investigate the relationship between economic growth and human development and found that the expansion of capacity and freedom leads to enhanced economic performance, and that human development significantly affects economic development (Bandara and Dehejia 2014, Ezeabasili, O. Isu and Mojekwu 2011, Korobanicova 2016). Other researchers have also explored the link between human capital development and economic performance (Aurangzeb 2003, Bloom, Canning and Sevilla 2001, Muhammad Imran *et al.* 2012, Samimi, Madadi and Heydarizadeh 2014). However, their findings vary. Some of them found the positive impact of health spending on economic growth (Piabuo and Tieguhong 2017). Other researcher determined the contribution of education to economic growth (Sbaouelgi 2017).

There are several studies of the relationship between direct investments and human capital. The idea is based on an augmented Solow growth model, which incorporates human capital, together with physical capital determines the performance of the economy. FDI has a positive impact on economic performance, whose impact is reinforced by existing human capital. That is, human capital contribute to the performance of the economy as a facilitator for technological spillover derived from FDI (Dj Julius 2017a, Su and Liu 2016). FDI and DDI are mostly absorbed into the manufacturing sector, where the main benefits of these physical investments were captured by the company. The increase in total factor productivity due to physical investments suggests that technological spillovers provided by FDI and DDI are positively related to absorption capacity, generated by human capital (Alarcon Osuna 2016). In this context, human capital is in the form of skilled workers trained for technical, managerial and professional positions, all of which are generated by human investment (Muhammad Azam, Saleem Khan, Zalina binti Zainal, Namasivayam Karupiah 2015).

The above discussion highlights that the impact of physical and human investments on economic growth results in diverse findings, the variations in which are due to variation in the socio-economic circumstances of various countries. Therefore, investigating this issue in each specific aspect of Indonesia is important. The GDP was assumed to be determined solely by investment (*i.e.*, physical investments and human investment). Thus, the impact of each variable on GDP was analyzed. In addition to analyzing these variables at the national level, the same variables in by triggering side and outside Java were also investigated. The possible differences among the three types of investment relationships with GDP are expected to exert different policy impacts. This study determines whether the economic achievement represented by gross domestic product (GDP) in Indonesia is influenced by physical and human investments and how the linkage among these variables to GDP.

## 1. Methodology

The data used were obtained from Statistics Indonesia, the Indonesia Investment Coordinating Board, and the World Bank in 2007–2015. The research variables are the DDI, DFI, and HDI in 33 provinces in Indonesia. The basic model in determining the effects of DDI, DFI, and HDI on economic growth is as follows:

$$RGDP_{it} = \alpha + \beta_1 FDI_{it} + \beta_2 DDI_{it} + \beta_3 HDI_{it} + \varepsilon_{it} \quad (1)$$

where: RDRP - Regional Gross Domestic Product; DFI - Direct foreign investment; DDI - Direct domestic investment; HDI - Human Development Index; i = Provinces (33); t - Year (2002–2015);  $\alpha$  = Intercept;  $\beta_2$  - Regression parameters;  $\varepsilon_{it}$  - Error term.



Firstly, the data were classified into three groups: national-level data, data from regions in Java Island which represent developed regions, and data from regions outside Java Island which represent relatively underdeveloped regions. Six provinces in Java Island are assumed to be developed areas: Jakarta, Banten, West Java, Central Java, Yogyakarta, and East Java. The 27 other provinces in Java Island were all assumed to be relatively underdeveloped regions.

Model (1) was implemented on data in all groups to obtain residual sum square statistics, the results of which were used in a Chow test to examine whether the grouping was valid.

Chow test Procedure. F-statistics was obtained using the following formula:

$$F = \frac{S_5/k}{S_4/(N_1 + N_2 - 2k)} \tag{2}$$

where: S1 - Residual sum square of model (1) for the overall data sample (i.e., national-level data); S2 - Residual sum square of model (1) for samples in group java; S3 - Residual sum square of model (1) for samples other than those in S2 (i.e., outside-Java data); S4 = S2 + S3; S5 = S1 - S4; N1= Sample size in S2; N2= Sample size in S3; k = Number of parameters to be estimated

All residual sum square values obtained through regression according to model (1) in each grouping, which are: national group, Javanese group and group outside Java. Thus, three times the estimated static model for each grouping was performed. If the F-statistics obtained was sufficiently high to reject H0, then the Java and outer Java groupings are statistically different from the national group.

Secondly, three Hausman tests were performed for each group to determine whether to select the fixed-effect or random-effect model to estimate model (1) in each grouping.

## 2. Results and discussion

### 2.1. Results

Firstly, the three tables in Appendix A present the estimation of the common effect of the relationship model among DDI, DFI, and HDI on economic growth in the three data classifications (i.e., national, Java, and outside Java).

In the tables, the statistics appears as follows:

S1=9.47E+18; S2=4.85E+18; S3=2.56E+18; S4=7.41E+18; S5=2.06 E+18

N1= 54; N2= 243; k = 4.

The calculation of Equation (2) resulted in an F-statistic of 20.1. Therefore, H0 was rejected, meaning that a regression result difference existed between the National and Java and Outside Java groups. In other words, significant differences existed in the effects of DDI and DFI on GDP between National and Java and Outside Java classifications.

Secondly, the hausman test. The Hausman test result summary of the three groups is shown in Table 1.

Table 1. Hausman Test results

No	Classification	Chi-Sq. Statistic	
1	Java	13.554362	***
2	Outside Java	30.192394	***
3	National	105.954604	***

Note: \*p<0,1 \*\*p<0,05 \*\*\*p<0,01

According to the Hausman test results, the p-values for the Java, outside Java, and National groups were smaller than 0.05. H0 was rejected, meaning that the best method for estimating the relationship between DDI, DFI, and HDI and GDP for the three classifications is the fixed-effect model. In addition, fixed effect model was used to anticipate time-invariant covariates, ie technology. The explanatory variables in this research model are "capital" which translated into physical investments (DDI and DFI) and human capital. Another possible explanatory time invariant variable was technology.

The summary of panel data regression results using the fixed-effect model for the three classifications is shown in Table 2, and all estimation results are presented in Appendix B.

Table 2. Summary of panel data regression results

Variable	National Level		Java		Outside Java	
	Coeff	p-value	Coeff	p-value	Coeff	p-value
Intercept	-3.99E+08	***	-2.80E+08		-2.88E+08	***
DDI	15001.88	***	21842.83	***	7902.074	***
DFI	24257.55	***	59570.33	***	55273.19	***
HDI	8463813	***	9209499		5738486.	***
	$R^2 = 0.92$		$R^2 = 0.95$		$R^2 = 0.91$	
	F stat = 89.0; Prob = 0.00		F stat = 120.62; Prob = 0.00		F stat = 70.32; Prob = 0.00	

Note: \*p<0,1 \*\*p<0,05 \*\*\*p<0,01

At the national level, p-values indicated that DDI, DFI, and HDI variables exerted significant effects on GDP. High R<sup>2</sup> values and large F-statistics also indicated that the estimation had proper goodness of fit.

Slightly different regression results were obtained for the developed regions located in Java Island, as DIs (*i.e.*, DDI and DFI) significantly affected the RGDP. By contrast, HDI indicated that the quality of human development presented no significant effect on GDP. As with the previous results, we obtained the values of R<sup>2</sup> and F-statistics that illustrated the goodness of fit of the estimation results.

The last estimate was obtained to classify regions outside Java that were assumed to be relatively underdeveloped. Similar to the estimates obtained at the national level, all DDI, DFI, and HDI variables significantly influenced GDRP.

### 3. Discussion

Overall, the DDI and DFI variables in regions inside and outside Java and at the national level exerted positive and significant influences on GDP. This finding is consistent with those of Cheung (Cheung, Dooley and Sushko 2012) which indicate that investment positively affects the economic growth of low-income countries and negatively affects that of high-income countries. This finding is also in line with those of Lumbila (Lumbila 2005) which prove that DFI and DDI can complement each other and even positively impact economic growth if supported by a sound macroeconomic policy and environment.

The Indonesian government continues to spread investments outside Java and to reduce concentration in the center of economic growth in the island. The investment spread throughout Indonesia will be able to further national economic growth. Investment activities will impact job creation, thereby enabling communities to increase their economic activities and living standards, which are also accompanied by increased revenues. Therefore, the existence of investments increases economic activity and ultimately results in economic growth, as conveyed by many researchers (*e.g.* Adams and Opoku 2015, Aizenman, Jinjarak and Park 2013, Amin, Khalid and Yao 2014, Zouhaier and Fatma 2014).

The HDI variable exerted a positive effect on GDP for regions outside Java and at the national level. This finding is in line with that of Whalley and Zhao (Whalley and Zhao 2013) which demonstrate that human capital has a significant role in GDP. Different conditions occur in Java Island, where HDI demonstrates a positive but insignificant relationship with GDP. This finding contradicts that of Costantini and Monni (Costantini and Monni 2008) which emphasize that economic growth is positively influenced by human development, trade openness, institutional quality, and natural resources. The finding contradicts those of Fleisher (Fleisher et al. 2007) as well, which imply that human capital investments in underdeveloped regions in China can provide economic efficiency and growth.

Unlike in regions outside Java, the HDIs of developed regions were already at high levels. The HDI comprises three basic dimensions: healthy living, knowledge, and decent living standards. The qualitative development of human life in Java has already reached a high level. Therefore, these regions do not require specific policies to increase HDI in relation to GDP. By contrast, the HDIs of regions outside Java still require a sound policy to help in their improvement, thereby enabling them to influence GDP.

### Concluding remarks

The above findings and discussion led to the following conclusions:

1. Panel data regression results indicated that with a common intercept, all variables, namely, DDI, DFI, and HDI, exerted positive and significant influences on GDP;
2. Upon the influence of investments, differences in GDP characteristics existed among the different data groups (*i.e.*, National, Java, and Outside Java);

3. The best method for the panel data regression of all data classifications was the fixed-effect model;
4. The determinants of GDRP in Java regions were DDI and DFI; HDI exerted no significant effect. Finally;
5. The determinants of GDRP in regions outside Java and at the national level were DDI, DFI, and HDI.

A policy to be drawn is the discretion to improve human development index in outside Java. In Java areas, market forces had brought about the human development index to its optimum level, but not so for outside Java areas.

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## APPENDIX A: Chow Test

Table A1. Common Intercept-National Level

Cross-sections : 33; Total pool (balanced) observations: 297			
Dependent Variable: RGDP			
Variable	Coeff	t-Stat	
Intercept	-6.16E+08	-3.576423	***
DDI	26942.50	13.74152	***
DFI	111998.6	11.23460	***
HDI	10376963	3.936322	***
Sum squared resid	9.47E+18		

Table A2. Common Intercept-Regions in Java

Cross-sections: 6; Total pool (balanced) observations: 54			
Dependent Variable: RGDP			
Variable	Coeff	t-Stat	
Intercept	24442655	0.036322	
DDI	34756.78	7.406893	***
DFI	84507.23	3.985124	***
HD?	2502993.	0.255048	
Sum squared resid	4.85E+18		

Table A3. Common Intercept-Regions outside Java

Cross-sections included: 27; Total pool (balanced) observations: 243			
Dependent Variable: RGDP			
Variable	Coefficient	t-Stat	
Intercept	-6.46E+08	-5.607619	***
DDI	11759.29	6.540936	***
DFI	106941.0	6.104465	***
HDI	10892871	6.134024	***
Sum squared resid	2.56E+18		



## APPENDIX B: Panel Data Regression-Fixed Effect Model

Table B1. Fixed effect panel data for national level

Dependent Variable: PDRBB			
Sample (adjusted): 2007 2015, Cross-sections included: 33			
Variable	Coeff	t-Stat	
Intercept	-3.99E+08	-9.62	***
PMDN	15001.88	6.59	***
PMA	24257.55	2.93	***
IPM	8463813.	13.78	***
R-squared	0.922697	Durbin-Watson stat	0.975349
F-statistic	89.00875	Prob(F-statistic)	0.000000

Table B2. Fixed effect panel data for regions in Java (developed regions)

Dependent Variable: PDRBB			
Sample (adjusted): 2007 2015, Cross-sections included: 6			
Variable	Coeff	t-Stat	
Intercept	-2.80E+08	-0.61	
PMDN	21842.83	4.99	***
PMA	59570.33	4.61	***
IPM	9209499.	1.35	
R-squared	0.955446	Durbin-Watson stat	1.185031
F-statistic	120.6253	Prob(F-statistic)	0.000000

Table B3. Fixed effect panel data for regions in outside Java (less developed regions)

Dependent Variable: PDRBB			
Sample (adjusted): 2007 2015, Cross-sections included: 27			
Variable	Coeff	t-Stat	
C	-2.88E+08	-7.041932	***
PMDN	7902.074	5.578450	***
PMA	55273.19	12.20854	***
IPM	5738486.	8.960984	***
R-squared	0.905436	Durbin-Watson stat	0.987704
F-statistic	70.32568	Prob(F-statistic)	0.000000

## Developing Knowledge in an Enterprise via Team Learning

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### Abstract:

The aim of the paper is to identify the influence of team education on the level of knowledge and skills achieved and the creative action leading to the improvement of enterprise processes. The focus is on the scope of team education in hours in three groups of corporate entities differentiated by size. We analyze the dependency of differences in the scope of employee education from the size of the corporate entity and the scope of team training and employee creative action. Methodology starting points are described in the third chapter and the fourth one contains results of research. The paper contains the presentation of research results in 14 tables and their interpretation. Data were collected by means of the questionnaire and interview methods and processed by means of statistical methods. Opinions of selected managers in enterprises analyzed on the enterprise education organized in teams and discussed. The research shows that the brainstorming method, the Gordon Method, and synectic method are most frequently methods applied in enterprises analyzed. In the case of team education, sigma is high, which means that team education is not statistically significant in relation to dependent variable (assessment of knowledge and skills).

**Keywords:** action learning; case study; creative action; explicit/tacit knowledge; further professional education; team learning

**JEL Classification:** A20; A29; I29

### Introduction

A dynamic development of enterprises, development of technology, and huge increase in knowledge increase the demands on further professional education. Nowadays, it would be hard to find a profession in which the employees' knowledge and skills gained through formal education or vocational training is sufficient for their entire working life. Education has become a lifelong process; it is not only the need of individual employees to maintain their working capacity by acquiring an adequate amount of knowledge directly related to the performance of their profession. Further professional education is in the best interest of management of most corporate and non-corporate entities, irrespective of their size. Consequently, it is important to pay attention to its content and methods. Nowadays, it is often necessary to acquire knowledge and skills in other subject disciplines, which promotes an interdisciplinary approach to education.

Within the work on the research project KEGA No. 014EU-4/2016 "Preparation of the content and structure of subject disciplines focused on the development of knowledge and skills of graduates from non-economic health service fields of study", we explored further professional education also in other sectors.

### 1. Theoretical delimitation of the knowledge for purposes of further adult education

The business environment is subject to constant changes closely linked to changes in the structure and content of work. Knowledge is becoming a key condition for the development of each subject. There appears a need for the most effective treatment of knowledge and other forms of intellectual capital as hidden assets of corporate entities. In a more complex framework, knowledge is part of cognitive capacities, while information constitutes only passive material (Kelemen 2007).

Knowledge is human information that is useful and applicable in the economy. The focus is on the applicability of information in everyday practical problem-solving activities, while using knowledge and

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experience. The concept of knowledge has different meanings and values in different contexts, depending on the time, location and assumptions of those who work with it. The knowledge chain (Truneček 2004, 13) can be depicted as base level data, *i.e.* facts, images, and sounds, which do not convey meaning by themselves. In the process of interpreting, filtering, and summarizing, the data are becoming meaningful and transformed into information. The information applied in practice represents knowledge. Knowledge is the accumulation of information for some purpose, with the intent to gain benefits (Bellinger, Castro and Mills 2004). The knowledge chain is often supplemented with superior (higher-rank) values such as wisdom and understanding (Sensky 2002) and the expertise, as mentioned by Beckman (1997, 29 – 32). For example, in (Bellinger, Castro and Mills 2004) the knowledge chain is placed in coordinates where the x-axis is knowledge and the y-axis is context. The string is made up from the following sequence:

DATA (description of reality)  
 ► INFORMATION (cognition of structure)  
 ► KNOWLEDGE (cognition of causes and consequences)  
 ► WISDOM (cognition of principles)

Bellinger (Bellinger, Castro, Mills 2004) asserts that the relationship between data, information and knowledge is not necessarily a one-way process; instead, he emphasizes the importance of spiral relationships. Some authors hold a more comprehensive view of knowledge and believe that knowledge does not flow directly from the information (even though they are aware of its superiority); therefore, they prefer the parallel arrangement of information and knowledge to the sequential one. According to Bělohávek (Bělohávek, Košťan and Šuler 2006) and Bureš, knowledge is generated through education and experience, and it is only after its connection with the information that resulted from the data, that knowledge enables the decision-making process itself needed for the performance of activities (Bureš 2007, 27).

Knowledge requirements are changing compared to the past. It is necessary to re-assess the amount of traditional knowledge and ensure the innovation of knowledge, the dissemination of the narrowly specialized knowledge of individuals, and the penetration into the depth of a particular issue through the knowledge of several participants in problem solving. The applicability of knowledge differs across time and various groups of people and teams. The basis of communication and coordination of cooperation is the integration of knowledge. In essence, the following four basic levels of knowledge can be characterized as follows:

- *Acquired knowledge*, which represents the level of acquired knowledge of the book, and it forms the basis for managing the department;
- *The experience and skills* gained through the daily use of book knowledge and school knowledge, which represent a practical transfer;
- *Acquisition of information, the cognition of systemic connections, and discovering causes and consequences*; these are related to applying knowledge and solving complex problems, which often occur at the borderline with other areas;
- *Creative action* where the process of knowledge integration has to result in self-initiated creative action. An important role is to be ascribed not only to motivation, but also to overcoming personal goals and interests (Suntingerová 2010)

Boisot's matrix (Bureš 2007, 30) is an endeavor to categorize knowledge, which is arranged into a four-level matrix, containing the following levels:

- Patented knowledge – context-dependent;
- Personal knowledge – not codifiable and transferable; it depends on the experience of a particular person and is difficult to disseminate;
- Generally widespread knowledge – as the knowledge existing in general awareness, which is based on life experience;
- Public knowledge – codified and usually structured (it occurs in writing genres).

The most widely used and universally accepted classification of knowledge was presented by Polanyi and Sen (2009), who differentiates two kinds of knowledge:

- Explicit knowledge, *i.e.*, conscious, expressed, formulated, which is easily captured and can be shared via information and communication technologies;

- Tacit knowledge, *i.e.*, silent, unspoken, knowledge preserved in the minds and imagination of individuals and manifested in their behavior. The word *tacit* comes from Latin and means something that is difficult to express in words or images; it is often the knowledge of how to do something or recognize an analogical situation (Dalkir 2005, 342). Polanyi even claims that tacit knowledge would be destroyed when if we tried to formalize it.

Knowledge can come in explicit and implicit forms (Mládková 2003, 90-94). The explicit form is documented and obvious. The implicit form of knowledge is not recorded and is based only on experience. It is important to transform the hidden (*tacit*) form into the explicit form. *Explicit knowledge* – this is the so-called demonstrable knowledge that can be expressed in words or made visible. It is recorded in books, documents or databases and is more or less accessible. By contrast, *implicit knowledge* is a dynamic and personal knowledge that exists in the form of behavior, ideas, values, opinions, and experiences in each person's mind. Therefore, this kind of knowledge can be very difficult to describe or document. This knowledge is not directly owned by corporate entities and is being developed every day.

In attempting to render a more complex classification of knowledge, the literature breaks down implicit knowledge into the knowledge that can be converted into an explicit form and one where the transformation is difficult. Thus, it is possible to classify knowledge (Bureš 2007, 29) also in the following way (Table 1):

Table 1. Classification of implicit knowledge in terms of its transferability into explicit form

Knowledge	Characteristics
Implicit knowledge (Formulable)	Knowledge in the mind and vision of individuals that can be transformed into an explicit form at any time. It is the knowledge of the process and its restrictive conditions present in the notions/vision of the owner.
Implicit knowledge (Unformulable)	Knowledge hidden in the thoughts and ideas of an individual, which cannot be translated into an explicit form; it cannot be formalized or documented. For example, it is the knowledge of an expert in a certain area or experience gained over many years.

Source: Bureš (2007)

For corporate entities, the balance between theoretically specialized knowledge (explicit knowledge) and know-how (implicit knowledge) is very important. While the theoretical knowledge can be “acquired” by recruiting young, theoretically well-prepared employees, or by developing existing employees through introduction training, the implicit knowledge based on experience has to be revealed, classified, systematized, developed, and made available to others in order to ensure its integration and application in the process as well as in the implementation of activities. However, the importance of employees and their knowledge is also in minor improvements to the existing situation, as these can improve the position of the corporate entity in a competitive environment.

## 2. Development of knowledge and team learning

It is generally believed that success depends on the knowledge and skills of an individual, while only few realize that the success of an entrepreneur is dependent on the knowledge and abilities of all those involved. The current situation in enterprises is characteristic of a low participation in information and knowledge, promotion of high individual competitiveness, and underestimation of team learning. A team is a group of people who complement each other with knowledge, have a common work goal and access to the work for which they are responsible. High-performance teams invest a lot of time and effort in exploring, shaping, and discussing their existence and roles. Team working is not the same as working in a group. In the team, each employee has his or her place, a role that is not the same as that of someone else, but the employees are dependent on one another. Further employee training activities also focus on supporting teamwork, focusing on the development of character traits and social skills. The development of character traits is the object of the interest of employers, in particular, the activation characteristics of the personality, which reflect the employees' relationship to activities performed by them. The development of social competences focuses on the ability to work in a team or a group, team leadership, or groups, self-discovery, getting to know others, as well as on developing communication skills in various situations. Corporate learning should particularly highlight what differs a corporate entity from its competitors.

Corporate learning should focus on developing and supporting business-specific knowledge, *i.e.*, all the activities necessary to ensure the entity's competitiveness, strategic goals and visions, which relate to finding new methods of work, improving individual processes, or eliminating activities that do not generate value.

Learning should be incorporated in day-to-day activities rather than be something that is paid attention from time to time on a specialized course. The business world is changing in so fast that solutions to day-to-day problems and situations is possible only through the transformation of an individual's knowledge into the complex knowledge of the corporate entity, while preferring a free and creative access to knowledge, improving communication, coordination, cooperation, and trust.

In the process of education, the didactic approach is often complemented with other learning approaches, which emphasize co-operation and collaboration in education, as well as the learners' high participation. Organized learning is no longer a dominant form of education. Instead, digitization in education and on-line learning opportunities create a wide operational space for education. The role of education should not involve only acceptance of the change, leading to the change, but also preparing for the change, ensuring this way the competitiveness of the corporate entity. Corporate education should create conditions for sharing and developing knowledge, both in the real world as well as in the virtual one.

For the needs of further education, wherever possible and appropriate, it is necessary to move from the dominant role of the teacher to that of the learner. These needs exert pressure on educational activities and on learning processes and the various methods applied in them. The action learning process is taking the lead, transforming the learner from the recipient of the information into a problem solver. Action learning allows identifying the problem, proposing an alternative solution, testing this solution in the real-life situation, and evaluating the consequences.

The modification of action learning is a team learning that has its origins in the United Kingdom. It is based on "sharing problems and questions with others" (Crainer 2000, 194). Team learning can be defined as the process in which teams create knowledge by pooling and developing the team's knowledge, experience, and capabilities. Team learning requires appropriate communication, change of attitudes and behavior so that team members can integrate knowledge into an autonomous action. The aim is to increase the team's performance and thus that of the entire corporate entity. The business world is changing so fast that problem solving rests only in the minds of the team members themselves, who (through team learning) identify the key issues that need to be addressed to take care of mobilization of resources and finding answers, often through trial and error. The need for continuous improvement in organizations, bringing competitive advantages, is linked to the tasks of the teams. It is important to involve all company employees in this process. In practice, there are two basic approaches to improvement. It can be a way in which business changes are proposed and managed by management, the so-called engineering, or a "bottom-up" approach when the changes are initiated by employees who are closest to production processes or to the implementation of processes and systems.

From among the applied learning methods, case studies are suitable in team learning, especially for developing analytical thinking, diagnostic skills, and decisions free of real situation risks, role-playing or simulation providing practical training in negotiation and conflict resolution. Case study is a simulation of work tasks. The problem situation is set in order to guide the learning process in its solution. The aim here is to provide the learners step-by-step with new skills to learn the practices they will later use in their specific task. The case study method is linked to work in groups. Its essence is to analyze a particular situation, discuss it, propose several variants of its solution, and select one of them.

The purpose of the case study is:

- working with real-life issues, *i.e.* dealing with the problems, facts, conditions, and conflicts that occur in the real world;
- practicing decision-making, which requires most case studies to be resolved;
- encouraging learners to think independently and creatively.

Case studies are based on previous experience and knowledge, exchange of views on the situation, and creative thinking. A certain variant of case studies is the syndicated method. It starts with the distribution of listeners to two to four small groups (syndicates) that solve the problem situation separately. Each group chooses their spokesperson, who then interprets the results. The instructor does not interfere with the independent activities of groups and moderates the final comparison of results of both groups. In addition to the speaker, syndicates can also select observers, who analyze the way the group works. The advantages of the method are in the intensity of discussion and problem-solving autonomy.

To develop team-working abilities, we can also use the Assessment Center (Diagnostic Training Program), often referred to as a multi-site trial, participated by at least three internal and external observers, which allows a reassessment of individual and group work by others and self-evaluation (Hroník 2002, 46). The Assessment Center is applied in identifying learning needs when the program focuses on the strengths and



weaknesses of employees and managers as well as on their development potential in the future or on the career growth planning in an enterprise. In this case, according to Kociánová (2010), the name Development Center is more precise.

In some cases, we can use outdoor training – a complex form of short and intensive training, often taking place outdoors. Sorting activities of varying physical and psychological difficulty enables us to support team building, uncover its weaknesses, stimulate communication and co-operation, or develop creativity. Outdoor training has an impact on changing attitudes, opinions, and behaviors, so it can also make team learning more effective and improve communication.

In-group education, problem-orientated methods are used, which come in the form of dialog teaching methods. The preparation of dialog teaching methods such as brainstorming, the Gordon method, or the synectic method is very demanding in terms of professional and methodical mastery. All of these methods are based on a common basis and focus on creative discussion on generating new ideas. The best-known method of learning is the brainstorming method, which is a typical method of creating new ideas. It is used to solve more complex tasks and non-standard problems in individual teams, or groups. When brainstorming is applied for educational purposes, it creates a rich basis for discussion and knowledge sharing, consolidation, and formulation of new ideas.

Brainstorming is participated by a group consisting from five to twelve members. The maximum number of participants in brainstorming should not exceed fifteen persons. The composition of the brainstorming group should be heterogeneous in terms of knowledge. It is recommended to write ideas on a large sheet of paper, billboard, or project them on a large screen so that all participants have an overview of what has already been said. We have to maintain a relaxed mental atmosphere, which is the basis of effective learning. The basic characteristic of brainstorming is that the stage of generating ideas is separate from the assessment phase. Participants first discuss about the criteria, for example, benefits, efficiency, *etc.*, and then search for the ways of implementing the ideas. Then they design a system of acquired knowledge and the possibilities of its application and further development.

A discussion referred to as the Gordon method is an analogy of brainstorming; however, the only person who knows the problem to be solved is a moderator. The moderator introduces the problem very broadly and lets participants discuss it from diverse aspects. It is suitable when the participants are not aware of the focus of the discussion. The moderator gradually narrows down the problem to one or two practical solutions. The advantage of this method is that participants' approach is not limited. The conditions for dialog and discussion are also created by a synectic method in which ways of stimulating ideas are maximally used. The moderator leads the participants to identifying the *bearer* of the problem. The bearer of the problem informs participants about the issue in about three to five minutes. Participants are making notes, guided by the moderator. In addition to what they have heard, they should write their own ideas, feelings, wishes, and even random thoughts. These records are called springboards. Their purpose is to encourage generating ideas rather than solving the problem.

Some improvements in group educational activities and mutual learning can be seen in the Quality Circles. This method originated in Japan in the early 1950s and gradually expanded to the entire world. Quality Circles (QC) are small groups of at least three, but a maximum of ten employees from the same workplace, who meet at regular intervals, who are able to identify, analyze, design and present solutions to problems that are within their competence (Mueller 1993, 182).

Education should be designed for all employee categories, ranging from administrative staff, through service staff, up to knowledge employees, including managers. It is therefore important to effectively connect those who know with those who need to know and to transform their personal knowledge into corporate knowledge.

### 3. Research design and essential methodological bases

The theoretical part of the article is an analysis of findings from domestic and foreign academic resources related to the needs of empirical research. We deal with the needs of further professional education and the importance of individual methods in educating groups of employees and teams. Having examined the resources available, we arrived at the conclusion that there are few analyses related to the size of the corporate entity and the number of the hours of further corporate training and the number of hours used for joint dialog of groups and special-purpose teams. Learning in groups and teams that come in the form of action learning influences the creation of knowledge in the enterprise. The aim of further vocational education is to increase knowledge and skills so that the tasks are performed in the best possible way and the goals are met. After analyzing existing resources, we created both theoretical and empirical niche for the research within the KEGA project No. 014EU-4/2016. The aim



of the research was to identify the implications of team education on the level of knowledge and skills and the support of creative action in the course of creation, innovation, and integration of the knowledge aimed at improving processes.

In this paper, we focus on assessing the scope of team education in hours in individual corporate entities by size. We explore the differences in the range of team education from the size of the corporate entity, and the influence of the size of an enterprise on the creative action of employees. Under creative action, we understand all the activities related to innovation and integration of knowledge, aimed at improving procedures and processes and supporting high quality, which guarantee a continuous improvement.

Based on these aims and considerations, research hypotheses were established. Each hypothesis testing is aimed at verifying the underlying hypothesis, zero hypotheses –  $H_0$ . Compared to zero hypotheses, we have determined alternative hypotheses  $H_1$ .

$H_0$  = zero dependency between variables

$H_1$  = dependency between variables.

If, based on hypothesis testing, we reject a hypothetical hypothesis; we accept an alternative to the hypothesis. The alternative hypothesis states what is true when the zero hypotheses does not apply (Pacáková *et al.* 2009, 411)

Research hypotheses were determined as follows:

Hypothesis no. 1:

$H_0$  = Small, medium-sized and large corporate entities (SoE) do not differ in the time dedicated to team education and training (AL).

$H_1$  = Small, medium-sized and large corporate entities (SoE) differ in the time dedicated to team education and training (AL).

Hypothesis no. 2:

$H_0$  = Small, medium-sized and large corporate entities enterprises (SoE) do not differ in opinions of creative employee behavior (CB) expressions.

$H_1$  = Small, medium and large enterprises (SoE) differ in their views on creative employee behavior (CB).

Hypothesis no. 3:

$H_0$  = Small, medium-sized and large corporate entities (SoE) do not differ in the assessment of employee knowledge and skills (AKS).

$H_1$  = Small, medium-sized and large corporate entities (SoE) differ in the assessment of employee knowledge and skills (AKS).

Hypothesis no. 4:

$H_0$  = Creative behaviors of employees do not depend on the time devoted to team education (AL) of employees.

$H_1$  = Creative behaviors of employees depend on the time devoted to team education (AL) of employees.

Hypothesis no. 5:

$H_0$  = Assessment of knowledge and skills (AKS) does not depend on the time of team training (Action Learning–AL)

$H_1$  = Assessment of knowledge and skills (AKS) depends on the time of team training (Action Learning – AL).

The research was conducted by means of the interview and questionnaire methods. The interview was used to gain a better understanding of respondents' opinions and experiences. The interview was applied in the preliminary research and in designing the questionnaire. The questionnaire method was used for practical reasons, as the research required a representative sample of respondents. Moreover, the questionnaire method makes it possible to collect information from a larger number of respondents in an acceptable time and at reasonable costs. The questionnaire contained the information section on the respondent's basic data and the expert section on the respondents' views on the implementation of the training in their corporate entities and on the outcomes. During the research, some respondents withdrew from the research, and some of the questionnaires were not considered because they were not fully completed.

Opinions of 287 respondents (from the originally addressed 360 respondents) were taken into account. Returns were 79.72%, which we consider a success. The aim was to allow the number of respondents to generalize the information received and present their ideas on how to improve the learning process in corporate entities.

Representation of respondents by enterprise size was as follows:

- respondents from large corporate entities – 112 respondents;
- respondents from medium-sized corporate entities – 88 respondents;
- respondents from small corporate entities – 87 respondents.

In each group of enterprises (by size), 120 respondents were addressed. The greatest interest in being involved in the research was recorded in large corporate entities. In the case of middle and small corporate entities, we observed some apprehension to be involved in the research. The respondents who participated in the assessment were personnel managers and line managers or owners, mostly in small enterprises. Research sample consisted from knowledge workers (the concept of knowledge worker was first used by Peter Drucker as early as in the 1960s (Drucker 1992) and service workers with secondary (including apprenticeship) and tertiary education, who take part in educational activities. The aim of these activities is the development of knowledge and skills of individuals as well as in the various forms of active learning in the group, in the team and in projects. Within the framework of the characteristics mentioned above, the research sample was selected at random, so that the results were not affected by a biased selection.

The individual respondents form the statistical units, and their opinions are the basis for the application of selected statistical methods, which enabled us to analyze the issues explored. In addition to basic statistical tools, when applying the central trend rate, *i.e.* modus and median, we investigated the mutual linear relationships between the two variables selected or between several variables. Median is the value that divides the file into two equal parts, and modus is the most common occurring value in the examined file.

Both manual processing and automated processing were used to statistically process the data (Chajdiak 2009, Matulčíková and Breveníková 2018, 742 – 750). The results of the statistical processing are further presented in the tables and interpreted verbally. The hypotheses are tested by means of regression analysis to examine the relationship between two or more variables.

#### 4. Research results

The starting-point of our explorations is an assumption that the employees as an important asset not only ensure a corporate entity's existence of but also its competitiveness. Employees have the best knowledge of their workplace and are the most likely to discover inefficient behaviors. In improvement processes, an important role is played by team learning.

In individual tables we present opinions of selected managers (whose profile is described in chapter 3) of education in enterprises organized groups, in teams and in dealing with projects. The starting-point here is the idea that it is the employees who are best familiar with the processes and procedures, and thus are able to submit proposals for improvements. Recently, team improvement has become widespread in enterprises, as it enables to utilize creative thinking techniques and arrive at original solutions to problems. On this basis, team learning expanded too. Various methods characterized in the theoretical part of this paper are applied in action learning. Enterprises pay attention to team learning on various levels, and Table 2 contains the number of hours dedicated to team learning. Team learning is connected with the creation of knowledge, innovation, and integration of corporate knowledge. For this reason, team learning is also designated as action learning.

Table 2. Total hours spent on education of groups and teams in analyzed corporate entities

Designation for the needs of statistical processing	Meaning of the designation education of groups and teams in hours (within an interval determined)	Number of respondents in absolute figures
0	No attention is paid to the given type of education	33
1	1 – 4 hrs.	80
2	5 – 8 hrs.	55
3	9 – 17 hrs.	64
4	18 – 26 hrs.	35
5	27 – 35 hrs.	17
6	36 – 60 hrs.	3

Source: results of empirical research

Despite all the positive aspects connected with the theoretical application of team learning, almost 12% of corporate entities do not create space for team learning. In the case of the methods used in Table 3, we describe their practical use in the entities analyzed. Table 2 shows that 254 respondents confirmed the application of these methods, while 33 respondents said they did not use any of the methods. The following methods were applied in the analyzed sample of respondents:

Table 3. Methods applied in enterprises for knowledge development

Methods	Percentage of respondents using the method
Brainstorming	92.12%
Gordon discussion method	12.20%
Synectic method	40.15%
Simulations	44.09%
Case studies	8.31%
Syndicate method	31.10%
Outdoor Training	13.77%
Special purpose teams for dealing with topical problems, application of quality circles, etc.	93.72%

Source: results of empirical research

Respondents' opinions indicate that the creation of task groups, circles and project teams, entrusted with solving specific problems, has the greatest importance in creating business knowledge. Another important method is the use of brainstorming to solve current problems. Team learning and creating conditions and corporate culture for learning organizations focus not only on the reproduction of knowledge but also on increasing work efficiency. These approaches to education were started by the research and technology progress in the second half of the twentieth century.

The range of knowledge related to the field of knowledge was greatly influenced by P. F. Drucker in a series of his books in the 1990s. Drucker (Sensky 2002) recognized three types of knowledge, namely:

- improving procedures, products and services;
- using existing knowledge to create new products, processes and services;
- applying of knowledge in the process of generating new knowledge.

This kind of concept and interpretation of knowledge is recognized even today. The knowledge that is owned by employees in a corporate entity determines the company's higher or lower success rate.

For these purposes, action methods of learning are developed and applied, where innovations and knowledge integration within a corporate entity take place through active employee approach, which is reflected in the improvement of procedures and processes, new products, upgrading old products, and in improving product and service quality.

The purpose of any education, either individual or team training, is the benefit manifested in the product innovations, in better production and higher quality, etc. Respondents participating in the project evaluated the benefits of the education and training provided in their own organization, which we denote in our research as an employee creative action.

Table 4. Respondents' opinions of the share of improvements in procedures and processes and quality which can be ascribed to educational activities

Designation for the purposes on statistical processing	Meaning of the designation in % in the interval of evaluated benefits from educational activities (creative action)	Number of respondents in absolute figures
-	No benefits	59
1	1 – 10%	96
2	11 – 15%	59
3	16 – 20%	50
4	21 – 25%	15
5	26 – 30%	8
6	More than 31%	0

Source: results of empirical research

As many as 59 respondents out of 287 respondents admitted they had no records to track the share of the benefits from educational activities. This means that they do not feel the impact of creative employee action after completing their educational activities. Most respondents believe that education benefits are only due to the improvements of technology and work organization, while education enables employees to be able work in increasingly difficult conditions. Almost a half, *i.e.* 42.10%, of the respondents (out of 228 respondents) ascribes the benefit of 1% to 10% to the creative action of employees after their participation in educational activities. Nearly 26% of respondents (out of 228 respondents) perceive the benefit in the range of 11–15%. 21.92% of employees rate the benefits in the interval of 16–20%; and 6.57% of employees evaluate the creativity of the employee creative action after the educational activities in the interval of 21–25%. Only 3.5% of respondents rate the employee creative action in the range of 26–30%. In the following table, we present respondents' opinions of the assessment of acquired knowledge and skills.

Table 5. Assessment of knowledge and skills acquired in the course of team learning

Designation for the needs of statistical processing	Meaning of the designation: Assessment of employee knowledge and skills	Number of respondents
5	Excellent rating	72
4	Above-average rating	112
3	Average rating	87
2	Below-average rating	16
1	Poor rating (fail)	0

Source: results of empirical research

Assessment of knowledge and skills was not conducted only on the level of knowledge but also in terms of the willingness to use, develop, and share the knowledge. Excellent rating (5) means that employees have exceptional knowledge and skills they can effectively apply in the performance of work and other assigned tasks. They seek innovative and relevant techniques, share knowledge on a voluntary basis, and are willing to use it not only for their own work but also for educating their co-workers. The above-average rating (4) indicates that employees have a thorough current knowledge and skills that reflect their performance as well as other assigned tasks, and occasionally expand their knowledge and skills, and share information with colleagues. An average rating (3) means that the work done reflects sufficient knowledge and skills, but to perform other assignments the knowledge is partial; information about changes is accepted, but employees do not make any special effort to find new opportunities for improvement. The below-average rating (2) suggests that staff often lack knowledge and skills to perform even routine tasks, and often avoid changes in knowledge and skills requirements and learning opportunities. The poor rating (1) indicates that employees constantly display an inadequate knowledge and skills, and they lack the willingness to acquire other knowledge and skills and to use them at work. Managers evaluated their subordinate employees in terms of their level of knowledge, skills, and interest in acquiring new knowledge by means of various methods and forms of education. The most frequent assessments of staff knowledge and skills were above average. For a better overview, the statistical file is characterized through the selected computational statistics (modus and median) in Table 6. We have chosen two statistical functions, namely modus and median with regard to the type of statistical survey.

As can be seen from the results of descriptive statistics most often via the modus, in team learning, training is provided 1–4 hours monthly. The median, which divides the set into two equal parts, is the range of team learning from five to eight hours in a month. The share of creative employee action resulting from team employee training is most often between 1–10% for the improvement of procedures, processes, and systems, the improvement of work quality and continuous improvement, which ensued from the calculation of modus and median.

Assessment of knowledge and skills, where information and knowledge sharing are evaluated, is rated as above average, in both cases after calculating the modus as well as the median. In the framework of processing results and their analysis, we also tested the hypotheses defined in paragraph 2.

Table 6. Selected tools of descriptive statistics

Variables analysed	Statistical tools/instruments			
	Modus		Median	
	Designation for needs of statistical processing	Meaning of designation	Designation for needs of statistical processing	Meaning of designation
Team learning (action learning – AL)	1	1 – 4 h.	2	5–8 h.
Creative action (CA)	1	1–10%	1	1–10%
Assessment of knowledge and skills (AKS)	4	Above the average	4	Above the average

Source: results of empirical research (h. = hours)

One of our goals was to ascertain if the size of the business predicts the time spent on team training. Our next intention was to ascertain whether the creative action of employees depends on the size of the business, and whether there exists the relationship between corporate entities' size and employee performance, and whether there is a relation between the size of the enterprise and the assessment of knowledge and skills (hypotheses 1 – 3).

Table 7 Analysis of correlation dependencies – to establish the existence of the relation between enterprise size and selected dependent variables (Spearman's correlation coefficient)

Variable	Enterprise size (SoE)	
	Spearman's Corr. Coeff	Sig. (2-tailed)
Team learning (AL)	- 0,599	0,000
Creative action (CA)	- 0,529	0,000
Assessment of knowledge and skills (AKS)	- 0,118	0,046

Source: results of empirical research (IE – independent variable, dependent variables).

Based on the calculation of the correlation coefficients, it can be stated that team training (AL), creative action (CA) and assessment of knowledge and skills depend on the size of the enterprise (given the value of Sig. 2-tailed). The calculated correlation coefficient is evaluated according to the following rule: We considered the values achieved from (0.8 to 1) or (-0.8 to -1) to indicate strong dependence, from (0.3 to 0.8) or (-0.3 to -0.8) it is moderate dependence and the value from (0 to 0.3) or (-0.3 to 0) indicates a weak dependency. Based on the results, it can be stated that in team training and in the case of creative action, correlation dependency can be considered moderate. When evaluating knowledge and skills (AKS)  $\delta = 0.046$  and  $r = -1.118$  in view of the size of corporate entity, the correlation dependency is very low.

Next, we will only deal with statistically significant relationships, i.e. those where based on the calculation of the correlation coefficient, there exists dependency, while  $\delta = <0.05$ . In our case, this holds for all the three variables.

When testing hypotheses, we proceed from the Levene test, where in the case of significance  $>0.05$  we apply the ANOVA parametric test, and if the significance is  $<0.05$ , we apply the KRUSKAL – WALLIS nonparametric test.

Table 8. Differences in time spent on team education while considering the enterprise size

Test of Homogeneity of variances

	Levene Statistic	df1	df2	Significance
Team Learn (AL)	2.59	2	284	0.08

Note: Significance is  $> 0.05$ ; for further verification of Hypothesis 2, we apply ANOVA test.

ANOVA

		Sum of Squares	df	Mean Square	F	Significance
Team	Between Groups	214.84	2	107.42	77.61	0.00
Learn (AL)	Within Groups	393.10	284	1.38		
	TOTAL	607.94	286			

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Based on ANOVA test under 0.00 significance, it is possible to corroborate an alternative hypothesis:

H<sub>1</sub> = Small, medium-sized and large corporate entities (SoE) differ in the time needed for the education of teams (AL).

Table 9. Differences in the opinion of creative employee behaviors, while considering the size of enterprise

Test of Homogeneity of variances

	Levene Statistic	df1	df2	Significance
Creative behaviors (CB)	10.77	2	284	0.00

Note: Under the given significance, we have to apply the Kruskal – Wallis nonparametric test.

Kruskal–Wallis Test

Ranks			
	VP	N	Mean Rank
(CA)	1	112	191.72
	2	88	137.23
	3	87	89.42
	Total	287	
Test Statistics <sup>a,b</sup>			
	CA		
Chi-Square	80.062		
Df	2		
Asymp. Sig.	0.000		

Note: a. Kruskal Wallis Test; b. Grouping Variable: SoE

By means of calculation, we ascertained that Asymp. Sig. = 0.00. It can be stated therefore, that enterprises by size differ in the assessment of the employee creative action. Consequently, we accept an alternative hypothesis: H<sub>1</sub> = Small, medium-sized and large enterprises (SoE) differ in their opinions of creative employee behaviors (CA).

Table 10. Differences in opinions of the evaluation of employee knowledge and skills while considering the size of enterprise

Test of homogeneity of variances

	Levene Statistic	df1	df2	Significance
AKS	15.97	2	284	0.00

In the case of the significance = 0.00, we have to apply the Kruskal – Wallis nonparametric test:

Kruskal – Wallis Test

Ranks			
	SoE	N	MeanRank
AKS	1	112	158.05
	2	88	132.52
	3	87	137.52
	Total	287	

Test Statistics a, b

AKS	
Chi-Square	6.051
Df	2
Asymp. Sig.	0.049

Note: a. Kruskal Wallis Test b. Grouping Variable: SoE

Asymp. Sig. = 0.049, fulfils the condition Asymp. Sigma < 0.05, i.e., businesses differ in the assessment of the knowledge and skills of their employees. In the case of hypothesis 5, we accept an alternative hypothesis:

H<sub>1</sub> = Small, medium and large enterprises (SoE) differ in the assessment of knowledge and skills (AKS) of their employees.



Table 11. Influence of team learning on creative action

	Creative action	
	Spearman's Corr. Coef	Sig. (2-tailed)
AL	0.890	0.000

Source: results of empirical research

The creative employee action is very strongly dependent on team training time, *i.e.* action learning, which directly supports the proposals for improving the quality of procedures, processes, innovation of products, services improvement. It leads to an increase in the quality, and finally to generating new knowledge through regulation and integration of knowledge ( $r = 0.890$ ;  $\delta = 0,000$ ).

Table 12. Regression analysis of the influence of team learning on creative action

Coefficients<sup>a</sup>

MODEL	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	-0.052	0,076		-0.693	0.489
Team training/learning (AL)	0.803	0.032	0.911	24.992	0.000

Note: a. Dependent Variable: Creative action

Our intention was to ascertain whether creative employee action was dependent on team learning (action learning). Our calculated equation is:  $CA = -0.052 + 0.803 \times AL$ . Creative action is proportionate to the training of teams (AL). Creative action considerably depends on the implementation of team learning in individual organizations according to the equation:  $CA = 0.803 \times AL$ . If we increase the time spent on team learning by one unit, creative behaviors of employees will increase 0.803 times. On the basis of the analysis, we accept the hypothesis:

*H1 = Creative employee behaviors depend on the time dedicated to team learning (AL).*

Table 13. Dependency of the assessment of knowledge and skills and team learning

Team learning (AL)	Assessment of knowledge skills	
	Spearman's Corr. Coeff.	Sig. (2-tailed)
	0.367	0.000

Source: results of empirical research

Based on the calculated correlation coefficient, the assessment of knowledge and skills is in moderate correlation dependency with team learning ( $r = 0.367$ ,  $\delta = 0.000$ ). This dependency will be further characterized by means of regression analysis.

Table 14. Regression analysis of the influence of team learning on the assessment of knowledge and skills

Coefficients <sup>a</sup>					
Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Constant	3.024	.098		30.775	0.000
TeTTeam learning (AL)	0.062	.042	.104	1.480	0.140

Note: a. Dependent Variable: AKS

Based on the results of empirical research, we intended to find out whether the Assessment of Knowledge and Skills (AKS) depends or does not depend on the time of team education and training (AL). For this purpose, hypothesis 5 was formulated. Based on the calculations, the equation can be written as follows:

$$AKS = 3.024 + 0.062 \times AL \tag{1}$$

In the case of team education and training, sigma is high ( $\delta = 0.140$ ), which means that team training is not statistically significant to the dependent variable. To increase knowledge and skills has to be secured by means of education oriented to training of individuals.

In order to cover the maximum content of learning in the minimum possible time, various methods are used, which act as a dynamics factor of the entire process of education. The acquisition of the content of learning is most effective if active methods of education are used. Needs for dealing with current job-related problems

together with looking for new ways of development lead to the need for the implementation of team education and training.

## Conclusion

Development of opinions of education is closely related to social conditions and development of society. Knowledge society is characteristic of its members' persuasion about the need for a societal character of knowledge, its expansion, innovation, and integration. The work with data is based on the application of access to information made available in enterprises by various types of information systems. Interest in sharing knowledge and using advantages ensuing from it for society, organizations and individuals is supported in organizations by means of various dialog methods and methods of complex problem solving, which are also viewed as methods of education. Results of our empirical research corroborate the importance of team education and training for developing employee creative action and creative behaviors.

The identification of knowledge, acquisition of knowledge, development of knowledge, its transfer and collection are subject to various barriers, including for instance:

- lack of knowledge necessary for the development of knowledge management;
- low interest in real professionals; low standard of information technology;
- lack of clarity in intentions and philosophy of the subject;
- absence of an appropriate corporate culture;
- low level of knowledge exchange in corporate teams;
- unsystematic access to knowledge; inadequate support for creative processes;
- insufficient attention to implicit knowledge;
- low willingness of partners to cooperate; and the use of seniors' knowledge, etc.

Creating knowledge, the building of knowledge databases, and possibly evaluating employee benefits require interest, motivation, and absorption capacity.

In order to create a suitable environment for the creation, dissemination and application of knowledge, various practices are used, most often including:

1. *Joint working team*, which associates co-workers; it constitutes one unit or investigators of one task who have good working and personal relationships;
2. *A network of co-workers* is made up of a freely grouped staff linked by common interests, objectives, approaches, and expert authority;
3. *Alliance of organizations*, which represents connections across the organization and creates a communication channel for people associated with a common interest area. It is usually an informal conversation (e.g. at various conferences or seminars), which enables the transfer of tacit knowledge.

The research has confirmed that creative employee action depends on team training ( $r=0.890$ ;  $\delta=0.000$ ). Thus, it is necessary to support the manifestations of action learning of employees related to the creation, innovation and integration of knowledge in the corporate entity. Based on respondents' replies, it may be stated, that the requirements placed on employees' rest mainly on preciseness, consequential approach, and experience in performing work obligations while creativity is some kind of bonus beyond these requirements. High employee creativity is required only in some job positions. Employee creativity is developed via employee participation in dealing with projects and creating project teams. Current problems are often dealt with by means of the brainstorming method. Based on research results, it can be stated that apart from brainstorming, also methods similar to the Gordon Method and synectic method are applied. The assessment of employee knowledge and skills, according to research results, does not depend on team education. Experience and respondents' replies indicate that the crucial role here is performed by individual education of employees, which focuses on the elimination of particular shortcomings in knowledge and skills. However, creating conditions for team education has a favorable influence on the development of corporate knowledge, which affects the entire process of improvement, and that in turn opens for enterprises paths to succeed on the market.

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## The Effect of Technological Progress on Economic Growth in Thailand According to New Growth Theory

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### Abstract:

This paper aims to analyze the effect of research and development expenditure and foreign direct investment (domestic and international technological transfer, respectively), on economic growth in Thailand by measuring the total factor productivity (TFP) from 1986–2016. The findings indicate that research and development expenditure and foreign direct investment, have a long-run relationship with economic growth measured by TFP. At the same time, when independent variables experience shock, TFP deviates from the equilibrium path. The results of the error correction model (ECM) show that TFP returns to equilibrium in the next five periods approximately. Moreover, growth rate is applied to measure the effect of the relationship between research and development expenditure and foreign direct investment on economic growth. The least squares estimator (LSE) is used to identify the relationship since the growth is stationary at level. The results show the different effects of research and development expenditure and foreign direct investment on the TFP of Thailand.

**Keywords:** R&D expenditure; foreign direct investment; technological progress; total factor productivity; Thailand

**JEL Classification:** C32; F21; O11; O19; O32

### Introduction

Technological improvement is one of the plausible reasons for structural change and might affect economic growth in the long term. Blakemore and Herrendorf (2009) stated that innovation is found to be the most important factor in new economic generation, increasing overall productivity. Innovation is the result of the technological progress obtained by the accumulation of knowledge from the research and development process (Hanel 2000) that can increase a country's TFP. However, other sources contribute to the level of technological development, generating new innovations to transfer knowledge from a high technology country through foreign direct investment. The OECD (2002) found that innovation in host countries is developed by foreign direct investment inflow through various channels such as knowledge spillover, capital goods, and increased human capital. Therefore, this study examines the two sources of funding for technological progress in Thailand. The first is the domestic channel, explained by research and development expenditure, and the second is the international channel, in the form of foreign direct investment. Ascertaining the effect of research and development expenditure and foreign direct investment on the country's technological improvement can clarify the dominant sources for increasing its TFP.

### 1. Literature review

Technology is considered the key to economic growth. Schumpeter (1934) stated that technological progress through innovation is very important for growth, which accords with the findings of neoclassical economists. Solow (1956) accepted that technology plays a role in the production function; it is constrained as an exogenous variable. New growth theory or endogenous growth theory is one of the first attempts at explaining the role of

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technology in economic growth. Details concerning the role of technological progress on economic growth are shown in a great deal of literature; for example, Romer (1986), Lucas (1988), and Aghion and Howitt (1992). Romer focused on the externality effect, while Lucas believed human capital could be the core factor determining economic growth. Aghion and Howitt explain new growth theory using the quality of goods.

As the key to economic growth, technological progress is worth examining the source of its progression. Qin and Du (2017) stated that technological progress could be transferred from both external and internal sources. External sources relate to the knowledge transferred from other countries, where technological levels are higher, through foreign direct investment. Internal sources of technological progress involve the stock of knowledge accumulated from research and development activities.

Research and development is very important for technological progress since it assists in the distribution of benefits through the production process, including a more effective operating system, and better quality capital stock and intermediate goods. Therefore, the role of research and development expenditure on TFP has been mentioned in many studies. Satisfactory econometric results from Hanel (2000) were reported on the relationship between TFP and expenditure on research and development through both interindustry and international technological spillover. In this study, the international effect comes from intermediate foreign goods and capital equipment, including foreign direct investment. The results show a positive relationship between research and development expenditure and TFP. In particular, the interindustry spillover effect plays a bigger role than domestic research and development expenditure. International spillover also has a positive relationship with TFP but to a lesser extent than interindustry spillover.

Many studies also confirm the findings of Hanel (2000), such as Blanco, Prieger and Gu (2015), Bozkurt (2015) and Mladenovic, Cvetanovic, and Mladenovic (2016). Blanco, Prieger and Gu reached the conclusion that research and development expenditure has a statistically positive relationship with economic growth through the positive external channel of technological progress. Bozkurt, who collected data from a great deal of literature, concluded that research and development expenditure plays a considerable role in economic growth, especially in developed countries. S. Mladenovic, Cvetanovic, and I. Mladenovic also found a quantitative relationship between research and development expenditure and economic growth in 28 European countries. The results of their study indicate that if research and development expenditure increases by 1%, economic growth will increase by 2.2%.

Alternatively, technological progress can come from countries with high or low technology through intentional trade and foreign direct investment. The OECD (2002) reported that foreign direct investment is one of the most important causes of economic growth. The relationship between foreign direct investment and economic growth has been described in many research articles. Kohpaiboon (2003) studied the effect of trade policy on economic growth in Thailand — influenced by the findings of Bhagwati (1973).

Bhagwati (1973) explained the theory behind a strict or relaxed trade regime, benefiting countries receiving foreign direct investment. After testing his theory, he concluded that countries with an export promotion regime tend to benefit from foreign direct investment. On the contrary, countries with an import promotion regime are likely to receive little or negative benefit from foreign direct investment (Bhagwati 1978).

The model by Kohpaiboon (2003) uses new growth theory with technology as the endogenous variable, explained by the value of foreign direct investment and the policy regime. The results indicate that a foreign trade regime significantly affects the value of foreign direct investment, clearly supporting Bhagwati's hypothesis. Moreover, Kohpaiboon (2003) finally concludes that Thailand should have an export promotion regime rather than one focusing on imports.

Foreign direct investment can affect the technological level through international technological spillover transmission, which is also the initial cause of domestic interindustry spillover. Kohpaiboon (2005) studied the relationship between foreign trade regimes and technology spillover, focusing on a cross-country analysis of the Thai manufacturing sector. The objective of his study was to establish the role of technology spillover on TFP in the manufacturing sector, receiving similar results to Hanel (2000). Kohpaiboon (2005) believes that foreign direct investment not only increases capital stock but also helps the receiving country to increase its technology. The results of his study indicate that Thailand has a very high proportion of foreign direct investment compared to output, especially in the manufacturing sector where it is approximately 50%. According to Bhagwati's hypothesis, foreign direct investment is affected by the openness of a foreign trade regime.

A review of the relevant literature provides a clear understanding of the various theories relating to growth, especially new growth theory that focuses on the role of domestic and international technological transfer. To identify the effect of research and development expenditure and foreign direct investment on TFP, a model



representing the relationship among studied variables is developed in the methodology section. Lastly, the empirical results explain the relationship of the studied variables, confirmed by econometric statistics.

## 2. Methodology

The model used in this study is developed from the concept of Hanel (2000) by adopting more independent variables as external sources of technological progress through foreign direct investment. Moreover, the previous period effect of independent variables is assumed to affect the country's production productivity, represented by TFP.

When studying the effect of technological progress on economic growth it is important to consider what it actually means. In a previous study, the Solow model defined technological progress as an exogenous variable but in a real situation, it can be developed by many factors. Huňady and Orviská (2014) concluded that technological progress is the accumulation of knowledge provided by the research and development process. Therefore, research and development expenditure can be a proxy for technological progress.

Assume the Cobb-Douglas production function is represented by equation (1):

$$Q_t = A_t F_t \quad (1)$$

where:  $Q$  is the output, determined by input and the technological level;  $A_t$  is the technological progress, which has a positive relationship with output;  $F$  is the input used in the production process to receive output. Input generally has a positive relationship to output. Input consists of labor, capital, and intermediate goods.

Technological progress results from the accumulation of knowledge, which can be written in relation to equation (2):

$$A_t = \phi K_t^\gamma e^{\lambda t} \quad (2)$$

where:  $\phi$  is a parameter,  $K_t$  is the knowledge accumulation at time  $t$ , and the transmission of technological progress through the research and development process, creating technological progress;  $\lambda$  represents the rate of change in technology, in other words, = the extent of the technological effect.

However, the literature review reveals a lagged effect from the technological factors, based on the studies by De Loo and Soete (1999) and Aghion, Boustan, Hoxby, and Vandenbussche (2009). Therefore, equation (2) can be modified by allowing both the current and last period research and development expenditure into the equation. Equation (2) is replaced by equation (3).

$$A_t = \phi e^{\lambda t} \prod_{i=0}^T K_{t-i}^\gamma \quad (3)$$

A great deal of literature supports that advanced technology can be transferred from developed countries through foreign direct investment. Choe (2003) found causality between foreign direct investment and economic growth. These results accord with those of Nair-Reichert and Weinhold (2001) and Shaikh (2010).

Technology can be transferred from a country with a high technology level to one lower through the flow of foreign direct investment (Kohpaiboon 2003). New innovations provide technological progress through the process of learning by doing, and by the transmission of higher technology from developed countries. This represents technology transmission through the flow of foreign direct investment. Therefore, foreign direct investment can also be a proxy for technological progress. The foreign direct investment variable determines technological progress, so equation (3) can be replaced by equation (4).

$$A_t = \phi e^{\lambda t} \prod_{i=0}^T K_{t-i}^\gamma FDI_{t-i}^\alpha \quad (4)$$

Equation (4) shows the relationship between research and development expenditure and foreign direct investment on technological progress. The input factor can be written as the proportion of all input used to produce output, as shown in equation (5)

$$F_t = \pi X_{mt}^{cm} \quad (5)$$



where:  $F_t$  is the function of all inputs used in the production process;  $\pi$  is a parameter;  $X_{mt}$  are inputs, consisting of labor, capital, and all intermediate goods;  $\sum \alpha_m = 1$  from the assumption of constant returns to scale.

Let (4) and (5) into (1), as shown by the results in equation (6). Substituting equations (4) and (5) into equation (1) shows the effect of both the research and development expenditure and foreign direct investment on TFP. This relationship is shown in equation (6):

$$Q_t = \phi e^{\lambda t} \left( \prod_{i=0}^T K_{t-i}^{\gamma_i} FDI_{t-i}^{\theta_i} \right) \pi X_{mt}^{\alpha_m} \tag{6}$$

In equation (6), output depends on research and development expenditure ( $K_t$ ), extent of the technological effect ( $e^{\lambda t}$ ), and input ( $X_{mt}^{\alpha_m}$ ). Take the natural logarithm in equation (6) to adjust it into linear form (linearization) as shown in equation (7):

$$\ln Q_t = \ln \phi + \lambda t \ln e + \sum_{i=0}^T \gamma_{t-i} \ln K_{t-i} + \sum_{i=0}^T \theta_{t-i} \ln FDI_{t-i} + \ln \pi + \alpha_m \ln X_{mt} \tag{7}$$

$$\text{And; } \alpha_m = \sum_{m=1}^M \alpha_m = 1, \ln\left(\frac{Q_t}{X_t}\right) \equiv \ln(TFP)$$

$$\ln\left(\frac{Q_t}{X_t}\right) = \ln \phi + \lambda t \ln e + \ln \pi + \sum_{i=0}^T \gamma_{t-i} \ln K_{t-i} + \sum_{i=0}^T \theta_{t-i} \ln FDI_{t-i} \tag{8}$$

$$\ln(TFP_t) = (\ln \phi + \ln \pi + \lambda t) + \sum_{i=0}^T \gamma_{t-i} \ln K_{t-i} + \sum_{i=0}^T \theta_{t-i} \ln FDI_{t-i} \tag{9}$$

Assume  $(\ln \phi + \ln \pi + \lambda t) = \rho$ , Operate total derivative

$$\frac{dTFP_t}{TFP_t} = \frac{d\rho}{\rho} + \sum_{i=0}^T \gamma_{t-i} \frac{dK_{t-i}}{K_{t-i}} + \sum_{i=0}^T \theta_{t-i} \frac{dFDI_{t-i}}{FDI_{t-i}} \tag{10}$$

where:  $\gamma = \frac{dQ}{dK} \frac{K}{Q}$ ,  $\theta = \frac{dQ}{dFDI} \frac{FDI}{Q}$  because  $\gamma, \theta$  is the power of research and development expenditure in the production function. From the Cobb-Douglas production function, the strength of the variable lies in its elasticity to output. Substitute  $\gamma = \frac{dQ}{dK} \frac{K}{Q}$ ,  $\theta = \frac{dQ}{dFDI} \frac{FDI}{Q}$  into equation (10), to represent the relationship of TFP as equation (11).

$$\frac{dTFP_t}{TFP_t} = \frac{d\rho}{\rho} + \sum_{i=0}^T MP_{K_{t-i}} \frac{dK_{t-i}}{K_{t-i}} + \sum_{i=0}^T MP_{FDI_{t-i}} \frac{dFDI_{t-i}}{FDI_{t-i}} \tag{11}$$

Equation (11) represents the effect of both the current and last period of research and development expenditure and foreign direct investment on TFP and is used to test the relationship of the studied variables shown in the empirical results section.

### 3. Empirical results

Table 1 shows the stationarity of variables used in this study, covering the period from 1986–2016 using the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests. The unit root test results confirm that the three variables of TFP, research and development expenditure, and foreign direct investment, are stationary at level I(0) when in growth rate form, but in log form they are stationary after being converted into first difference I(1).

Table 1. Results of ADF and KPSS tests

Variables	Augmented Dickey-Fuller (ADF)		Kwiatkowski-Phillips-Schmidt-Shin (KPSS)	
	Level	First difference	Level	First difference
ln TFP	0.1965	-3.4326***	0.4114	0.2859***
ln RD	1.322	-4.0859***	0.6362	0.29***
ln FDI	-1.584	-8.7939***	0.5219	0.3394***
GTFP	-3.4493***	-	0.2929***	-
GRD	-3.8191***	-	0.2886***	-
GFDI	-6.5128***	-	0.1189***	-

Note: \*\*\*significant at 1% level

Equation 9 implies a relationship among TFP, research and development expenditure, and foreign direct investment. After the stationarity of all variables is confirmed at first difference, the Johansen cointegration test is used to verify the occurrence of long-run equilibrium. Akaike's information criterion (AIC) was employed for lag length, indicating that five lags are optimal in this model. Table 2 shows the integrated vectors used to set up the long-run relationship model among TFP, research and development expenditure, and foreign direct investment. The trace statistic at  $r \leq 2$  is 16.06 more than the critical value of 9.16 so the null hypothesis, which indicates that there are at least two cointegrating vectors, is rejected and the alternative hypothesis of three cointegrating vectors is accepted. Therefore, one cointegrating vector is chosen to explain the effect of research and development expenditure and foreign direct investment on TFP, which is shown in normalized form in Table 2.

Table 2. Results of the Johansen test for cointegration

Trend: Constant			Number of obs. = 28	
Sample: 1989–2016			Lag = 5	
H0	H1	Eigenvalue	Trace Statistic	5% Critical Value
$r = 0$	$r = 1$	0.987977	177.2953	35.19275
$r \leq 1$	$r = 2$	0.945424	80.03499	20.26184
$r \leq 2$	$r = 3$	0.517994	16.05556**	9.164546
Normalized cointegrating equation: $\ln TFP = 3.72675 + 0.11826 \ln RD + 0.022964 \ln FDI$				

Note: \*\*significant at 5% level

After the selected cointegrating vector to generate the model is run using the LSE to generate the error term, the next step is to use the estimated error term in the Error Correction Model (ECM). After the confirmation that long-run equilibrium exists, although in the short run there may be shocks to the independent variables (causing the TFP to deviate from the equilibrium path), an ECM estimates the speed of adjustment at which the dependent variable returns to equilibrium after the shock to independent variables. In this study, the ECM estimates the speed of adjustment in the TFP of Thailand as a result of the changes in research and development expenditure and foreign direct investment. The ECM can be specified as follows:

$$\Delta TFP = \beta_0 + \beta_1 \Delta RD + \beta_2 \Delta FDI + \beta_3 U(-1) \quad (12)$$

Table 3. Error correction model for total productivity (lnTFP)

$\Delta \ln TFP$	Coef.	Std.Err	T	P
$\Delta \ln RD$	-0.028826	0.047821	-0.602788	0.5525
$\Delta \ln FDI$	0.004027	0.008423	0.478147	0.6371
$\Delta U(-1)$	-0.202319	0.075094	-2.694217	0.0129**
CONS	-0.113	0.045312	-2.493796	0.0203
R-squared	0.24046		Adjusted R-squared	0.14139
Prob (F-statistic)	0.091337		Durbin-Watson stat	1.267356

Note: \*\* significant at 5% level

The ECM model estimates from equation (12) are shown in Table 3. The short-run coefficients at first difference for research and development expenditure and foreign direct investment were -0.288 and 0.004, respectively but the p-value of both variables was greater than 0.05, and therefore, the coefficients for  $\Delta \ln RD$  and  $\Delta \ln FDI$  were not statistically significant. The coefficient of the error term was statistically significant at 0.05 of -0.2023, implying a correction in the previous disequilibrium period when the occurrence of positive or negative

shocks was adjusted by 20.23% annually. In other words, when shocks occur to independent variables the dependent variable converts to the equilibrium path in 4.94 periods of time.

Alternatively, equation 9 can be transformed to equation (11), representing the effect of growth in research and development expenditure and foreign direct investment on TFP. All growth variables were tested for stationarity, as shown in Table 1, and were found to be stationary at level. Therefore, equation (9) can be estimated using the LSE without spurious problems. The results of the LSE estimation are shown in Table 4.

Table 4. Regression results when TFP growth is the dependent variable

GTFP	Coef.	Std.Err	T	P
GRD(-1)	0.101609	0.04185	2.427964	0.0259**
GFDI(-4)	0.018633	0.006458	2.88551	0.0098***
GFDI(-5)	0.041463	0.014178	2.924363	0.0091***
CONS	-1.470213	0.845535	-1.738797	0.0991*
R-squared		0.454281	Adjusted R-squared	0.363328
Prob (F-statistic)		0.010779	Durbin-Watson stat	1.861273

Note: \* significant at 10% level; \*\* significant at 5% level; \*\*\* significant at 1% level

Table 4 shows the results of the estimated growth in research and development expenditure and foreign direct investment in relation to TFP. The last period of growth in research and development expenditure has a positive relationship to TFP, indicating that a 1% increase in research and development expenditure causes a 0.102% increase in TFP. Other periods of research and development are not statistically significant. The coefficient for foreign direct investment in the prior periods 4 and 5 are 0.019 and 0.041, respectively and statistically significant at 01.

## Conclusion

The literature review implies that both research and development expenditure and foreign direct investment are important to economic growth when measured by TFP. In developed countries with high technology, the research and development process dominates foreign direct investment in terms of the sources of technological development. However, in developing countries, the results of technological progress are ambiguous because they have the potential to perform their own research and development process, while at the same time, foreign direct investment provides a shortcut for transferring knowledge from high technology countries.

This study shows the satisfactory econometric results of the effect of research and development expenditure and foreign direct investment on economic growth by measuring TFP. The research and development expenditure has no instant effect on the TFP of Thailand, but it takes a year to benefit from the results of the research and development process. On the other hand, foreign direct investment takes longer to affect TFP because foreign direct investment represents an inflow of capital stock for starting new businesses. The first year of foreign direct investment requires the establishment of capital. Output is only likely to start in the second year, so the transfer of knowledge from foreign direct investment should start in the third year, affecting the technological level during the fourth year. Moreover, the effect of research and development is greater than that of foreign direct investment. Therefore, the results of this study can be broadened to identify the source of technological progress affecting economic growth in other developing countries to confirm the predominant sources; the research and development process or foreign direct investment.

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## The Effect of Firm's Size and Leverage on Profitability: A Panel Data Approach

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### Abstract:

The purpose of this study is to investigate the effect of firm's size and leverage on the profitability of publicly listed firms adopting IFRS. A Panel data fixed-effects regression model is employed to estimate the relationship between firm size and leverage on profitability, while controlling also for the effects of other variables as asset turnover and liquidity. The study is based on a sample of 94 firms from Malaysia over the period from 2012 to 2016. The study is applied to the industrial sector. The study concluded that firm size is positively and significantly related to profitability. However, leverage is negatively and significantly related to profitability. This study contributes to the literature by using data from a developing country. It provides an important insight on the international debate on the effects of firm size and leverage on decision-making.

**Keywords:** developing countries; size; leverage; profitability

**JEL Classification:** M41; M48

### Introduction

The main goal of any firm is to maximize its success through its performance that is measured by its profitability. Accordingly, analyzing the determinants of firm profitability has been regarded as an important research theme by researchers in various fields such as economics, strategic management, marketing, accounting and finance (Ayuningrat *et al.* 2016, Gaur and Gupta 2011, Jónsson 2007, Kinata 2016, Matejun 2017, Nunes *et al.* 2009, Shin and Seo 2017, Wasike 2017, Yoo *et al.* 2016). In turn, it is the response variable in this study. Previous empirical studies show a plausible but mixed relationship between firm size, leverage, and profitability (Hoai and Thanwadee 2015, Liargovas and Skandalis 2010, Sundar and Al Harthi 2015). Hence, the outcomes are uncertain and entail more empirical research to settle the conflicting findings. In this way, the objectives of this study are twofold. The first objective is to empirically examine the connection between firm size and profitability. The second is to empirically investigate the connection between firm leverage and profitability.

The findings of this study signify that economies of scale have a major role in the industrial zone. This implies that large firms have better ability to face competition, control prices and cope with market changes, which may contribute to the positive relationship between size and performance. Additionally, the results indicate that leverage is negatively related to firm profitability. This result also supports the pecking order theory, where firms that create high earnings are anticipated to employ a smaller amount of debt capital than those that create low earnings. This research has potential policy implications. It helps managers to be able to take right decisions regarding their financing choice and strategies considered for improving firm performance.

### 1. Literature review and hypotheses development

There are numerous theories developed trying to explain why firms exist and the reason for the differences in their organization and performance. Some of which are the trade-off theory, the pecking order theory and the economies of scale. The static trade-off theory derived by Modigliani and Miller (2006) suppose that there are most favorable capital structures by performing a trade-off between the costs and benefits of debt and equity. However, other studies have shifted from the trade-off theory to pecking order theory (Durand and Coeurderoy 2001, Karim *et al.* 2017). The trade-off approach involves a fixed technique to financing decisions according to a target capital structure, while pecking order theory permits the operation of the firm to set the best capital structure for a particular firm at whichever specific instance.



According to the pecking order theory, firms select capitals consistent with the subsequent order: internal finance, debt, and equity. In turn, the pecking order theory proposes that a firm ought to favor to finance itself primarily internally via retained earnings. If this means of financing is unavailable, the firm ought to then consider financing itself using debt. If this is not feasible, as a last option, the firm should consider financing itself by issuing new equity. This pecking order is essential because it indicates to the public how the firm is operating. If the firm finances itself from within, it means it is strong. If the firm finances itself via debt, it is an indication that management is sure the firm can cover its debt. If the firm finances itself by issuing new stock, this is generally a negative sign. Hence, successful firms are not required to depend heavily on outside funding. Some practical proof supports this argument and is consistent with the pecking order theory (Mudambi and Nicosia 1998). The pecking order theory has been maintained via numerous scholarly literatures. (Tzelepis and Skuras 2004)

Economies of scale describe a competitive advantage that large firms have over smaller ones. It argues that firm size is related to profitability as large firms have greater strategic diversification, a better chance of renegotiating with customers and suppliers, greater capability to face competition, and keeping prices higher than the competitive point. Relevant with this idea, a positive association between firm size and profitability is predicted (García Padrón *et al.* 2005).

## 2. Firm size and profitability

The firm size is a key element in verifying the profitability according to the notion of economies of scale. This concept proposes items or services can be provided with lower costs by bigger firms. Thus, a positive relationship between firm size and profitability is expected. Amato and Wilder (1985) conclude that it is possible to maintain a positive association between firm size and profitability, but at a particular size, then this relationship might turn negative. With respect to Glancey (1998) when bigger firms consider the economies of scale, a positive association is anticipated between profitability and size of the firm.

Different research studies suggest different relationships between firm size and profitability ranging from those in favor of a positive association to those not. Conflicting empirical outcomes may be due to different time horizons, indicators, used samples, industry groups, and business environment. Some researchers found that firm size has a positive relationship with firm profitability (Doğan 2013, Gleason *et al.* 2000, Isada and Isada 2017, Lee 2009, Papadogonas 2006, Saliha and Abdessatar 2011, Shubita and Alsawalhah 2012, Sritharan 2007, Zeitun and Gang Tian 2015). Babalola (2013), employing a sample of registered manufacturing firms in Nigeria, investigates the effect of firm size on the profitability using a panel data set. Profitability was calculated using ROA, whereas both total assets and total sales were utilized as substitutes of firm size. Outcomes reveal that firm size, represented as total assets and total sales, has a positive effect on the profitability. Similarly, Al-Jafari and Al Samman (2015) find a positive significant relationship between profitability and firm size on a sample of 17 listed manufacturing firms in Oman using ordinary least square model. The authors conclude that big on the rise firms with resourcefully managed assets increase revenue and eventually boost profitability.

Inyama and Victoria (2014) investigate the importance and nature of the relations involving firm size and financial performance in all the firms in the Nigerian brewery industry for the period 2000-2013. The degree that Earnings Per Share (EPS) is influenced by the intensity of fixed assets is assessed. The Engle and Granger 2-step co-integration approach was adopted. Findings show that firm size has short-term and long-term positive effects on EPS. There is no causality running from either EPS to total assets or otherwise at both stages. For a sample of Sri Lankan hotels and travels, Sritharan (2015) examines the influence of firm size on profitability using the fixed effect econometric estimation models. The results reveal that firm size is positively related to profitability. In the agricultural sector in Kenya, the Mule *et al.* (2015) study assesses the effect of firm size on the financial performance during 2003 to 2013 via a pooled ordinary least square approach. Firm size was considered via the total assets whereas the financial performance was calculated by ROA, return on equity (ROE) and EPS. These outcomes specify that firm size had positive and statistical significance on all the three indicators of the financial performance revealing that big firms were discovered to have a competitive advantage to small firms.

On the other hand, a number of studies provided contradictory evidence on the association among firm size and profitability. Opposing theories exist that propose that big firms come under the control of managers seeking goals of personal interest hence managerial value maximization function may replace profit maximization of the firms' goal function. They concluded that the relationship between firm size and profitability is insignificant or negative (Becker-Blease *et al.* 2010, Salawu *et al.* 2012). For example, Pervan and Višić (2012) find that firm size has a weak influence on firm profitability. While in Pakistan, Kouser *et al.* (2012) paper analyzes 70 listed nonfinancial firms using panel data techniques. The outcome demonstrates that firm size has a negative impact on the profitability. Similarly, Kartikasari and Merianti (2016) examine the effect of firm size on its profitability. One



hundred qualified manufacturing firms registered on the Indonesian Stock Exchange in the period of 2009-2014 were analyzed using panel data technique. The result showed that size had a significant negative impact.

Yet other researchers have found an insignificant impact of firm size on firm profitability (Durand and Coeurderoy 2001, Lauterbach and Vaninsky 1999, Mudambi and Nicosia 1998, Niresh and Thirunavukkarasu 2014, Tzelepis and Skuras 2004). For example, Mahmoud Abu-Tapanjeh (2006) provides evidence that an insignificant relationship existed between firm size and profitability. Niresh and Thirunavukkarasu (2014) explore the effects of firm size on the profitability of 15 active manufacturing firms listed on the Colombo Stock Exchange (CSE) during the period 2008 - 2012 in Sri Lanka. In the study ROA represents the firm profitability, Total Assets represent the Net Profit and Total Sales represent the firm size. Correlation and regression techniques have been employed in the empirical investigation. Findings show there is no analytical association involving the firm size and profitability of publicly registered manufacturing firms in Sri Lanka.

### 3. Firm leverage and profitability

Leverage has been defined in various ways. It is defined as the ratio of long-term debt to total long-term capital (Kinata 2016, 304-313). Kouser, Bano and Azeem (2012) describe leverage as the funds provided to business for which it has to bear the fixed cost. However, many studies suggest that leverage carries risk as well. Hurdle (1974) implies that firms with low debt have high market power and lower risk and firms with high debt have low market power and high risk.

According to García Padrón *et al.* (2005), large firms can decrease the level of information asymmetries in the market and acquire financial resources without difficulty. In small firms, managers are liable to be the owners. Owners desire to continue to be in control of their firms as they gain an individual advantage over the financial return on their investment. They are required to go without some development prospects if these prospects are hard to recognize and depend further on debt. The development of small firms is more susceptible to internal finance than that of bigger firms (Cressy and Olofsson 1997). Hussain and Matlay (2007) state that small firms go for external alternatives of funding only if the internal alternatives are not available or not enough. Small firms attempt to satisfy their financial needs by a pecking order of personal and retained earnings, debt and issuance of new equity. The pecking order approach is simply implemented in small firms since small firms borrow as their investment requirements more willingly than trying to realize an optimal capital structure (Daskalakis and Psillaki 2008).

The existing literature gives conflicting evidence on the relationship between leverage and profitability. Some researchers find that leverage has a positive relationship with firm profitability (Baker 1973, Ehi-Oshio *et al.* 2013, Mok *et al.* 2007). In Indonesia, Kartikasari and Merianti (2016) study the impact of firm size and leverage to its profitability. One hundred manufacturing firms registered on the Indonesian Stock Exchange in during 2009-2014 were analyzed using the fixed effect panel data regression model. It was found that leverage had a significant positive impact on profitability whereas size had a significant negative effect. Negasa (2016) investigates the effect of the capital structure on firm profitability of Ethiopian big private manufacturing firms using panel data for five consecutive years. Findings reveal that a significant positive association involving firm profitability and total debt ratio exist indicating the firm capital structure.

On the other hand, other studies have contradicted the pecking order theory and supported the targeted (fixed) debt to equity ratio. For example, Opler and Titman (1994) notice that during the industry downturns the higher the leverage, the higher the probability of losing market share leading to very little operating profits. According to Lang *et al.* (1996), firms having excellent investment opportunities have leverage positively connected to development, but for firms who are not able to overcome the consequences of their debt overhauling or who don't have good growth opportunities leverage is negatively related to development. Noteworthy is the findings of De Jong *et al.* (2011) study that infers in the static trade-off assumption, a firm raises leverage until it achieves its purposed debt ratio, whereas the pecking order gives way to debt issuance awaiting the debt limit to be achieved. Al-Jafari and Al Samman (2015) find a negative association among the financial leverage and profitability in a sample of 17 registered manufacturing firms in Oman using Ordinary Least Squares (OLS) model. In sum, empirical evidence shows mixed results and based on the influence of firm size and leverage on profitability. In addition, up till now, there is no study carried on publicly listed firms adopting IFRS in developing countries. In this paper, we study the impact of firm size and leverage on profitability in Malaysia. Thus, we form the subsequent hypothesis:

H1: A significant relationship exists between firm size and profitability of publicly listed firms adopting IFRS in Malaysia.

H2: A significant relationship exists between financial leverage and profitability of publicly listed firms adopting IFRS in Malaysia.

#### 4. Data and methodology

##### 4.1. Data

This study investigates the effects of firm size and leverage on the profitability of publicly listed industrial firms adopting IFRS. Data on all study variables were collected from Thompson Reuters Eikon database. The data set contains a total of 470 observations, with  $n=94$  from Malaysia. Malaysia is chosen based on two considerations. The first consideration is its compliance with the IFRS from 2012 to 2016. The second consideration is the rarity of literature that explores the association among firm size and leverage on profitability in Malaysia as a developing country using panel data methodology. Firms were selected on the basis of their audit reports that state their conformity with International Financial Reporting Standards (IFRS) during the period from 2012-2016 and their fiscal year end of December 31<sup>st</sup>.

The objective of this study is to investigate the relationship between firm size, leverage, and performance. However, from the literature, we consider the possibility of other control variables having implications on profitability, namely: asset turnover and liquidity. As a result, this paper consists of five variables; profitability, firm size, leverage, asset turnover and liquidity. The firm size is further operationalized into total assets and market capitalization, so there are six variables in this study. The response variable, profitability, is considered via ROA. It represents the ability of the firm to earn a profit. It was developed by DuPont in 1919 and is considered the most widely used financial models for measuring firm performance. As mentioned earlier, there are two variables used as proxies for the firm size: namely, log natural of total assets (SIZETA) and market capitalization (SIZECMC).

The variables used in this study and their measurements are as follows:

- Profit (ROA) (net profit before taxes / total assets);
- Firm size (SIZETA)(log natural of total assets);
- Firm size (SIZECMC)(log natural of market capitalization);
- Leverage (LEV) (total debt / total equity);
- Asset turnover (TURNOVER) ((Sales / total assets);
- Liquidity (LIQ) (current assets / current liabilities).

Table 1 contains the descriptive statistics of these variables. The mean value for ROA is 0.03 for firms, while size and leverage were having 19.6 and 0.45 respectively. 45% of the firm's capital is financed from debt. It is clear that liquidity has the highest standard deviation of the explanatory variables and therefore has the lowest contribution to the profitability variable.

Table 1. Descriptive statistics

	ROA	SIZETA	SIZECMC	LEV	TURNOVER	LIQ
Mean	0.030654	20.13037	19.64266	0.444659	0.734052	3.790317
Median	0.038458	19.84344	19.37073	0.431373	0.615707	1.733537
Maximum	0.438547	26.14114	25.60404	2.919502	3.813037	460.5273
Minimum	-1.423664	16.17828	16.23810	0.003998	-0.077420	0.015087
Std. Dev.	0.115598	1.814290	1.812611	0.265511	0.615422	18.24555
Observations	470	470	470	470	470	470

##### 4.2. Methodology

This study relies on panel data analysis to permit discrepancies in the type of unnoticed distinct country and firm effects. Panel data combines both time series and cross-sectional techniques. It has a number of advantages over both techniques. These include its ability to provide outcomes that could not be projected by either the cross-section data or the time-series data alone. Precisely, due to a large number of observations that increases degrees of freedom and decreases multi-collinearity problems, this results in improving the effectiveness and efficiency of econometric values (Asimakopoulos *et al.* 2009). Furthermore, its capability to control for heterogeneity in addition to state and time-invariant variables that are not probable with both time series and cross-sectional technique (Baltagi 2008).

This study applies panel fixed-effects regression model. The natural logarithm transformation was used in some variables to improve the regression's fit. To examine the association among response and explanatory variables, this panel data model was projected using log natural of total assets as a proxy for firm size:

$$Y_{it} = \alpha_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \epsilon_{it} \quad (1)$$

where:  $Y_{it}$ =ROA,  $X_1$ =SIZETA,  $X_2$ =LEV,  $X_3$ =TURNOVER,  $X_4$ =LIQ;  $\alpha_0$  = Constant;  $\beta$  = The Coefficient of the variable;  $i$  = firm;  $t$  = time period and  $\epsilon$  = error term.

In addition, another panel data model was estimated using market capitalization as a proxy for firm size:

$$Y_{it} = \alpha_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \epsilon_{it} \quad (2)$$

where:  $Y_{it}$  = ROA,  $\alpha_0$  = Constant,  $\beta$  = The Coefficient of the variable,  $i$  = firm,  $t$  = time period,  $X_1$  = SIZECAC,  $X_2$  = LEV,  $X_3$  = TURNOVER,  $X_4$  = LIQ and  $\epsilon$  = error term.

To determine whether to apply fixed-effects or random-effects regression model, Hausman's test is conducted. While the outcome of the Hausman's investigation shows that the discrepancy in the coefficients among fixed effects and random effects is orderly, fixed effects panel regression is used in this study.

## 5. Empirical results and discussion

Table 2 contains the correlation matrix between study variables. The values were computed using Pearson correlation of two tailed significances. The results indicate that the relationship between ROA and the other variables are statistically significant except for liquidity where the relationship is insignificant. In accordance with the findings, asset turnover and size represented as total assets and market capitalization are positively correlated with ROA at 24.5%, 19.7% and 32.9%, respectively. On the other hand, leverage is negatively correlated with ROA at 37.9%. It is also obvious that the correlation between ROA and size in terms of market capitalization and between ROA and leverage is medium, while the correlation between ROA and size in terms of total assets and between ROA and asset turnover is weak. There is very weak inter-correlation between each pair of the explanatory variables that may constrain any collinearity problem.

Table 2. Correlation Matrix

Probability	ROA	SIZETA	SIZECMC	LEV	TURNOVER	LIQ
ROA	1.000000					
SIZETA	0.197380	1.000000				
	0.0000	-----				
SIZECMC	0.329869	0.885871	1.000000			
	0.0000	0.0000	-----			
LEV	-0.379470	0.333523	0.185334	1.000000		
	0.0000	0.0000	0.0000	-----		
TURNOVER	0.245029	0.064134	0.099743	0.164656	1.000000	
	0.0000	0.0844	0.0072	0.0000	-----	
LIQ	0.034786	-0.089464	-0.050832	-0.187556	-0.086153	1.000000
	0.3496	0.0160	0.1716	0.0000	0.0203	-----

Tables 3 and 4 display the outcome of the fixed-effects panel regression. The results of the fixed effect model reported R-squared and adjusted R-squared values of 0.711654 and 0.637565 respectively in model 1. This indicates that 71% of the variability in profitability is measured by the explanatory variables of leverage, firm size and asset turnover. The recorded R-squared and adjusted R-squared values were lower in model 2 than model 1. This means that total asset is preferred as a proxy for firm size. The results show that size represented as total assets and market capitalization is positively associated to the firm profitability. The variable in model 1 recorded a t-value of 7.029680, a probability value of 0.0000 and a positive coefficient of 0.065921 at 5% level of significance. This result is in line with the results of many developing and developed country studies such as Babalola (2013), Mule *et al.* (2015). It supports the argument that larger firms make use of the economies of scale as size brings bargaining power over the suppliers. Big firms have more market that encourages them to require increasing prices and earn increasing profits (Pervan and Višić 2012).

Table 3. Model 1 Fixed-effects regression estimation results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.225660	0.190943	-6.418988	0.0000
SIZETA	0.065921	0.009377	7.029680	0.0000
LEV	-0.323922	0.019388	-16.70763	0.0000
TURNOVER	0.100398	0.012118	8.285159	0.0000
LIQ	-9.35E-05	0.000165	-0.567685	0.5705
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.711654	Mean dependent var		0.030654
Adjusted R-squared	0.637565	S.D. dependent var		0.115598
S.E. of regression	0.069593	Akaike info criterion		-2.311342
Sum squared resid	2.789656	Schwarz criterion		-1.368805
Log likelihood	986.8614	Hannan-Quinn criter.		-1.947588
F-statistic	9.605387	Durbin-Watson stat		2.061202
Prob(F-statistic)	0.000000			

Firm size may be positively related to borrowing capacity in such a way that potential bankruptcy costs become a smaller part of the value for larger firms that decreased Bankruptcy costs (Sritharan 2015). However, is in contradiction with the empirical findings of Pervan and Višić (2012), Kouser, Bano (2012), Kartikasari and Merianti (2016) who found a negative relationship between firm size and profitability. Other studies found no relationship between size and profitability (Mahmoud Abu-Tapanjeh 2006, Niresh and Thirunavukkarasu 2014). These results indicate that economies of scale may have an essential effect in the industrial zone. Additional explanation adds that large firms have better ability to face competition, control prices and cope with market changes that may contribute to the positive association between size and performance.

Table 4. Model 2 Fixed-effects regression estimation results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.358652	0.108315	-3.311205	0.0010
SIZEMC	0.023644	0.005383	4.392371	0.0000
LEV	-0.313314	0.020051	-15.62597	0.0000
TURNOVER	0.088373	0.012239	7.220645	0.0000
LIQ	-0.000177	0.000169	-1.050967	0.2937
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.697062	Mean dependent var		0.030654
Adjusted R-squared	0.619224	S.D. dependent var		0.115598
S.E. of regression	0.071332	Akaike info criterion		-2.261978
Sum squared resid	2.930820	Schwarz criterion		-1.319440
Log likelihood	968.9670	Hannan-Quinn criter.		-1.898224
F-statistic	8.955284	Durbin-Watson stat		2.168256
Prob(F-statistic)	0.000000			

The results indicate that leverage is negatively associated with firm profitability. The variable in model 1 recorded a t-value of -16.70763, a probability value of 0.0000 and a negative coefficient of 0.323922 at 5% level of significance. This result supports the pecking order hypothesis, where firms that generate high earnings are expected to use less debt capital than those that generate low earnings. In addition, it is in line with the results of many studies such as Al-Jafari and Al Samman (2015). They suggest that profitable firms depend more on equity as their main financing option as the increasing level of debt increase the interest payment and accordingly increase firm risk. Additional perspective on the negative relationship between leverage and profitability may be because of the developing nature of the financial markets of these firms where firms with higher levels of debt are less able to finance projects that may improve profitability due to the cost of pay off the debt periodically. In addition, it is possible that profitable firms prefer to finance their operations rather than reaching out to the external financial markets (Ebel Ezeoha 2008).

At the same time, this study result is inconsistent with the findings of the study of Abor (2005) where a significantly positive association between leverage and profitability is found and this suggests that profitable firms depend more on debt as their main financing option. Mangalam and Govindasamy (2010) discover a significant

positive relation among leverage and Earnings Per Share when the earnings of the firm are more than the fixed financial obligation to be paid for the lenders. Other empirical studies find weak or no relationship between leverage and firm profitability (Murphy Jr 1968, El-Sayed Ebaid 2009). According to the control variables; a positive association through the asset turnover and profitability is found which suggest that the firm profit will increase in parallel with the increase in the effectiveness of management due to increase in asset utilization. Finally, liquidity turned out to be statistically insignificant.

## Conclusion

This paper adds to the current literature in two avenues. First, instead of focusing on only one year, in this paper we study a broad sample of firms that signifies an adequately wide array of firm sizes during the phase between 2012 and 2016. Second, the focus is on the firms complying with IFRS in Malaysia.

The firm's financial performance influences the strength of the countries' capitalist economy. Hence, the determinants of firm profitability deserve more investigation. Lack of studies on firms adopting IFRS in developing countries has motivated this research study. This paper investigates the impact of firm size and firm leverage on the profitability of firms operating in Malaysia and complying with IFRS using fixed effects panel regression. Profitability is measured by ROA, while leverage is calculated using the ratio of total debt to total equity. Liquidity and asset turnover are considered as the control variables. Summarizing the outcomes, it is found that firm size represented, as total assets and market capitalization are positively associated with firm profitability. Further, this paper reveals a negative association among leverage and profitability. As for the control variables; a positive association among the asset turnover and profitability is found which suggest that the firm profit will increase in parallel with the increase in the effectiveness of management due to increase in asset utilization. Finally, liquidity turned out to be statistically insignificant. Several empirical agreements such as Gleason *et al.* (2000), Shubita and Alsawalhah (2012), and disagreements such as Lang *et al.* (1995), Stulz (1988) were observed in the literature review regarding this study.

By using the results concluded from this research, managers will be able to take the right decisions regarding their financing decisions and strategies to improve firm performance. There are certain limitations to this study that may serve as future research directions. Firstly, the study is applied to the industrial firms adopting IFRS. Hence this may serve as a barrier to generalizing the findings of this study to other sectors. Secondly, data for firms adopting IFRS were analyzed. More studies could be adapted to compare firms before and after adopting IFRS. Finally, only the impacts of two independent variables on profitability were studied. However, there are also other variables like cash conversion cycle, industry factor, corporate social performance, operating efficiency and others which also affect the firm profitability could be studied to cast more light on the determinants of profitability. All these limitations discussed above influence the generalization of the results.

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## Econometric Assessment of Factors of Graduate Employability

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### Abstract:

As it is known young people are aimed at fast career growth and intended to consider job as social lift. Employer has not always willing to pay for additional training of young experts. Besides, no social benefits, first of all accommodation, are provided for graduates of the university who has found a job in its degree field. Almost all of the universities in Kazakhstan have met with similar problems in the sector of employment of graduates. Taking into consideration modern tendencies in the sector of labour market the needs of employer, the universities of Republic have strategic position to form professional competencies of potential experts. This direction has the following objectives: accreditation of universities, participation in rating, obtaining licenses for educational programs that are in demand, equipping of laboratories with modern material and technical equipment, advanced training of the training staff, keeping feedback with employer and etc. Thus, employment of youth in the Republic of Kazakhstan represents a package of measures, directed to assistance of employment of youth aged from 15 to 28 years.

**Keywords:** labor market; engagement; educational services market; employment; logit-Model

**JEL Classification:** A10; I2; J6

### Introduction

Sustainable economic growth of Kazakhstan since 2000 has improved living standards, reduced poverty and wealth disparity, and also increased employment level. Today there is need for orientation on improvement of employability factors for vulnerable groups of population in Kazakhstan. Development of Kazakhstani labor market addresses key problems of employment of vulnerable groups with special attention to the youth, the elderly and people with disabilities. Kazakhstan tends to facilitate economic diversification, and in doing so, the State shall establish inclusive labor markets, which will provide efficient opportunities to vulnerable groups for employment. The labor market remains disparate with major regional disparities and a significant share of low-paid jobs. Well functioning labor market with efficient security network will be of significant importance in provision of better positions, as well as it will enhance role of active policy in the labor market and investment in skills. The main problem of Kazakhstan youth is not lack of working positions, but lack of opportunities to gain access to decent working positions and recognition of career prospects in formal sector.

### 1. Literature review

Employment issues present an important social and economic problem both for professional education system and for the country in general. This problem may be solved by establishment of efficient mechanisms of integration of labor market and market of educational services. We shall point out studies of such well-known academics, as Bacher (2017), Koblbauer (2017), Spencer-Oatey (2017), Dauber (2017), Korovkin (2016), Barham (2009), Walling (2009), Rodríguez-Planas and Jacob (2010).

Education system for future specialists shall take into account perspectives of their employment on the basis of actual demands of the national economy. Intended graduate of educational institution shall have certain competences upon graduation. Issues of professional competences are widely discussed by the international academic community: Scarpetta (2017), Martynenko and Menshykov (2017), Lai and Teng (2011), Velasco (Velasco), Ronald (2009), Eilström and Kock (2008).

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## 2. Methodology

Purpose of this research is to identify problems and main variables, which have impact on graduate employability, using a Logit-model. Positive dynamics is observed in the labor market of Kazakhstan. In comparison with data of 2016-2017, along with growth of number of economically active population by 11%, we can observe increase of a number of employees by 1,5 mln. people, decrease of a number of the unemployed by 178 ths. people and the self-employed by 448 ths. people. Unemployment level (general, youth, long-term) has reduced in average by 47%, and today it equals to 4,9% (445 ths.) of economically active population.

Not all graduates can find a job immediately after graduation. Employers more often are interested in hiring personnel with experience.

In this case, in the Republic of Kazakhstan there are public measures aimed at promoting employment and professional occupation on the basis of the national program. In the Republic of Kazakhstan are carried out the state program "Road Map employment 2020" (which includes the program "Youth practice" youth entrepreneurship support program, program of training and re-training), "With diploma to the village" and "Youth personnel reserve".

The leading state program in Kazakhstan is "The road map of employment of 2020", according to the passport of the program, by 2020 unemployment rate won't exceed 5% in the country. At the same time the level of female unemployment won't be higher than 5,5%, and the level of youth unemployment (15-28 years) won't exceed 4,6%.

The state program of industrial-innovative development of Kazakhstan for 2015 – 2019 provides for the development of basic universities and colleges: the development of new educational programs, placement of state orders for needs of projects of the state program, upgrading of laboratory facilities for new programs. Target training of highly qualified specialists for priority sectors of economy is carried out under this Program.

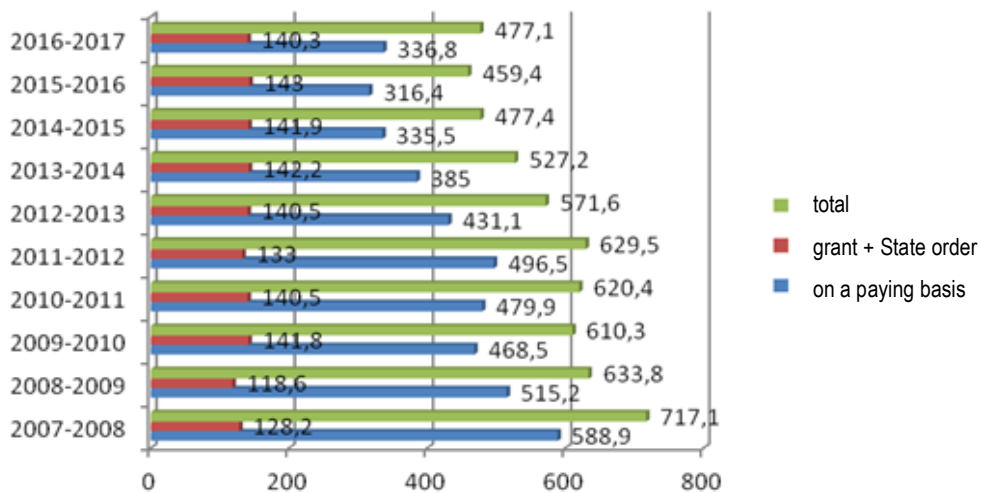
State support was provided to 770 ths. people during implementation of the state program "Employment road map 2020". As a result, 582 ths. people have been employed for permanent jobs. Unemployment level reduced from 5,2 % in 2013 to 5% in 2014-2015 and 4,9% in 2016-2017. Unemployment level among the youth, which is one of the target groups of the program, reduced from 5,5% in 2013 to 4,2% in 2014 and 4,3% in 2015, comprising in the third quarter of 2016-2017 a minimal indicator from the beginning of the century – 4,0%.

At the same time, we observe systemic issues, impacting the labor market and further economic growth: low quality of human resources, nonproductive employment, regional disparities and demographic misbalance, insufficient generation of working positions in the economy, etc.

In the period from 2006 to 2017 share of labor resources with higher and not completed higher education increased from 25% to 38,0%, with technical and professional education – from 27% to 36%. In 2013 share of labor resources with higher and not completed higher education was equal to 34%, and in 2014-2016 this indicator increased up to 40%. Along with that, share of labor resources with technical and professional education recently remains at average level of 33% (in 2014, in 2015 – 34%, in 2016 – 33%, in 2017 – 35%). Dynamics of data of graduates of 9 and 11 grades of general schools for the last three years shows those approximately 21 ths. people are employed without relevant qualification. However, approximately 20 ths vacant working positions per year remain unoccupied due to incompliance of qualification of labor resources with demands of the labor market.

The State provides option of free higher or postgraduation education on competition basis as per the state educational order, if a candidate enrolls for the first time, and excluding military and special educational institutions. The State order covers 1/3 of the total number of students of higher educational institutions in the country. The State order for education of specialists with higher and a postgraduation education is specified on an annual basis in accordance with demands of the economy (Figure 1).

Figure. 1. Dynamics of student body by mode of study (ths.p.)



Source: Compiled by the authors according to Statistical data of the Ministry of the National Economy of the Republic of Kazakhstan, the Committee on Statistics, <http://stat.gov.kz/>

Share of graduates employed by relevant specialty in the first year upon graduation is an indicator of the national rating of higher educational institutions. Letters of employment verification from employers until 2013 implemented monitoring of level of employment of graduates. Since 2014 employment has been verified through the integrated information base of the State Center of pension payment. As per the State program of education system development for 2011-2020, this share shall be 75% to 2017, 80% to 2020 (for students on a paying basis) and 90% to 2020 in relation to employment of graduates, studied on the basis of the state educational order, by relevant specialty within the first year upon graduation.

Thus far dynamics of employment of graduates in the country is not so good (Table 1).

Table 1. Dynamics of employment of graduates

Year	% employment
2011	75,6
2012	76,9
2013	79,6
2014	69,8
2015	70,1
2016	72,3
2017	73,1

Source: Compiled by the author according to Statistical data of the Ministry of the National Economy of the Republic of Kazakhstan, the Committee on Statistics, <http://stat.gov.kz/>

However, dynamics of employment of graduates, studied on grant or the state order, has no transparency, and provision of mandatory working off for a period of 3 years is legally stipulated for graduates, studied by rural quota. Provision of working off for all graduates of higher and postgraduation educational programs within the state order has been introduced since January 2017.

### 3. Case studies

In the framework of this article we conducted the research on the basis of example of Karaganda Economic University (KEU) and identified factors, which less or more influence on employability of a graduate (analysis was conducted with use of data of graduates of 2016-2017, studied in KEU on grant basis). We built the Logit-model for analysis of employment of graduates, studied in KEU on the basis of grant. We used a binary variable as a dependent variable.

$$y = \begin{cases} 0, & \text{if a graduate is unemployed;} \\ 1, & \text{if a graduate is employed.} \end{cases}$$

We used the following variables as explicative variables:

- Z<sub>1</sub> - specialty, for which a student got educational grant:



$$Z1 = \begin{cases} 0, \text{technical specialty;} \\ 1, \text{economic specialty.} \end{cases}$$

- Z<sub>2</sub>- sex of a graduate with grant:

$$Z2 = \begin{cases} 0, \text{male;} \\ 1, \text{female.} \end{cases}$$

- Z<sub>3</sub>- affordability of higher education for graduates of urban and rural general educational schools:

$$Z3 = \begin{cases} 0, \text{rural area;} \\ 1, \text{urban area.} \end{cases}$$

- GPA (Grade Point Average) – grade point average for certain period of time (in our case – for all period of study). Each grade has its numeric expression (A-4, B-3, C-2, D-1, F-0), and grade point average is calculated by the amount of such grades. The highest is 4,0.

- Mark1 - grade point average in secondary school certificate at time of enrollment in higher educational institution.

- Mark2 - grade point average in diploma upon graduation of higher educational institution.

Approximation of data was performed in Stata program with use of Logistic regression tool. The following analysis protocol was derived:

Logistic regression	Number of obs	=	29
	LR chi2(5)	=	6.04
	Prob > chi2	=	0.3026
Log likelihood = -11.766013	Pseudo R2	=	0.2042

Y	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
Z1	.7376629	1.177517	0.63	0.531	-1.570228 3.045554
Z2	2.143578	1.257762	1.70	0.088	-.32159 4.608747
Mark1	-1.697257	3.085845	-0.55	0.582	-7.745402 4.350888
Z3	1.125773	1.337063	0.84	0.400	-1.494823 3.74637
GPY	.0283266	1.61475	0.02	0.986	-3.136526 3.193179
_cons	6.277608	14.82779	0.42	0.672	-22.78433 35.33955

We wrote the Logit-model on th basis of resulted coefficients:

$$\hat{y} = 6,28 + 0,74Z_1 + 2,14Z_2 - 1,7Mark1 + 1,13Z_3 + 0,028GPY \quad (1)$$

Analysis of regression coefficients allows conclusion the following:

- economic specialty increases employability of a graduate in  $\exp(0,74) \approx 2$  fold;
- employability of female graduates is higher in  $\exp(2,14) \approx 8,5$  in comparison with male graduates;
- with increasing of average grade by 1 in school certificate, ratio of employability falls into  $1,7 * 100\% = 170\%$ ;
- employability of a graduate of urban school is higher in  $\exp(1,13) \approx 3$  fold in comparison with a graduate of rural school;
- with increasing of average grade by 1 in higher educational institution, ratio of employability increases by  $0,028 * 100\% = 2,8\%$ .

## Conclusion

Higher education policy is the key to education throughout life, and it gains special importance as population is constantly increasing in many countries. It is one of the main factors of economic competition ability in global economy based on knowledge, and also it facilitates social cohesion and welfare. Researchers call the other reasons of non-employment of university graduates. First, young people entering the university for certain major were focused on current market condition at the labour market. On completion it's found the other specialties are in demand. Secondly, despite of privileged tendency in raise of grants for technical majors, the majors in the sector of information technologies as well as bio- and nanotechnologies, training staff of universities almost are not changed. Therefore, knowledge transferred to the students' keeps continuity without orientation to current needs of employers' market. Often, theoretical knowledge that was obtained in the training process by the



graduate are hardly in accordance with employer's requirements, not to mention practical skills and abilities. Thus, the major acquired by graduate does not correspond to requirements of real time. This is because the training staff of universities are not changed and knowledge that transferred by them are not in accordance with real time. Experience has shown that most of licensed graduates of university either have to work in the specialty they have not trained in, that is currently happened, or have to retrain and receive a specialty that is more in demand.

For instance, 44.5% of employers wholly are not satisfied with training level of university graduates in Kazakhstan. 18% consider that graduates do not correspond to modern requirements, economic needs. It says that 63% of employers basically are not satisfied with training level of university graduates.

As it is known young people are aimed at fast career growth and intended to consider job as social lift. Employer has not always willing to pay for additional training of young experts. Besides, no social benefits, first of all accommodation, are provided for graduates of the university who has found a job in its degree field.

Almost all of the universities in Kazakhstan have met with similar problems in the sector of employment of graduates. Taking into consideration modern tendencies in the sector of labour market the needs of employer, the universities of Republic have strategic position to form professional competencies of potential experts. This direction has the following objectives: accreditation of universities, participation in rating, obtaining licenses for educational programs that are in demand, equipping of laboratories with modern material and technical equipment, advanced training of the training staff, keeping feedback with employer and *etc.*

Governments of many countries are realizing that higher educational institutions shall develop skills required for maintenance of global competitive research base and spreading of knowledge for public welfare. Kazakhstan higher education system has gained significant achievements over last ten years. Nevertheless, there is still a way for improvement of presentation of Kazakhstani skills in the labor market and support of economic growth through researches and innovations.

The labor market shall be reformed for improvement of results and better services rendering in order to stimulate integration and welfare. It is required to take measures in lacking areas, for example, in the State Employment Service, which is able to facilitate job seekers in finding promising opportunities for employment.

We point out the following recommendations: Implementation of systematic and independent assessment of measures in the field of employment, in particular, active labor market programs, for identification of advanced methods and channels of resources for efficient intervention; Provision of adequate social protection for people in need, and elimination of gaps in security of income in elderly age; Extension of efforts against formality and enforcement of the labor legislation.

Results of analysis of employability of KEU graduates showed that today economic specialties are the most demandable at this stage of economic development. Economic specialties facilitate graduates in employment in small or major companies. Furthermore, understanding of economic basics may help in establishment of own business. Demand for economic specialties is not always accompanied with high salary. As per data of the Committee on statistics of the Republic of Kazakhstan, average monthly salary of economists is the highest in Atyrau region – 238.766 KZT, then in Astana – 214.504 KZT, and in Almaty economic specialists have an average salary of 138.542 KZT.

Our research showed that KEU graduates are employed only in Karaganda region, and salary of economic specialists is equal to 81.241 KZT (in average for the region), thus employability of female graduates is 8,5 fold higher than employability of male graduates. In our opinion it is related to the fact that the most of men do not agree for such salaries, they prefer to work on technical positions, where salaries are quiet higher.

High school grade is not priority factor in employment of graduates as per results of our research. Employers point out such characteristics as responsibility, professional curiosity, working efficiency, communicative skills, creative thinking among preferred personal properties of a graduate.

Employability of a graduate, finished urban school, is 3 fold higher than employability of a graduate, finished rural school. Education level of population and level of development of educational and academic infrastructure constitute integral part of economic growth. Issue of affordability of higher education has the same significant importance as issue of competencies, given by schools, which form initial competitive properties in employment. Respectively, if competencies, acquired in school and higher educational institution, were at high level (urban school and high grade at university), resulting in high GPA, employability of a graduate increases only by 2,8%. Even high performance of a graduate is not a certain indicator of employability of a graduate. Graduates shall develop such personal properties, as stress resistance, literacy, decency, comprehensive knowledge and result-oriented performance.

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## Study Abroad Internationalization Management: Motivation Factors' Analysis

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### Abstract:

The aim of the empirical research is to explore the factors, which determine students' motivation to study abroad and effective factors in choosing country. Method of research includes the analysis of academic literature, construction and validation of questionnaire, analysis of data in R programme. Total 103 respondents completed the survey: 55 students who have already participated and 48 willing to participate in academic mobility programmes. The most important factors motivating students to study abroad: it was an important personal experience, it was important to improve my language skills, it creates future work possibilities in my country, it was important to experience another culture, it was important to get an international impression in my studies. The following key factors have been selected by students in choosing country to study abroad: it was important with high education level in the country, it was important with a low crime rate in the country, it was important with the culture in the country, it was important with low expenses in the country. Although there exists a comprehensive literature on international students' motivations for choosing to study abroad, not much research has been done concerning how Kazakhstan students choose to study outside of their home country and what factors influence their choice. The identification of key determinants is important for development and implementation of higher education policies aimed at inbound and outbound academic mobility.

**Keywords:** factor analysis; academic mobility; internationalization; motivation; higher education institutions; study abroad.

**JEL Classification:** I25; I26.

### Introduction

The internationalization of higher education is becoming an objective process in the world market formation of educational services. The main reasons for the internationalization of universities are maintaining reputation and competitiveness with other educational institutions, attracting professors and students, attracting funding, and external influential factors (e.g. the state and accreditation agencies). In the European Higher Education Area, internationalization is a key element in achieving the objectives of the Bologna Declaration, the Lisbon Strategy and the Turin Convention that lead to the creation of a competitive knowledge-based society. Modern trends appeared because of expanding education beyond national boundaries by creating new types of educational services providers, education technologies, programs and qualifications.

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A number of factors characterizes the changing landscape and coordinate system in the global educational space: expanding access to education, strengthening the geopolitical struggle for intellectual resources and influence, the race for talented and solvent entrants, strengthening competition in the market of educational services, and the emergence of powerful educational networks. The shift of focus from the global competition of universities to the competition of educational programs, and the new competitive educational model based on close cooperation with business and industry are becoming key aspects of higher education development. In the educational market, there is a growing need to develop and implement double-degree and joint programs with foreign universities in order to increase the capitalization of the graduates.

## **1. Literature review**

Economic, educational, political, cultural, family and career factors influence the students' desire to study abroad. Students noted several factors that motivate them to participate in study abroad programs. According to research, the reasons vary from professional to personal, including:

- the desire to use study abroad as a stepping stone to obtain work in the international market and build a career (Emanoil 2012);
- the opportunity to gain internship programs experience of hosting university, which can promote further international career (Mazzarol and Soutar 2013);
- study in another country and university, and create an international network (Park 2014).

Studies also showed that there are tangible barriers that force students to conclude that it will be difficult for them to study abroad. Significant barriers include language differences, finance, time, work commitments, family obligations, and the lack of connection between studying abroad and obtaining professional knowledge and skills (Marcum 2012). Researchers Henthorne, Miller and Hudson noted that the cost of programs and language barriers are important factors for students to make decisions about studying abroad (Henthorne and Miller 2011).

Although international student mobility has always been one of the key aspects of the internationalization of higher education, it has changed both in scope and in the variety of approaches. The number of students receiving higher education outside their own country increased from 0.8 million in 1975 to 3.7 million in 2009 (OECD 2013), and by 2020 this figure would increase to 4.5 million (UNESCO 2016). Since the government and other institutions are increasingly admitting the benefits of attracting international students, more and more participants appear in the international educational market.

According to Zweig, Chen and Rosen, students, who are going to study abroad, believe that it will add the value to them as professionals (Zweig and Chen 2014). As the studies of Kelo, Teichler and Waechter (Kelo and Teichler 2016) showed, students expect that foreign education will give them great opportunities for career growth and the advantages in finding work on their return to their country of origin. Waechter and Maiworm found that personal development and lack of opportunities in their home country encourage students to study abroad (Waechter and Maiworm 2015).

Macready and Tucker identified the following key motivations for studying abroad: learning cultural heritage, living abroad experience, willingness to travel, the best academic offers, and professional advancement. Kavakas (Kavakas 2013) and Emanoil (Emanoil 2012) supplemented a number of factors that affect the academic mobility of students: geographic proximity, climate and environmental conditions, safety status, advice from relatives and friends, opportunities for immigration, scholarships, and living and transportation costs.

Mazzarol and Soutar (Mazzarol and Soutar 2013) noted that students go through three stages in the decision-making process; the first step is to stay in the country or go abroad. The important role here plays push factors in their home country. When the decision to go abroad is made, the second step is to choose the country of study. At this stage, various pull factors affect the attractiveness of one country more than other. Pull factors, such as university profile and proposed courses or programs, also, play crucial role at the final stage of decision-making on choosing a university. The authors concluded that the most important factors influencing the students' choice are the desire to improve their life experience and level of well-being; the level of security of the country; prestige of the country; costs that will need to be spent on education; convenience in issuing a visa and the opportunity to find a good job after graduation.

Bernunger & Mattsson, as a result of their research, found that the primary motivating factors for short-term studies in foreign universities are personal development, improvement of language skills, and the acquisition of an international component in the field of their specialization. The model and questionnaire developed by Bernunger and Mattsson were adapted and used in this study (Bernunger and Mattsson 2011).

## 2. Methodology

In 2010, Kazakhstan became the first country in Central Asia that joined the Global Higher Education Area and took steps to harmonize national qualifications and credits with the European Qualification Framework and the European Credit System (ECTS). Changes in the system of higher and postgraduate education of the Republic of Kazakhstan were dictated by the influence of international trends, and now it is an urgent to use competence model in educational programs, increase academic mobility of students, emphasize the role of information technologies, and improve the educational and methodological base in accordance with world educational trends. The introduction of the Bologna process was an incentive for the international mobility of students in Kazakhstan. Currently, outgoing academic mobility is the main component of the strategy of internationalization in Kazakhstan. In 2015, 48,875 students studied in foreign universities (UNESCO Institute for Statistics 2016). The main host countries are the Russian Federation (35,106), UK (1725), and the USA (1884). International student mobility extensively depends on external financing such as Erasmus Mundus, Ernst Mach, Mitsubishi, etc, students' self-funding, and financing of the Ministry of Education and Science of the Republic of Kazakhstan.

International academic mobility program is an important component of internationalization and allow preparing competitive students for the global labor market and improving the institutional reputation and competitiveness of the university. As international practice shows, employers now give priority to graduates who have an international experience. In 2004, more than 2 million students participated in academic mobility programs and according to researchers' forecasts, by 2025, the number will reach 8 million.

Despite the fact that there is an extensive literature on the motivations of students in decision-making process to study abroad, there is a practically no research in Kazakhstan about how Kazakhstan students make choices and what factors influence them. Whereas, identification of key determinants is important for the development and implementation of higher education policies, which are aimed at increasing and improving academic mobility of students.

In the questionnaire, which tests importance of factors that motivate students to study abroad in academic mobility program and select the study destination, participated 103 respondents: 55 participants of academic mobility program and 48 who wish to participate in academic mobility program. The questionnaire was divided into several sections: general information on the respondent, the source of funding (actual/desired), main countries for studying, the important decision making factors to study abroad (8 factors) and to choose a country of study (11 factors).

Table 1. General information about respondents

Category		%
Gender:	Male	24.31
	Female	76.69
Age:	18-19	35.92
	20-21	58.25
	22+	5.83
Degree level:	Bachelor	96.11
	Master	3.89
Sources of funding (AM members only):	Funded by Ministry of Education and Science of RK	25.45
	Funded by Erasmus+ programmes	5.45
	Funded by international agencies	3.63
	Self-funding	58.20
	Others	7.27

Note: \* 92% of Non- AM students would prefer financing through various grant programs. The remaining 8% at their own expenses

Source: compiled by authors

The basic age category of students refers to 20-21 years and it is 58.25%, almost 77% of all respondents are women, and 96.11% are studying at the bachelor degree. As it can be seen from Table 1, students who have already participated in academic mobility programs indicated as sources of funding: the budget of the Ministry of Education and Science of the Republic of Kazakhstan - 25.45%, Erasmus + program - 5.45%, grant programs of international agencies (Mitsubishi, Ernst Mach, etc.) - 3.63%, self-funding -58.20%. The majority of students (92%), who have not yet participated in academic mobility programs, but would like to study in a foreign university for one semester or academic year, noted that they prefer financing from state and international grant funds.



Table 2. Selection of regions and countries to study

Regions where respondents studied or would prefer to study		
Region	% of students studied abroad	% of wishing to study abroad
Western and Central Europe (Germany, Netherlands, France, etc.)	12.72	54.16
Eastern Europe (Poland, Czech Republic)	54.57	14.60
South-East Asia (South Korea, Japan, China)	12.72	12.50
Russian Federation	10.9	14.58
USA	9.09	4.16

Source: compiled by authors

More than half of the students who have already taken part in academic mobility programs chose the countries of Eastern Europe (54.57%), equal numbers scored for Western/Central Europe (12.72) and South-East Asia (12.72%), The Russian Federation (10.9%) and the United States (9.09%). Students who wish or plan to study abroad within academic mobility program determined the following ranking of regions and countries: Western/Central Europe is a priority (54.16%), Eastern Europe and the Russian Federation scored almost equal (14.60% and 14.58%), and South-East Asia (12.50%) and the USA (4.16%) were less preferable.

### 3. Reliability analysis

During the analysis of factors, Cronbach alpha value was calculated to check the internal consistency and reliability of the scale. The database consists of 19 elements, which divided into two sections. The alpha coefficient for the first section, which includes 8 elements, was a value of 0.8446, and for the second section of 11 elements, a value was 0.7457. It should be noted that a reliability coefficient, which is "acceptable" for social science research, is 0.70 and above. In this regard, both sections meet this requirement; therefore, have a relatively high level of consistency and reliability.

### 4. Application functionality

Table 3 presents the results of calculations by using the Student's one-sample test method for revealing the decision-making factors to study abroad and to choose the destination of study. Respondents assessed the importance of each factor on the following scale: 1=very important; 2=quite important; 3=quite unimportant; 4=very unimportant. Based on the dimension of the scale, the value "3" was taken as the test value for the Student's test.

It can be seen from the table that the two factors of the first section (x7 and x8) and the three factors from the second section (x9, x10, x16) do not have statistically significant differences from the test value of 3 ( $p > 0.05$ ). These factors, as well as factors with a mean less than 3, are considered as the least important for respondents.

According to the results of the first section of Table 3, there were identified five the most important factors that motivate students to study in foreign universities (Table 4).

Table 3. Motivation factors

Code	Factor	Mean	Standard deviation
Section 1: The importance of factors in the decision to study abroad			
x1	It was important to improve my language skills	1.776699	1.0472376
x2	It was important to experience another culture	1.941748	1.0555664
x3	It was important to experience another student life in another country	2.048544	0.9739614
x4	It was important for future work possibilities in my country	1.825243	0.9844595
x5	It was an important for personal experience	1.485437	0.9888008
x6	It was important to get an international impression in my studies	1.757282	1.0142709
x7	It was important with recommendation from other students	3.087379*	0.8414133
x8	It was important with recommendations from teachers	2.990291*	0.9234966
Section 2: Importance of factors in choosing the country and university			
x9	It was important with the climate as a deciding factor	2.912621*	0.9193646
x10	It was important with recommendations from family and relatives	2.912621*	0.8867964
x11	It was important with recommendations from friends	3.038835	0.8847546
x12	It was important with the culture in the country	2.495146	1.0182047
x13	It was an important with closeness to my country	3.223301	0.9993335
x14	It was important with prior experiences in the country	3.320388	1.0118280



Code	Factor	Mean	Standard deviation
x15	It was important that family/friends lived in that country	3.378641	0.9913004
x16	It was important with low transport cost to the country	3.038835*	1.0748673
x17	It was important with low expenses in the country	2.650485	1.1607024
x18	It was important with high education level in the country	1.922330	1.0449629
x19	It was important with a low crime rate in the country	2.213592	0.9037014

Note: \* Factors that do not have statistically significant differences from the test value of 3

Source: compiled by authors

Table 4. The key factors of decision to study abroad

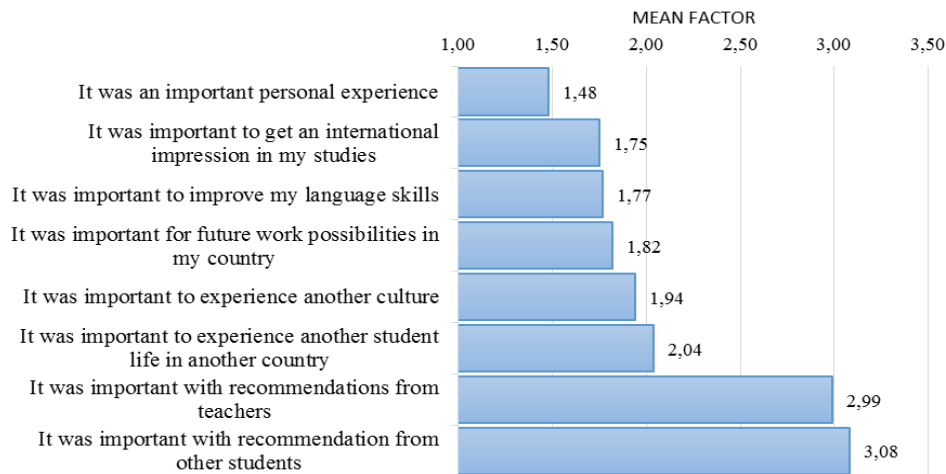
Code	Factor	Mean	Standard deviation
x5	It was an important for personal experience	1.485437	0.9888008
x6	It was important to get an international impression in my studies	1.757282	1.0142709
x1	It was important to improve my language skills	1.776699	1.0472376
x4	It was important for future work possibilities in my country	1.825243	0.9844595
x2	It was important to experience another culture	1.941748	1.0555664

Source: compiled by authors

The selection is based on values of a mean. All factors have  $p < 05$  according to the Student's test. The most important factor in the scale is the factor with the lowest mean.

Respondents identified the five most important factors out of the eight proposed factors. "It was an important for personal experience" was the most important motivating factor with a mean of 1.48. The next most important factor was "It was important to get an international impression in my studies" with a mean of 1.75. In the third position was "It was important to improve my language skills" with a mean of 1.77. "It was important for future work possibilities in my country" also proved to be one of the most important factors with a mean of 1.82. "It was important to experience another culture" closes the five most important factors. The mean was 1.94.

Diagram 1. Importance factors mean



The evident representation of results of the first part of Table 3 is shown on the diagram 1. Here we see that the least important factors according to respondents are "It was important according to the recommendation of teachers" (average 2,99) and "It was important according to the recommendation of other students" (average 3,08).

According to the results of the second section of Table 3, four most important factors can be identified in choosing the destination of study (Table 5). The selection is based on values of a mean. All factors have  $p < 05$  according to the Student's test. The most important factor in the scale is the factor with the lowest mean.

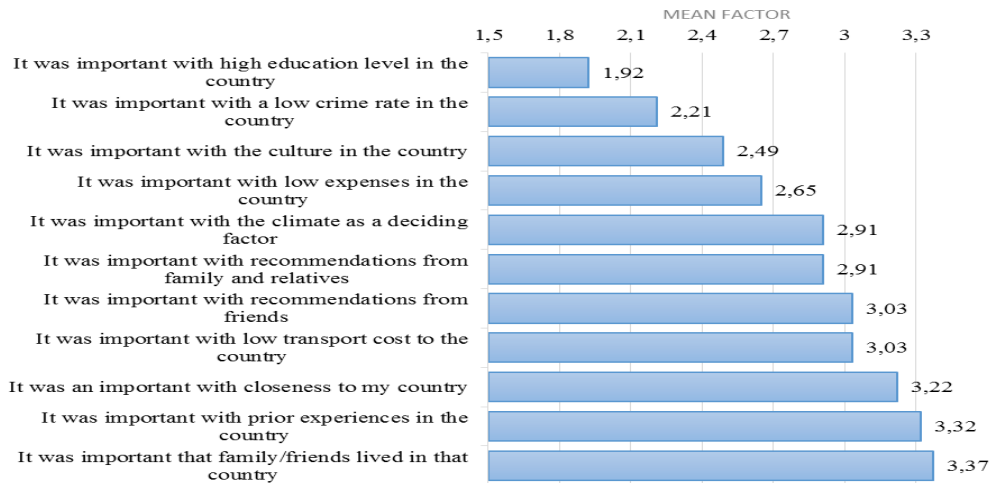
Table 5. The key factors in choosing the country of study

Code	Factor	Mean	Standard deviation
x18	It was important with high education level in the country	1.922330	1.0449629
x19	It was important with a low crime rate in the country	2.213592	0.9037014
x12	It was important with the culture in the country	2.495146	1.0182047
x17	It was important with low expenses in the country	2.650485	1.1607024

Source: compiled by authors

In the part "Importance of factors in choosing the country of study", the respondents assessed 11 motivating factors. "It was important with high education level in the country" was the most important factor in choosing a country with a mean of 1.92. The second important factor was the "It was important with a low crime rate in the country" with a mean of 2.21. Next comes the "It was important with the culture in the country" with a mean of 2.49. The last significant factor in choosing a country was "It was important with low expenses in the country" with a mean of 2.65.

Diagram 2. Importance of factors in choosing the country of study



The evident representation of results of the second part of Table 3 is shown on diagram 2. The least important factors according to respondents are: "It was important with closeness to my country" (3.22), "It was important with prior experiences in the country" (3.32) and "It was important that family/friends lived in that country" (3.37).

## Conclusion

Academic mobility of students is an important component of the internationalization of higher education in Kazakhstan and it appears in governmental programs and concepts. Result-oriented teaching and academic mobility are aimed at developing the competencies that learners would need for adapting to the changing labor market. Academic mobility program promotes the integration of Kazakhstan's education in the international educational area, improvement of the quality of education, comparability and recognition of Kazakhstan's educational programs with the programs of foreign universities, and enhancement the internationalization of higher and postgraduate education. From the point of view of interviewed students, the key factors that motivate students to study in foreign universities within the academic mobility program are personal experience and development, international experience in the specialty/future profession, improvement of language skills, job opportunities in their country after return, and experience of living in another culture. The results are correlated with the findings of Emanoil (2012), Marcum (2012), Mazzarol and Soutar (2013) Kelo, Teichler (2015) and Waechter (2015), Henthorne, Miller and Hudson (2011), and others. In this study, the issue studied by Waechter and Maiworm (2015) about the lack of opportunities in the home country as a motivating factor for studying abroad was not considered. In this regard, it is advisable to conduct research and analysis in Kazakhstani universities on quality assurance within the framework of the main directions of internationalization: internationalization abroad and internationalization at home.

Financing the academic mobility program in Kazakhstan is carried out by the expense of the state budget, extra-budgetary funds of the university, grants of international organizations, as well as personal funding of students. From the results of this study, it can be seen that students who took part in academic mobility programs mainly used their own money (58.20%) and the state budget allocated by the Ministry of Education and Science (25.45%). At the same time, 92% of students who are only planning to take part in academic mobility programs have indicated that it is preferable to get funding from state and international grant agencies. The cost that will need to be spent on studying abroad is one of the key matters. Experience shows that many students cannot afford studying through academic mobility program in foreign universities because of the low solvency of the

family. The issue of barriers and limitations in the implementation of international academic mobility is also relevant in studying internationalization trends of the country.

In the regards of choosing a country of study, more than half of the students, who have already participated in academic mobility programs, indicated the countries of Eastern Europe, and equal numbers of students selected Western/Central Europe and South-East Asia. The least number of students picked the Russian Federation (10.9%) and the United States (9.09%). Most students, who only plan to study abroad as part of academic mobility program, preferred Western and Central Europe. Countries in Eastern Europe, Southeast Asia and the Russian Federation scored almost the same percentage, while the US was less preferable country. Respondents identified four important factors while choosing a country for academic mobility program: high level of education in the country, low crime rate in the country, the country's culture, and low expenses within the country. As academic literature also reflects, economic, educational, political, cultural, family and career factors influence the students' desire to study abroad.

The results, which were obtained within this empirical study, can be taken into account in the development and implementation of academic mobility programs at the national and institutional levels.

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## The Impacts of Financial Market Access, Credit to Private Sector and Gross Domestic Product on Financial Development in China: A Vector Error Correction Model Approach

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### Abstract:

Chinese markets have attracted many investors around the world. However, policies designed to develop these markets and the overall economic performance in China has been mixed over the years. This study aims to evaluate the impacts of financial market access, credit to the private sector and GDP on the development of financial market in China using the Vector Error Correction Model (VECM) approach from 198A-2015A. The negative value and the statistical significance of the error correction term support the long-run cointegration results. Additionally, the residuals are stable, normally distributed and serially uncorrelated based on the robustness checks. By implication, the study concludes that, domestic credit to the private sector and real GDP have positive impacts on the development of financial market sector in China, while financial market access and total reserves have negative impact. Resultantly, China needs broad and inclusive financial reform such as credit and exchange rate policies that will operate as a free market or a mixed economic system to attract investors and provide legal and regulatory framework to evaluate the implemented policies in order to ensure confidence in the minds of both existing and prospective investors and to boost domestic and international trade to achieve sustainable development in China.

**Keywords:** China; financial development; cointegration; economic growth; domestic credit

**JEL Classification:** C01; C10; D53; G01; G02; G10; G15

### Introduction

Financial markets can play an integral role in the growth process of any economy, the world over. This is because of their pervasive nature, which attracts significant attention from policymakers, financial experts, investors, and economists and even stakeholders in the economy who are directly or indirectly interested in financial market development. The fact is that an efficient financial market is an indicator of the robust business direction of an economy. Financial markets bridge the gap between these economic units by mobilizing their savings and surpluses to accelerate and enhance efficiency and growth of the economy through providing investment opportunities as well as the transfer of funds from the surplus to the deficit economic units in order to achieve economic goals.

The financial market in China has developed into a unique component of the international financial market. The fact is that it attracts and makes it so pervasive to potential and existing investors. It is a known fact that stock market crashes are generally related to a collapse in the banking sector performance, as can be seen in the financial markets of developed countries in recent decades, but this is not the case for China considering its economic and statistical analysis. According to Rousseau and Wachtel (2000), the 2009 stock market crash did not prevent banks in China from continuing to generate profit as opposed to the financial markets of developed countries.

## 1. Literature review

According to Amadeo cited in Abubakar, Omoshola and Aminu (2016), financial markets are markets where the trading of financial stocks, bonds, commodities, foreign exchange as well as derivatives is conducted in order to raise cash for governments and businesses to finance viable projects that reduce the risks of the companies and maximize the wealth of investors. Similarly, Liu, Zhou, Huang and Hao (2018) maintained that the economic reforms and opening-up policies of 1978 generated outstanding improvements for China's economic growth by an average annual GDP growth rate of 9.72% between 1978-2014. In order to achieve sustainable economic development, improved market adjustment philosophy as well as global financial market practices and strategies are inputs for the success of the financial market in China. Despite the uniqueness of China's financial market, Zhong, Yingwei and Yuanyuan (2018) argued that the financial market openness in China had lacked some form of coordination among submarkets coupled with the lack of a coordinated approach and perfect foundations since its establishment. The fact is that during the early stage of the policy reforms, loans (*i.e.*, credit) were regarded as an institutionalized concern to a certain extent rather individual (*i.e.*, business financing) credit base because it was believed that China's financial problems emerged due to default associated with the individual credit scheme as well as other management strategies such as accounting and auditing, and the evaluation system.

Although several studies have been conducted on the financial sector development, financial market reforms and opening-up economic policies of China, no study has been conducted on the specific topic, namely the impacts of financial market access, credit to private sector and gross domestic product on financial development in China using a VECM approach. The interest in the study area and the country is motivated by one of the early studies by McKinnon (1973), who found that financial sector development influences growth performance through the internal and external accumulation of capital as well as technological change which are supported with the incentives of improving the domestic saving rate. On the contrary, Guryay, Safaklı and Tuzel (2007) found an insignificant positive impact of financial sector development and GDP in the Turkish Republic of Northern Cyprus. They concluded that there was no evidence to indicate that financial sector development promotes the GDP in the Turkish Republic of Northern Cyprus. Additionally, China is among the best and most rapidly developing economies in the world, with an average 9.7% annual growth rate from 1989 to 2017 because of its sound financial market that is able to exploit the liquidity required to boost economic growth.

The early studies by McKinnon (1973) on the influence of financial sector development on economic performance and the subsequent adoption of the economic reform and opening-up policies of China's financial markets in 1978 brought about the implementation of various studies related to the research on this topic. Nevertheless, it is a known fact that the extant studies have not reached a consensus on the significance of financial market sector development and economic growth. This mixed conclusion is characterized by the differences in the econometric techniques used in the studies, such as the ECM, ARDL, GARCH, and OLS methods. Other determinants of the mixed findings are the types of variables and the units of measurement employed in the analysis. Additionally, the frequency of the data used such as daily, monthly, quarterly, and yearly can produce different results. In general, the type of economic system as well as the growth rate of these of studied countries can also affect the homogeneous findings.

In an empirical study conducted on Islamic countries, Greenwood and Smith (1997) studied the relationship between economic growth and financial sector developments by means of the VAR method. The Granger causality test indicated that the relationship stems from the GDP to financial sector development.

Similarly, Rousseau and Wachtel (2000) conducted research using yearly data for Norway, Sweden, Canada and USA yearly data from 1971-1929. The variables used were the size of the financial institutions, the ratio of corporate stock to corporate bonds and GDP. The study employed the Vector Error Correction Model and Granger Causality test. The finding of the research indicated a significant association between financial sector development and GDP in the Islamic countries.

By employing dynamic panel techniques and instrumental variable measures to evaluate the effect of financial intermediary development on economic performance as well as to scrutinize relationship between cross country divergence in both legal as well as accounting systems and the distinction in terms of the level of financial sector development by taking a sample of seventy-four (74) countries, Levine, Loayza and Beck (2000) argued that the financial intermediary development (*i.e.*, as exogenous components) is significantly related with the growth performance in these studied countries. Additionally, their findings showed that the cross-country dissimilarities in legal as well as accounting systems accounted for variations in financial sector development. Overall, the findings suggest that accounting and legal reforms or frameworks of reference that can support creditors' rights contracts enforcements as well as accounting principles and practices that can improve financial



sector growth as well as promote economic performance should be implemented. The fact is that the legal systems that rigorously enforce the contracts and, standards of accounting which offer a qualitative, complete and presentable corporate financial statement have a tendency to have an improved and developed financial sector intermediary.

In contrast, panel data was utilized by Zang and Kim (2007) to examine the correlation between GDP and financial sector development. The research further investigated evidence of causality using the Sims-Geweke test and the outcome indicated that financial development stems from economic growth. Although, the analysis for sensitivity was conducted to normalize the outcomes reliability, the results still indicated that economic growth impacts financial sector development which is contrary to the findings of Levine, Loayza and Beck (2000).

Similarly, Guryay, Safaklı and Tuzel (2007) studied the financial sector development and economic growth in the Turkish Republic of Northern Cyprus by means of the ordinary least squares (OLS) estimation technique using annual data from 1986A-2004A. The findings of their study revealed a negligible positive effect of financial sector development on GDP in Northern Cyprus. Nonetheless, the result from the Granger causality test confirmed the evidence of unidirectional causality from economic growth to financial sector development. By implication, it was concluded by the authors that economic growth causes financial development in North Cyprus.

Zhong, Yingwei and Yuanyuan (2018) maintained that developing the financial market sector in China through innovative opening-up policies requires further development of the policies according to international financial market standards such as a credit rating system, accounting standards as well as measures on monetary plus financial coordination that will lead to significant improvements. By implication, this will no doubt strengthen China's competitiveness that will increase its ability to play a central role in international financial development and consequently impact on growth performance.

On the contrary, Jun, Kai, Ming, Yue and Xuefei (2018) examined the further opening up policies of the financial market development sector in China. It was argued by the authors that despite the progress made by the policy, the development in the sector has been limited because certain restrictions have been placed on international financial organizations in connection to ownership and scope of business thereby reducing their market share access in China. Another finding from the study revealed other aspects that require further improvements include; accounting, auditing, and taxation. Overall, these problems have a direct impact on the financial development and consequently the overall economic performance of China.

In a study conducted in Nigeria by Abubakar, Omoshola and Aminu (2016) to determine the association between the development of the financial market and GDP in the country using evidence from VECM between 1981A-2014A. The findings revealed a significant effect of the development of the financial market to real domestic product in Nigeria. They strongly recommend that there is a need for comprehensive financial reform as well as a legal framework to complement legal and supervisory institutions. The study also maintained that credit should be channeled into the private sector in order to meet business and investment opportunities in the economy and around the world.

Similarly, Victor and Samuel (2014) studied the implications of financial development on the growth performance of the Nigerian economy from 1990A– 2011A. The results of their cointegration analysis revealed that on aggregate, development of the financial sector has an impact on the growth performance of the Nigerian economy but private sector credit does not. It was maintained and recommended that private sector credit should be improved as a priority by making supplementary funds accessible to these institutions in the form of soft rates of interest on credit as well as by removing stringent collateral conditions as a credit facility.

This research is conducted on the basis of the mixed results of the previous studies because there is no consensus as to how exactly the financial market access, domestic credit and GDP affect financial development in the Chinese economy. The fact is that some studies have established a positive relationship, while others have produced a negative or no overall impact.

As a result of these mixed arguments from previous studies, it is both relevant and necessary for this study to analyze related studies to uncover their standpoints in order to empirically examine the impacts of financial market access, credit to the private sector and gross domestic product on financial development in China using a VECM approach between the periods of 1981 and 2015.

## **2. Research methodology**

### **2.1. Data collection and unit measurement**

This paper employs data from World Development Indicators (WDI) database for (DCRP), (RGDP), (TRSV) and the International Financial Statistics (IFS) database for (FMAI) and (FDIX) for the periods of 1981 to 2015 to reflect the turning point of the opening up policies in China after 1978 in order to study the impacts of financial



market access, credit to the private sector and GDP on financial market sector development in the country using Vector Error Correction Model (VECM) approach. We employed the Financial Development Index (FDIX), this takes into account the quality of access to financial services, laws, regulations, business environment and financial crises in the economy as well as Financial Market Access Index (FMAI) which takes into account the quality and efficiency of the development of financial transactions for existing and prospective investors in the financial markets in China. Private sector credit (DCRP, % of GDP) includes financial resources, loans, and purchase of non-equity securities as well as additional accounts payable that can institute claim for disbursement as well as payment. Then, industrial value added as a percentage of GDP is proxy of real GDP (RGDP) growth rate. Finally, the total reserve (TRSV) as a percentage of GDP represents the international reserves to total external debt.

2.2. Model specification

As described above, there are various functional forms of relationship models between the development of the financial sector market and the growth of an economy. Resultantly, the paper differs from the related models considered in the paper as it takes into account the Financial Market Access Index (FMAI) and the Financial Development Index (FDIX) variables described above. The econometric model is specified as follows:

$$FDIX = \beta_0 + \beta_1 FMAI + \beta_2 DCRP + \beta_3 RGDP + \beta_4 TRSV + U_t \tag{1}$$

Where it is expected that the coefficients  $\beta_1 > 0$ ,  $\beta_2 > 0$ ,  $\beta_3 > 0$  and  $\beta_4 > 0$  will be positive and  $U_t$  represents the white noise error term employed to capture the effects of variable not included in the model. The  $t$  indicates time and  $\beta_0$  represents the constant term.

2.3. Estimation Techniques

It is a known fact that most macroeconomics variables are non-stationary. Nelson and Plosser (1982) recommended that the order of integration should be found and the appropriate test for cointegration should be determined. We applied the Augmented Dickey Fuller (ADF) and Phillips Peron (PP) tests for stationarity. However, We expected the variables to be of the same order either  $I(0)$ ,  $I(1)$  and  $I(2)$  then the Johansen Multivariate test of co-integration analysis was applied to check the long-run relationship among the variables in the model accordingly.

Consequently, the Vector Error Correction Model (VECM) as specified by Engle and Granger (1987) is analyzed. However, the long-run model is then formulated which integrates both the short-run as well as the long-run equilibrium model. The error correction model (ECM) incorporates the form below:

$$\Delta Y_t = \alpha + \sum_{i=1}^p \beta \Delta Y_{t-1} + \pi ECT_{t-1} + \varepsilon_t \tag{2}$$

From Equation 2 above, the first difference is  $\Delta$ , the  $p$  by 1 vector of variables is represented by  $(y_t)$  but when it is lagged by one period it becomes integrated as  $(y_{t-1})$ . Additionally, the intercept is  $(\alpha)$ , the short-run coefficients is  $(\beta)$ , and the long-run coefficients of the  $ECT_{t-1}$  is  $(\pi)$  which stands for the speed of adjustment to the equilibrium. It is important to note that the coefficient of  $ECT_{t-1}$  is expected to reveal a negative sign as well as significant values to converge deviations in the following period. The  $\varepsilon_t$  is white noise. Since our variables in Equation 1 are  $I(1)$ , we can apply the method of ordinary least squares (OLS) and related diagnostic checks will be applied on the error term.

3. Empirical Results and Discussion

3.1. Unit Root Test for Stationarity

Avoiding non-stationary series is a significantly important pre-condition for empirical studies via the stationary test of the variables of interest. However, Enders (1995) recommended that researchers to employ both the Augmented Dickey Fuller as well as the Phillips Perron test for stationarity, which determines the robustness of the ADF test.

Table 1. ADF Unit Root Test results for China

(1981A 2015A)		Level		First Difference		
Model	Intercept	Constant and Trend	Remarks	Intercept	Intercept and Trend	Remarks
FDIX	-2.229990 (0.1999)	-2.375118 (0.3851)	NS	-4.684307*** (0.0007)	-5.436492*** (0.0005)	S^
FMAI	-1.823858	-2.622645	NS	-8.261863***	-8.303609***	S^

(1981A 2015A)		Level		First Difference		
Model	Intercept	Constant and Trend	Remarks	Intercept	Intercept and Trend	Remarks
	(0.3630)	(0.2733)		(0.0000)	(0.0000)	
DCRP	-0.224688 (0.9258)	-2.372260 (0.3865)	NS	-5.176423*** (0.0002)	-5.107441*** (0.0012)	S <sup>^</sup>
RGDP	-1.757418 (0.3942)	-1.266436 (0.8788)	NS	-3.522408** (0.0135)	-3.604259** (0.0448)	S <sup>^</sup>
TRSV	-1.672516 (0.4354)	-3.028575 (0.1409)	NS	-3.178063** (0.0305)	-3.765085** (0.0320)	S <sup>^</sup>

Source: authors' computations from eviews10

Note: \*\* indicates significance at 5% and 10%, and \*\*\* indicates significance at 1%, 5% and 10% levels. NS indicate 'non-stationary' and the null hypothesis is rejected based on the critical values of Mackinnon (1991). S indicates 'stationary', (^) indicates the test estimated with intercept, as well as with trend and intercept. The p-values values are in ().

From Table 1, it can be seen that the results of the ADF stationarity tests reveal that all the variables are I (1). That is FDIX, FMAI, DCPS, RGDP and TRSV are first difference stationary. For that reason, the test satisfies the condition for the application of the cointegration technique, since all the variables are I (1).

Table 2. Phillips Perron Unit Root Test Results for China

(1981A 2015A)		Level		First Difference		
Model	Intercept	Constant and Trend	Remarks	Intercept	Intercept and Trend	Remarks
FDIX	-2.521924 (0.1193)	-2.260953 (0.4427)	NS	-6.608243*** (0.0000)	-7.132512*** (0.0000)	S <sup>^</sup>
FMAI	-1.692819 (0.4257)	-2.417003 (0.3648)	NS	-8.261863*** (0.0000)	-8.303609*** (0.0000)	S <sup>^</sup>
DCRP	-0.224688 (0.9258)	-2.608766 (0.2790)	NS	-5.176423*** (0.0002)	-5.107441*** (0.0012)	S <sup>^</sup>
RGDP	-1.588476 (0.4774)	-1.419832 (0.8367)	NS	-3.522408** (0.0135)	-3.564086** (0.0448)	S <sup>^</sup>
TRSV	-1.327575 (0.6053)	-1.915952 (0.6244)	NS	-3.378369** (0.0191)	-4.153789** (0.0130)	S <sup>^</sup>

Source: authors' computations from eviews10

Note: \*\* indicates significance at 5% and 10%, and \*\*\* indicates significance at 1%, 5% and 10% levels. NS indicate 'non-stationary' and the null hypothesis is rejected based on the critical values of Mackinnon (1991). S indicates 'stationary', (^) indicates the test estimated with intercept, as well as with trend and intercept. The p-values values are in ().

From Table 2 above, it can be seen that the results of the PP unit root tests confirm that all the variables are I (1s). That is FDIX, FMAI, DCPS, RGDP and TRSV are first difference stationary. For that reason, the test satisfies the condition for the application of the cointegration technique, since all the variables are I (1s).

Table 3. Lag Selection Criteria

lag	LogL	LR	FPE	AIC	SC	HQ
0	-803.5650	NA	1.32e+15	49.00394	49.23069	49.08023
1	-676.3211	208.2174*	2.74e+12	42.80734	44.16780*	43.26509*
2	-648.9601	36.48135	2.65e+12*	42.66425*	45.15843	43.50346

Notes: \* Indicates lag order selected by each criterion; LR: Sequential Modified LR Test Statistic with each test at 5% level; FPE: Final Prediction Error; AIC: Akaike Information Criterion; SC: Schwarz Information Criterion

Source: Author's computation using Eviews10

HQ: Hannan-Quinn Information Criterion from Table 3 above, it can be observed that LR, SC, and HQ recommend the use of 1 lag, while FPE and AIC recommend the use of 2 lags. The decision is that the lower the value, the better the model. Resultantly, 2 lags will be applied because the values of the AIC and FPE are the lowest.

### 3.2. Cointegration Test results

Table 4.4 and 4.5 present the results of the Trace and Max-Eigen value Tests.

Table 4. Johansen Multivariate Cointegration Test (Trace)

Hypothesis		Eigen value	$(\lambda_{\text{trace}})$ Statistic	0.05 Critical value	Prob.*
H <sub>0</sub>	H <sub>1</sub>				
R = 0	R > 0	0.773705	107.5154	69.81889	0.0000*
R ≤ 1	R > 1	0.617097	59.96604	47.85613	0.0025*
R ≤ 2	R > 2	0.420898	29.24688	29.79707	0.0578
R ≤ 3	R > 3	0.286545	11.76604	15.49471	0.1685
R ≤ 4	R > 4	0.029606	0.961685	3.841466	0.3268

Source: Author's computation using Eviews10

Note: Trace test shows 2 cointegrating equations at 5% significance; (\*) indicates rejection of null hypothesis at 5% significance; (\*\*) is based on Mackinnon-Haug- Michelis (1999) probability values

Table 5. Johansen Multivariate Cointegration Test (Max)

Hypothesis		Eigen value	$(\lambda_{\text{maxeigen}})$ t-Statistic	Critical value 0.05	Prob.*
H <sub>0</sub>	H <sub>1</sub>				
R = 0	R > 0	0.773705	41.54935	33.87687	0.0007*
R ≤ 1	R > 1	0.617097	30.71915	27.58434	0.0191*
R ≤ 2	R > 2	0.420898	17.48084	21.13162	0.1505
R ≤ 3	R > 3	0.286545	10.80436	14.26460	0.1643
R ≤ 4	R > 4	0.029606	0.961685	3.841466	0.3268

Source: Author's computation using Eviews10

Note: Trace test shows 2 cointegrating equations at 5% significance; (\*) indicates rejection of null hypothesis at 5% significance; (\*\*) is based on Mackinnon-Haug- Michelis (1999) probability values

Based on the cointegration results shown in the tables above, it can be seen that both the cointegration tests (*i.e.*, trace and max) rejected the first and the second null hypothesis at 5% significance level. By implication, two cointegrating equations among the variables of interest are indicated. It is concluded that there is a long run association between our variables of interest exists. It is important to note that the results of our cointegration analysis correlated to those obtained by Abubakar, Omoshola and Aminu (2016) and Victor and Samuel (2014) in Nigeria who found evidence of cointegration between financial market development variables such as total reserves, credit to the private sector, stock value traded, financial deepening, liquidity ratio, market capitalization and real GDP.

### 3.3. The Long-Run relationship

Table 6, presents the long-run and coefficients of the normalized cointegrating equation where the standard error is in brackets and test statistics in parentheses. Given that two cointegrating equations have been established, it is concluded that a stable equilibrium association exists between the Financial Development Index (FDIX), Financial Market Access index (FMAI). Credit to the private sector (DCRP), real GDP (RGDP) and total reserve (TRSV). However, while GDP produced the highest impact on financial development in China as empirically supported by Guryay, Safaklı and Tuzel (2007), total reserve (TRSV) and domestic credit to private sector (DCRP) produced an unexpected negative sign that is contrary to the theoretical expectations.

In order to establish a robust interpretation, the signs of the variables are reversed and the results are normalized on FDIX and FMAI. Following Abubakar, Omoshola and Aminu (2016) the computations of the test statistics (*i.e.*, t-value) have been conducted by taking the ratio of the coefficient of each variable by its respective standard error. Nevertheless, the two variables are statistically significant especially the domestic credit which is not surprising considering the claim of Zhong, Yingwei and Yuanyuan (2018), who argued that the time of the initial opening-up reforms in China, credit opportunity was an institutionalized concern and not individual credit based because it was believed that China's financial problems emerged due to default associated with the individual credit system as well as its interrelated aspects of accounting, auditing, and rating system Jun, Kai, Ming, Yue and Xuefei (2018) found that China's financial sector remains fairly low because there are other aspects that require further improvements including accounting, auditing, and taxation. Additionally, the negative results produced by total reserve (TRSV) as well as credit to the private sector (DCRP) are similar to those found in the studies conducted on financial development in Nigeria Abubakar, Omoshola and Aminu (2016) and Victor and Samuel (2014).

Table 6. Cointegration results

Cointegrating Equations:	Cointegrating Equation (1)	Cointegrating Equation (2)
FDIX(-1)	1.000000	0.000000
FMAI(-1)	0.000000	1.000000
DCRP(-1)	-0.053959	-0.077049
Standard Error	(0.01796)	(0.01972)
Test Statistics	[-3.00384]	[-3.90677]
RGDP(-1)	1.26E-06	1.43E-06
Standard Error	(1.6E-07)	(1.8E-07)
Test Statistics	[7.70548]	[7.94531]
TRSV(-1)	-0.000556	-0.000549
Standard Error	(0.00223)	(0.00245)
Test Statistics	[-0.24898]	[-0.22357]
C	-3.474037	-2.181134

Source: Author's computation using Eviews10

### 3.4. Vector Error Correction results

Given that our variables of interest FDIX, FMAI, DCPS, RGDP and TRSV are first difference stationary I(1) and a cointegrated relationship has been established for estimating the Vector Error Correction Model (VECM), the (VECM) results are presented in Table 7 below:

Table 7. Short run and error correction model estimates

Variables	Coefficients	Standard Error	Test- Statistics	Probability
Constant	-0.094084	0.044925	-2.094214	0.0499
$FDIX_{t-1}$	-0.390561	0.200245	-1.950410	0.0660
$FMAI_{t-1}$	0.116292	0.061609	1.887583	0.0745
$DCRP_{t-1}$	0.004740	0.001576	3.007986	0.0072
$RGDP_{t-1}$	1.55E-07	7.83E-08	1.979875	0.0624
$TRSV_{t-1}$	-0.000341	0.000254	-1.341425	0.1956
$ECM_{t-1}$	-0.147748	0.068516	-2.156387	0.0441
STATISTICAL TESTS:		DIAGNOSTIC TESTS:		
$R^2$	0.578016	$B-G$ Serial Corr. LM Test		0.4512
Adjusted $R^2$	0.311500	$B-G-P$ Heteroscedasticity Test		0.9943
Schwarz Criterion	-2.643343	Q-Statistics: see appendix		> 0.05
F-statistic	2.16876	Jarque-Bera Test		0.871786

Source: Author's computation using Eviews10

Table 7 above presents the error correction estimates and short run-dynamics as well as the statistical and diagnostic tests results. Since, Cointegration among the variable of interest has been established and the most appropriate technique (*i.e.*, VECM) has been applied, it follows that the error correction term ( $ECM_{t-1}$ ) indicates how the system adjust to its long-run state of equilibrium. The coefficient of the  $ECM_{t-1}$  must be negative and significant to restore long-run equilibrium in the following period. Consequently, our model satisfies this condition because the coefficient of the one period lagged ( $ECM_{t-1}$ ) has a negative sign (-0.1477 approximately) and is statistically significant (0.0441). This negative sign indicates that the system is capable of converging to its long-run state of equilibrium after some disturbances.

The value of 0.1477 indicates that about 15% of the adjustment is corrected every year. This implies that the speed of adjustment will take about 7 years on average for the long run equilibrium to be fully converged after the disorder in the opening up policies in the financial system in china. This has coincided with the recent preparations and measures taken by the Chinese government to review its financial system decision affecting both domestic and foreign investors and its financial system in general by the end of 2018 (Yi Gang Governor People's Bank of China, 2018). However, given the nature of the developing and emerging markets in China, the results of our model produce some degree of confidence. This is supported by the work of Jun *et al.* (2018), who argued that the opening-up policies of financial the market sector in China are still not overwhelming because international financial organizations encounter some form of restrictions in connection to the ownership and scope of businesses, thereby restricting their market share access in China.

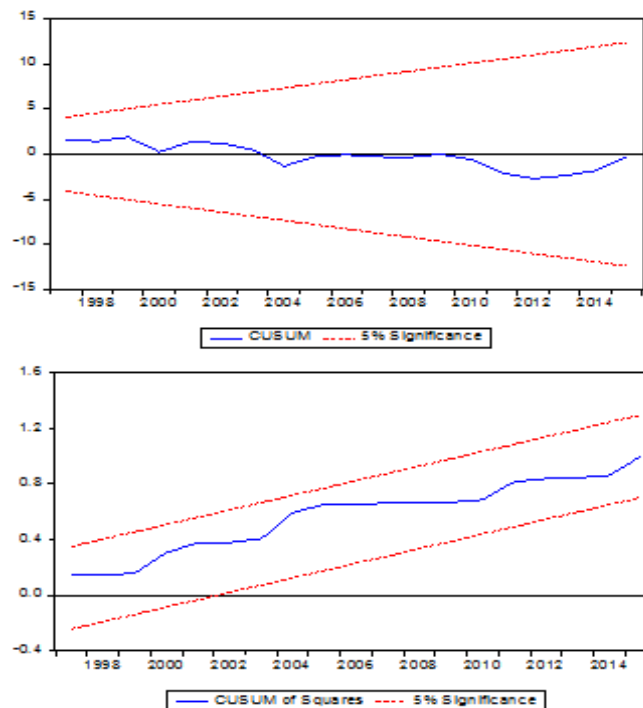
Zhong, Yingwei and Yuanyuan (2018) argued that the openness of China's financial market has lacked some form of coordination among submarkets coupled with the lack of a harmonized means of opening-up and

perfect foundations since its establishment. It was argued that further development of the opening-up policies to international financial market standards would lead to the improvements in the financial market sector in China. By implication, this will no doubt strengthen china's competitiveness to gradually play a more central role in the international financial development and consequently impact on its economic performance. The short-run coefficients indicate that only domestic credit to the private sector has more impact on financial development in China. This finding is supported by Zhong, Yingwei and Yuanyuan (2018), who stated that credit in China, has been more of an institutionalized issue rather than individually credit based. This explains one of the reasons for China's high economic performance due to the fact that it creates the suitable environment and opportunity for the private sector to obtain financing and consequently stand and develop as well as transforming into a mixed economy rather than a communist one. In general, the short run coefficients are largely significant given a relatively good fit from R-squared and adjusted R- squared ( $R^2$  and adjusted  $R^2$ ).

### 3.5. Robustness checks

The Table 7 also presents the estimates based on the econometric criterion on the residual of the conditional EC. The diagnostic and stability results validate the goodness of fit of our model econometrically as well as satisfactorily based on the fact that it has passed all the major econometric tests which include: normality test, autocorrelation test and heteroscedasticity test. In addition, the stability test for Cusum and Cusum of squared test. Overall, these robustness checks have established strong evidence of the goodness of fit of our model and consequently confirm that applicable inference can draw with a high level of confidence.

Figure 1. Cusum and Cusum of squares



Source: Author's computation using Eviews10

Brown, Durbin, and Evans (1975) recommendation provided an important insight with respect to the stability of a given model using the Cusum tests. The conditions stipulate that if the Cusum and Cusum of squared plots fall within the 5% significance boundary, then the ECM model is stable but if the plots fall outside the boundary, then the model is unstable. The Figure 1 above shows the recursive (stability) tests as well as that the stability of the parameters and variance estimates satisfied the stability conditions of the Cusum and Cusum of squared tests. As a result, our ECM model is stable.

### Conclusion

This paper investigates the relationship between financial market accesses, credit to the private sector and GDP on financial development for the period of 1980-2015. Our key contribution toward the literature is the investigation of the impacts of financial market access, credit to private sector and GDP on the development of the financial market sector in China using (VECM) approach, which is specifically seldom considered. The



technique has been applied to establish the causal associations both in the short-run and in the long run between the considered variables. Based on the empirical results of the study, we can conclude that the estimated unit root tests (*i.e.* ADF and PP) considered all variables as  $I(i.e[1s])$ . Afterward, two optimal numbers of lags were selected based on the recommendation of lowest values produced by (AIC) as well as (FPE) criteria. Thereafter, the Johansen test of cointegration reveals evidence of a long-run relationship among the variables in the model. Consequently, the coefficient of the one period lagged error correction term ( $ECT_{t-1}$ ) results supports the cointegration results because of the statistical significance and the satisfactory speed of adjustment (*i.e.*, the coefficient is negative and is statistically significance). Overall, the robustness checks confirmed the stability of the residuals in the model and the residuals are normally distributed as well as serially uncorrelated.

By implication, the study concludes that, domestic credit and real GDP have positive impacts on the development of the financial market in China, while financial market access and total reserves negatively impact on the development of the financial market sector in China. Resultantly, the study recommends the need for a broad and inclusive financial reform that will operate as a free market or a mixed economic system rather than pure communism that restricts market access to foreign investors in the country. Consequently, comprehensive credit and exchange rate policies should be guided by a legal and regulatory framework over time to evaluate the implementation of such policies in order to ensure confidence in the minds of both existing and prospective investors as well as to boost the domestic and international trades of China in order to achieve sustainable growth and development. These could inevitably treat the persistent opening-up policy problems among others and boost financial development in China. However, further studies could produce a deeper policy approach in the area that may be applicable in creating beneficial economic as well as financial market development policies that are principally designed towards accomplishing sustainable economic development.

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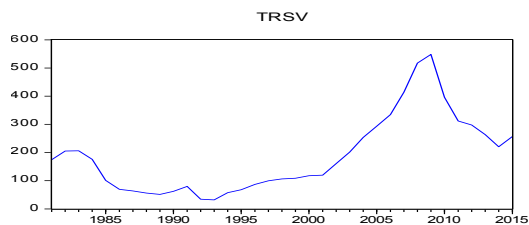
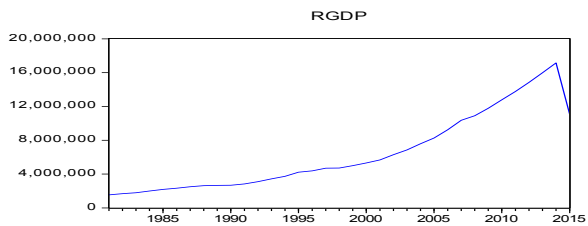
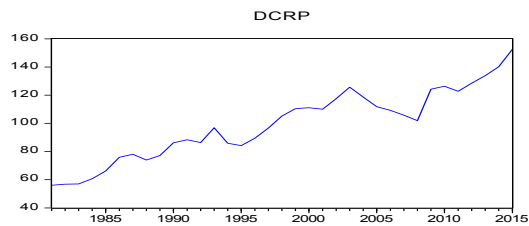
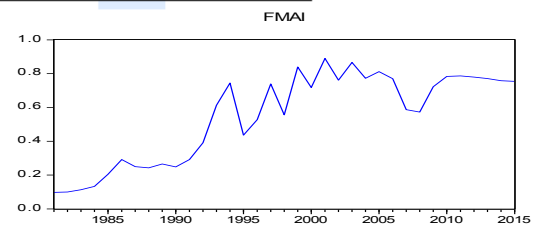
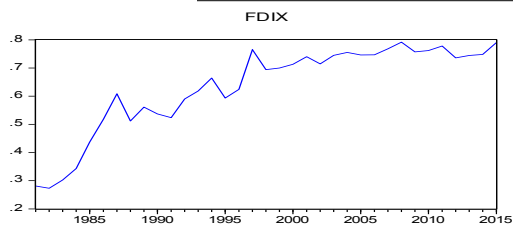


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APPENDIX

Sample: 1981 2015  
Included observations: 32

	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
1			-0.124	-0.124	0.5379	0.463
2			-0.017	-0.033	0.5482	0.760
3			-0.380	-0.393	5.9689	0.113
4			-0.039	-0.172	6.0286	0.197
5			-0.060	-0.165	6.1744	0.290
6			0.055	-0.197	6.3003	0.390
7			0.028	-0.144	6.3333	0.501
8			0.266	0.173	9.5353	0.299
9			-0.068	-0.052	9.7519	0.371
10			-0.032	-0.041	9.8039	0.458
11			-0.264	-0.137	13.424	0.266
12			0.011	-0.089	13.432	0.338
13			-0.094	-0.231	13.941	0.378
14			0.284	0.080	18.814	0.172
15			-0.057	-0.143	19.025	0.213
16			0.165	-0.024	20.868	0.184



## The Increasing Role of Internal Audit in the Banking System in the Context of Expanding the Range of Financial Services

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### Abstract:

The growing role of banking audit in the modern economy is associated with the expansion of the range of tasks assigned to it, so the focus is on a wider range of tasks involving a deep analysis of all areas of banking activity on which the overall efficiency of a credit organization, its liquidity and financial stability depend. Taking into account the fact that currently in Kazakhstan more and more attention is paid to the problems of improving corporate governance in the banking sector, as well as problems of improving the functioning of the banking system, developing new methods of organizing internal control and auditing and maintaining audit traditions that are adequate to the new realities, conditions of an unstable financial system, it becomes especially relevant. This article discusses the role of internal audit in the banking activities of second-tier banks of the Republic of Kazakhstan, discusses organizational and methodological aspects of conducting an audit of credit operations on materials of JSC Development Bank of Kazakhstan, and offers a number of recommendations to improve and strengthen the role of audit of commercial bank credit operations.

**Keywords:** loan portfolio; credit risk; internal audit; corporate governance; risk management

**JEL Classification:** G21; G24

### Introduction

The new economic model of development of our state, which had outlined in the Message of the President of Kazakhstan "Strategy Kazakhstan - 2050: the new political course of the established state" is based on a comprehensive economic pragmatism on the principles of profitability, return on investment and competitiveness. The solution of the ambitious tasks of entering the top 30 developed countries of the world makes it necessary to increase the role of the banking system as one of the fundamental spheres of the national economy.

The implementation of the Strategic Development Plan of the Republic of Kazakhstan until 2020, the introduction of performance-based budgeting, the upcoming transition to the International Financial Reporting Standards in the public sector from 2013, the implementation of activities of subjects of the quasi-public sector in

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accordance with the Law of the Republic of Kazakhstan "On State Property" require increased efficiency activities, as well as strengthening financial and other disciplines. In addressing these issues, the role of internal audit of the financial and banking sector is increasing, as an integral part of management.

## **1. Research background**

The growing role of banking audit in the modern economy is associated with the expansion of the range of tasks assigned to it, so the focus is on a wider range of tasks involving a deep analysis of all areas of banking activity on which the overall efficiency of a credit organization, its liquidity and financial stability depend.

As part of the analysis of the current issue of improving the quality and efficiency of auditing activities in the Republic of Kazakhstan in modern conditions, special consideration, in our opinion, requires an internal audit process as the main type development of companies of any level and structure.

The theoretical and methodological basis of the study was the work of local and foreign authors on the theory of management, banking and auditing. In the process of writing the article, the works of modern researchers who made a significant contribution to the development of the theory and practice of banking, management and intrabank control, such as: Tazhibaev (2015), Tanatova (2015), Dyusembaev (2016), Sheremet (2016), Zavarihin (2013), Shcherbakova (2013) and others.

The legal and factual basis are the legislative acts of the Republic of Kazakhstan regulating banking activities, regulations, international standards of banking and auditing. The article also used data from official banking statistics, materials of statistical reports published by domestic and foreign economic and financial institutions, as well as research centres.

The risk management processes of a second-tier bank are largely determined by its specificity. This is because each bank in Kazakhstan has its own specific niche, works with various customers, providing them with certain types of banking services. Properly organized internal control and audit is an effective preventive and post-regulatory measure, which allows not only to timely detect shortcomings in the Bank's activities, but also to take prompt measures to eliminate them.

The results of the external evaluation of the Bank's internal audit activities, in accordance with the International Standards and the Code of Ethics, demonstrate the high efficiency of the internal audit system, contributing to the achievement of the strategic objectives of a financial institution, using a systematic and consistent approach to assessing and improving the effectiveness of risk management, internal control and corporate governance systems.

In the article of Tazhibaev S.D. on improving the audit of credit operations by second-tier banks, it was noted that in conditions of tough competition in the field of banking products and services of the Republic of Kazakhstan, banks give particular importance to well-built corporate governance, which directly affects transparency, transparency and decision-making system in a financial institution, and strong the internal audit system is an important guarantor of success in this work, since the built-in internal audit system of the Bank ensures effective and effective measures to manage risks, strengthen internal control and improve corporate governance (Tazhibaev and Tanatova 2015).

In order to monitor the implementation of the program to improve the quality of internal audit, it is necessary to conduct an internal quality assessment, which includes:

- annual self-assessment of compliance with international standards and code of ethics;
- continuous monitoring of the work of audit assignments;
- achievement of key performance indicators of internal audit;
- the adequacy of internal regulatory documents and other activities.

According to the theory and methodology of audit and auditing activity, which is described by Dyusembaev (2016), internal control and audit at the Bank is carried out by the internal audit service, which is an independent structural unit that assesses the effectiveness of the internal control and risk management systems in all aspects of the Bank's activities in to ensure the efficient operation of the Bank and provide effective recommendations for its improvement.

In the framework of internal audit, it is checked:

- effectiveness of the risk management system;
- effectiveness of the procedure and processes of accounting to ensure timely, complete, accurate reporting to management and the authorized state body, including the processes of interaction between the departments of the Bank;
- effectiveness of the compliance risk management system;

- effectiveness of the processes and procedures for managing the risks of legalizing (laundering) illegal proceeds and financing terrorism is checked;
- effectiveness of the internal control system (Sheremet 2016).

First of all, in our opinion, this applies to credit operations, which can act in some cases with a high level of organization of credit work as the main source of stable bank profit, and in others in the absence of adequate control over the level of credit risk as the main factor in destabilizing the financial situation Bank. In this regard, the audit of credit operations of a commercial bank can be attributed to the most difficult and responsible areas of the bank audit. It seems that in the future, as Kazakhstan commercial banks move from speculative operations in financial markets to more active work with the real sector of the economy, while credit volumes grow, bank auditors will have to pay more attention to checking credit operations and assessing credit risk. We focus on organizational and methodological aspects of auditing credit operations. This applies to the selection and justification of the main directions of the audit, the development of a common audit organization, the definition of audit procedures and methods for obtaining audit evidence, and the maintenance of the working documentation of the auditor. To improve and strengthen the role of the audit of credit operations of a commercial bank, a number of recommendations can be offered, which are also considered in periodicals by such authors as Zavarihin, Shcherbakova (2013).

Based on the understanding of credit risk as a factor capable of having a decisive influence on the financial condition of a credit institution, the auditor needs to gather sufficient evidence to express a professional opinion on the reliability in all material aspects of the financial statements, but to assess the organization of the credit process, the effectiveness of credit risk management, and analyse the quality of the loan portfolio. In this regard, as the main objectives of the audit of credit operations of a commercial bank had invited to consider the following:

- establish the compliance of the credit operations conducted by the bank with the requirements of the current legislation;
- assess the quality of credit risk management;
- express a professional opinion on the compliance of the accounting requirements of the National Bank of Kazakhstan and reliability in all material aspects of the financial statements in terms of loans provided their security, accrued and received interest, provision for possible losses on loans.

The desire of domestic banks to become part of the global banking community should increasingly encourage them to quickly and appropriately address the issues of the place, role and importance of internal audit in the management of commercial banks, and determine the proper balance of internal audit with other forms and types of control, such as audit, external audit and internal control system. In addition, this will allow creating the prerequisites for improving the sustainability of the banking system of the Republic of Kazakhstan, enhancing the competitiveness of Kazakhstan's commercial banks on the world stage.

In this regard, we consider the comparative characteristics of certain types of control in commercial banks, which is shown in Table 1.

Table 1. Comparative characteristics of individual forms of control in commercial banks

Characteristic features of various types of control	Internal audit	External audit	Internal control (internal control system)	Audit
Goals	To solve the problems of bank owners: assess the effectiveness of control, accepted risks; expression of opinion; on the existing system of internal control at all levels of the bank, and based on this presentation of recommendations and advice on; management improvement	For expression opinions on the reliability of the bank statements	For control activities in the process of operational management, safeguarding assets and compliance held operations with legal requirements and internal rules and procedures	To establish the existing facts of violations of the law, regulatory documents and identify the perpetrators individuals.
Subordination	Accountable to the owners in the person of the general meeting of shareholders and the board of directors of the bank	Independent, outside organization	Executive bodies, in the face of the chairman of the board, president	By order of the board of directors, or executive body of the bank
Regulatory	Regulated by legislation regulatory documents and internal regulations of the bank	Regulated by law and normative acts of Kazakhstan	Regulated by legislation regulatory acts and bank internal regulations	Regulated by legislation; Regulatory acts and bank internal

Characteristic features of various types of control	Internal audit	External audit	Internal control (internal control system)	Audit
				regulations
Frequency of auditing procedure	At the request of the owners and in the mode established by them or their authorized bodies (by persons)	Required - annually, initiative - at the discretion of the governing bodies, conducted on selective basis	Conducted in accordance with schedule of control measures, or on separate instructions from the head of the executive management body	Periodic or one-time checks for detection and prevention of violations and abuses
Registration of results of checks	Reports conclusions and recommendations	Audit report in accordance with laws of Kazakhstan	Acts of checks lecture notes with conclusions and suggestions	Acts of audit with conclusions and proposals
Use of bank activities	Preparation of conclusions recommendations and draft decisions, oral consultations to improve the system corporate governance	Opinion on authenticity financial statements	Preparation according to the results of control measures conclusions offers, draft orders	Preparation of proposals for preservation of property of bank and identification of perpetrators in waste of bank funds

Source: compiled by authors

Based on analytical information and periodicals, as, for example, in his article Tovma N.A. which describes the development of internal audit in the Republic of Kazakhstan, it is noted that the audit program of the credit operations of a commercial bank is a detailed list of audit procedures for collecting audit evidence. The program should consist of two sections:

- to formulate an assessment of the credit risk management system. As part of the first section of the loan audit program, the auditor has asked to assess the ability of the bank to control the level of credit risk through effective organization of the loan process, careful study of borrowers' activities, their financial position and sources of debt repayment. It has recommended paying attention to checking the compliance of the established practice of conducting credit operations with the norms of the adopted credit policy and clarifying how it has being carried out both at the level of bank managers and at the level of executors;
- to collect a sufficient amount of audit evidence to express a professional opinion on the compliance of credit operations with the requirements of current legislation and accuracy in all material aspects of accounting and financial reporting in terms of loans provided, their security, accrued and received interest, provision for possible losses on loans. The second section of the program contains tests of controls and a list of audit procedures on the merits (Tovma 2015).

In the course of the audit, it is necessary to focus on the assessment of the quality of consideration of the loan application of the client and the subsequent observation of the loans. Special attention should be focused on the analysis of the content of the concluded credit agreements and verification of documentation related to the provision of loans. The most significant criteria for the classification of loans issued in the course of the audit had proposed to consider the terms of the loan, the subject of credit, the sector of the borrower, the region of the borrower, the quality of collateral, the degree of credit risk, profitability.

## 2. Methodology

As a comparative analysis in the field of conducting a bank internal audit, one can consider the loan portfolio of JSC Development Bank of Kazakhstan with similar financial development institutions.

In 2017, the total amount of loans issued by commercial banks amounted to 10.8 trillion tenge, of which 4.7 trillion tenge or 43.4% of all loans are long-term loans over one year. It is worth noting that compared to last year, the indicator for the total volume of loans issued increased by 10.2%. At the same time, 541.9 billion tenge has directed to long-term lending to non-commodity sectors of the economy: manufacturing, energy, transport and communications, second-tier banks.

During this period, in the framework of direct lending by the Development Bank, enterprises of non-primary industries were financed in the amount of 422.1 billion tenge or 78% compared with the volume of long-term loans issued by second-tier banks for lending to enterprises of non-primary sectors of the economy. In 2017, for the implementation of projects of the processing industry by the Development Bank, 339.8 billion tenge was issued or 80.5% of the total amount of financial resources issued by the Development Bank as part of direct



lending to non-primary sectors of the economy, which also amounts to 118.7% of the amount issued loans from second-tier banks to the manufacturing sector.

According to the financial statements of JSC "DBK, as of December 31, 2017, the volume of the loan portfolio of the Development Bank in the framework of direct lending amounted to 1,493 billion tenge or 81% compared to the total amount of actual debt on tier two banks directed to long-term lending to non-primary industries economy, according to the National Bank of the Republic of Kazakhstan. Which also amounts to 118.7% of the volume of loans issued by second-tier enterprises to the manufacturing sector (Table 2).

Based on the data presented in Table 2, such international financial institutions as the Eurasian Development Bank (EDB), the European Bank for Reconstruction and Development (ADB) carry out their activities on the lending market for the manufacturing industry and infrastructure in the Republic of Kazakhstan), The Islamic Development Bank (IDB), the European Investment Bank (EIB) and the World Bank Group, namely the International Finance Corporation (IFC), the International Bank for Reconstruction and Development (IBRD) and the International International Development Association (IDA).

Table 2. Comparative analysis of the credit activity of JSC "DBK" with similar financial institutions

Year	Long-term lending to non-primary sectors of the economy, in billion tenge			Share of the loan portfolio of Development Bank in comparison with the volume of long-term debt of enterprises of non-primary sectors of economy to STB, in billion tenge (as part of direct financing)		
	JSC "Development Bank of Kazakhstan"	STB	Share of DBK	JSC "Development Bank of Kazakhstan"	STB	Share of DBK
2013	81	343	24%	379	1072	35%
2014	231	377	61%	753	1151	65%
2015	262	399	66%	1368	1519	90%
2016	278	488	57%	1391	1708	81%
2017	422	542	78%	1493	1853	81%

Source: compiled by authors according to financial statements of JSC DBK

Bank constantly monitors the status of individual loans and regularly re-evaluates the solvency of its borrowers, and assesses the entire loan portfolio in terms of loan concentration and market risks. The maximum level of exposure to credit risk has reflected in the value of financial assets, for which they had reflected in the statement of financial position, and for obligations. As of the reporting date, the maximum credit risk amounted to (Table 3).

Table 3. Indicators of the status of individual loans of JSC "DBK" in thousands tenge

Indicator	2017	2016
Loans to customers	1,492,658,569	1,391,018,303
Loans to banks	67,999,981	212,912,815
Accounts and deposits in banks and other financial institutions	74,218,324	135,273,231

Source: compiled by authors according to financial statements of JSC DBK

At the end of 2017, the loan portfolio of the Development Bank amounted to 1,561 billion tenge, decreasing by 2.7% compared to last year. The decrease in the loan portfolio is associated with the repayment of loans issued by the STB in the framework of the replenishment of the working capital of the business through the mechanism of interbank lending. The share of the loan portfolio of total assets at the end of 2017 amounted to 60.9% (Table 4).

Table 4. Indicators of changes in the loan portfolio of JSC "DBK"

Indicator	2013	2014	2015	2016	2017
Loan portfolio, in billion tenge	379	815	1452	1604	1561
Level of provisions for the loan portfolio	12,2%	4%	1,7%	2,7%	4,8%
Dynamics of loan portfolio	10,2%	115%	78,2%	10,5%	-2,7%
Share of the loan portfolio of total assets	37,0%	62%	68,2%	65,5%	60,9%
Share of loans issued to customers from total assets	37,3%	57,6%	64,3%	56,8%	58,2%

Source: compiled by authors according to financial statements of JSC DBK

At the same time, the volume of direct lending (loans issued to customers) at the end of 2017 amounted to 1,493 billion tenge, an increase of 7.3% compared with last year. The share of direct lending from total assets

increased by 2.5% to 58.2%. At the end of 2017, the loan portfolio of the Development Bank decreased by 2.70% compared to the same indicator at the end of 2016, reaching 1,561 billion tenge. The currency structure of the loan portfolio of the Development Bank continues to demonstrate a positive trend to increase the share of loans in tenge. The share of loans in national currency in the structure of the loan portfolio increased from 44.1% in 2016 to 45.6% and amounted to 712 billion tenge in nominal terms as of December 31, 2017. At the same time, the share of loans in dollars amounted to 53.2%, which is 1.4% lower than the same period last year.

The tool of interbank lending has also used in the framework of lending to the SCP and small and medium-sized businesses (SMEs) for replenishing working capital. In 2016, second-tier banks had provided with funds in the amount of 82.8 billion tenge in order to finance UPC and 53.1 billion tenge - for financing small and medium-sized businesses. In March 2017, the program "Financing of working capital of UPC and SMEs" had completed, which resulted in second-tier banks financing 51 projects of UPC and 239 SMG projects. In addition, in order to increase the volume of support to domestic car assembly enterprises through the Development Bank, the Bank attracted 10 billion tenge of budgetary funds in December 2017, of which 8 billion tenge will be spent in 2018 through an interbank lending mechanism, and 2 billion tenge through an instrument leasing financing of JSC "DBK-Leasing" mastered in 2017.

The analysis of the loan portfolio in the JSC "Development Bank of Kazakhstan" allows us to identify problem areas that characterize the increased credit risk. In this regard, the target indicators of the credit risk management system in relation to the analysed bank can be formulated as follows:

- an increase in the share of standard loans;
- reducing the share of bad loans;
- reducing the size of non-performing loans.

The Development Bank has exposed to market risks associated with the presence of open positions at interest rates and currencies, mismatch of maturities of assets and liabilities exposed to the risk of changes in market conditions. Market risk management in the Development Bank has carried out by periodically assessing potential losses because of adverse changes in market conditions, as well as establishing and maintaining adequate limits on the amount of allowable losses and claims regarding the rate of return.

The analysis also showed that the bank has a well-developed credit policy defining management's approaches to the lending process and risk management. Risk management in the bank has given considerable attention. The Development Bank has developed a set of internal regulations and established regulated procedures for managing credit risk, including requirements for setting and adhering to the limits of the concentration of the loan portfolio. In order to measure credit risk, the Development Bank has introduced and uses a model for calculating the internal rating of borrowers, based on the methodology of the international rating agency Standard & Poor's.

### 3. Application functionality

The essence of the exponential smoothing method is that the time series is smoothed with the help of a weighted moving average, in which the weights follow the exponential law. This average can be used to estimate and current correction of the expectation of the process. A weighted moving average with exponentially distributed weights characterizes the process value at the end of the smoothing interval, being an average characteristic of the last levels of the series. This property has used in forecasting. Based on the existing inertia of economic processes, as a result of which the process in the forecast period takes place under approximately the same conditions as in the analyzed period, such a weighted moving average can be quite an effective tool for developing forecasts (Magnus and Katyshev 2014).

The time series prediction scheme using the exponential smoothing method, therefore, consists of the following steps.

1. Select the type of model of exponential smoothing.

2. The parameter is determined  $\alpha$  according to the formula:  $\alpha = \frac{2}{m+1}$  (1)

or given by the researcher.

3. Calculate the initial conditions.

4. Calculate exponential averages.

5. Estimates of the forecast model coefficients are determined.

6. Predicted one point ahead.

7. The deviation of the actual value of the time series from the predicted is found.

8. According to the recurrence formula:

$$S_t^{[k]}(y) = \alpha S_t^{[k-1]}(y) + (1 - \alpha) S_{t-1}^{[k]}(y) \tag{2}$$

New exponential averages are calculated, and according to them, the estimated coefficients of the forecast model are determined accordingly.

9. The forecast has carried out on two points ahead, etc.

To build forecast models, the following formulas had used:

Type of model: Linear

$$y_t = a_0 + a_1 t + \varepsilon_t \tag{3}$$

Initial conditions:

$$S_0^{[1]}(y) = a_0 - \frac{1-\alpha}{\alpha} a_1 \quad S_0^{[2]}(y) = a_0 - \frac{2(1-\alpha)}{\alpha} a_1 \tag{4}$$

Exponential averages:

$$S_t^{[1]}(y) = \alpha y_t + (1 - \alpha) S_{t-1}^{[1]}(y)$$

$$S_t^{[2]}(y) = \alpha S_t^{[1]}(y) + (1 - \alpha) S_{t-1}^{[2]}(y) \tag{5}$$

Ratio Evaluation:

$$\hat{a}_0 = 2S_t^{[1]}(y) - S_t^{[2]}(y) \quad \hat{a}_1 = \frac{\alpha}{1-\alpha} [S_t^{[1]}(y) - S_t^{[2]}(y)] \tag{6}$$

Forecast Model:

$$y_{t+l}^* = \hat{a}_0 + l \hat{a}_1 \tag{7}$$

Forecast errors:

$$\sigma_{y_{t+l}^*} = \sigma_{\varepsilon_t} \sqrt{\frac{\alpha}{(2-\alpha)^3} [1 + 4(1-\alpha)^2 + 2\alpha(4-3\alpha)l + 2\alpha^2 l^2]} \tag{8}$$

The boundaries of the interval in which 95% of the possible Y values will be concentrated with an unlimited number of observations and  $t = 1$  ( $a + bt_p \pm \varepsilon$ )

$$\text{where: } \varepsilon = t_{krit} S_y \sqrt{\frac{1}{n} + \frac{(\bar{x} - t_p)^2}{\sum (\bar{x} - t_p)^2}} \tag{9}$$

As a smoothing interval for calculating the parameter,  $\alpha$  we will take a three-year period. Hence, the quantity  $\alpha$  calculated by the formula is 0.3.

Table 5. Forecast values of the developed forecast models

Indicators	2013	2014	2015	2016	2017	Forecast		
						2018	2019	2020
Loan portfolio, billion tenge	379	815	1452	1604	1561	2108,1	2423,4	2738,7
Model equation:	y = 315,3 t + 216,3							
Coefficient of determination R <sup>2</sup>	0,848							
Standard equation error	243,5993							
t-statistic	3,182							
F-statistic	16,7531							
Level of provisions for the loan portfolio, in %	12,2	4	1,7	2,7	4,8	0,25	-1,36	-2,97
Model equation:	y = -1,61 t + 9,91							
Coefficient of determination R <sup>2</sup>	0,376							
Standard equation error	3,7906							
t-statistic	3,1820							

Indicators	2013	2014	2015	2016	2017	Forecast		
						2018	2019	2020
F-statistic	1,804							
Dynamics of loan portfolio, in %	10,2	115	78,2	10,5	-2,7	3,15	-9,88	-22,91
Model equation:	$y = -13,03 t + 81,33$							
Coefficient of determination R <sup>2</sup>	0,16							
Standard equation error	54,5983							
t-statistic	3,1820							
F-statistic	0,5695							
Share of the loan portfolio of total assets	37	62	68,2	65,5	60,9	74,11	79,24	84,37
Model equation:	$y = 5,13 t + 43,33$							
Coefficient of determination R <sup>2</sup>	0,422							
Standard equation error	10,9535							
t-statistic	3,1820							
F-statistic	2,1934							
Share of loans issued to customers from total assets	37,3	57,6	64,3	56,8	58,2	67,14	71,24	75,34
Model equation:	$y = 4,1 t + 42,54$							
Coefficient of determination R <sup>2</sup>	0,4							
Standard equation error	9,1614							
t-statistic	3,1820							
F-statistic	2,0028							

Source: compiled by authors

## Conclusion

Currently, in the context of expanding the range of financial services and the relationship of commercial banks with other financial institutions, competition between them for attracting customers, deposits, interbank loans and other credit resources is becoming tougher (Sedelev 2015). The success of banking, the stable operation of the bank, the degree of confidence in it from the founders, shareholders and customers largely depend on the proper organization of its management, qualifications of personnel, the reliability of its accounting and reporting data, and therefore, there is an urgent need for an independent control over the activities of banks - internal banking audit, the purpose of which is:

- establishing the reliability of the accounting (financial) statements of banks;
- compliance of the performed banking operations with the current legislation and regulations of the National Bank;
- verification of compliance of the conducted banking operations with the general conditions of their conduct, as well as compliance of the procedure for conducting banking operations with the internal rules of the bank;
- in accordance with this goal, the following tasks of a bank audit can be distinguished, which are described in more detail by such authors as Melnik and Panteleev (2013);
- verification of compliance with current legislation;
- check the status of accounting statements;
- checking the quality of bank management;
- assessment of the credit policy and quality of credit risk management, etc.

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## The Impact of European Central Bank Operations upon Monetary Aggregates of the Eurozone

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### Abstract:

The European Central Bank is central bank of the eurozone. ECB represents the top subject of the European System of Central Banks as the monetary authority of Economic and Monetary Union in Europe. The ECB's monetary analysis is based on the fact that money supply growth and inflation are linked with each other. The paper quantifies the impact of the ECB operations upon monetary aggregates M2 and M3. Selected determinants of the analysis were ECB operations as - marginal lending facility, interest rate on marginal lending facilities, deposit facility, main refinancing operations, minimum reserves system and debt security issued. The monthly ECB data for the period from January 2016 to June 2018 were examined by using a linear regression analysis. The analysis confirmed the hypothesis that the main refinancing operations are statistically significant for monetary aggregates M2 and M3.

**Keywords:** European Central Bank; monetary aggregates; refinancing operations; minimum reserves system; marginal lending facility; deposit facility; model

**JEL Classification:** E580; E520

### Introduction

The ECB has a major position in defining the monetary policy of the Eurosystem. The primary objective of the Eurosystem is to maintain price stability in the euro area, thus protecting the international value of the euro, its purchasing power. The ECB's approach to processing, evaluating and comparing information is relevant to assessing risks to price stability and economic analysis. Within the monetary analysis have an important role monetary aggregates. The ECB regularly sets the key interest rates for the Eurosystem – the interest rate on the main refinancing operations, the rate on the deposit facility and the rate on the marginal lending facility. In order to achieve defined monetary policy objectives. The ECB also uses support tools to achieve the objectives - the payment system TARGET2, statistics and securities settlement. ECB since the establishment of the euro has assigned a prominent role of monetary aggregates in the application of decisions making process based on two analytical perspectives -pillars. Nowadays, monetary aggregates and monetary analysis based on aggregates represent the tools of control. The ECB monitors the development of monetary aggregates, which differ according to the degree of liquidity. The operational objectives of the European central bank are short-term interest rates. The Eurosystem's operational framework is designed to be able to refinance and absorb excess liquidity. The Eurosystem thus interferes with the structure of the banking system in accordance with the objectives of the single monetary policy.

### 1. Literature review

Establishment of the ECB and the Eurosystem is considered as a success. The ECB has successfully fulfilled its basic mandate to maintain price stability, although euro area inflation has slightly exceeded 2% per year. Monetary theory guides the central bank's monetary policy on two key instruments to ensure its primary objective - price stability.

The first instrument is to determine the refinancing rates to which the ECB affects, respectively controls short-term interest rates on the money market. However, longer-term financial instruments can be provided by both the public and the private sector, as a result of which the ECB cannot manage the money market and control the

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interest rate. On the other hand, the success of the euro has its own "dark sides", Wyplosz (2006). One of the criticized areas deals with the ECB's monetary strategy. Since its formation, the ECB has been criticized for its monetary policy strategy, influenced by the approach of the German Bundesbank (De Grauwe 2003, De Haan 2005 *et al.*).

The evolution of ECB's monetary analysis can be divided into two different phases. In the first phase, which lasted from the introduction of the Euro in 1999 until 2003, the ECB assigned a prominent role to money growth. During the second phase, from 2003 to 2007, the ECB's monetary policy reduced the role of money growth. Research that highlighted empirical and theoretical limitations of money-based indicators, notably Bordes *et al.* (2007) and Alves *et al.* (2007), supported these developments. After a review of the ECB's monetary policy framework in 2003 the 1st and 2nd pillars became the "economic analysis" and the "monetary analysis". Comprehensive sets of information obtained from both pillars were mutually compared and studied through global DSGE models.

The ECB relied on the monetary analysis to extract long-run inflationary signals from monetary aggregates, to crosscheck the information from the economic pillar. The emphasis shifted first to M3 and credit growth, which were also seen as early warning indicators of financial imbalances (ECB 2004), and then to a broad range of monetary and financial variables. The search for a new approach became evident in a high-level conference organized in 2006 (Stark 2006). Starting from 2007, with the onset of the financial crisis, liquidity provision and restoring confidence in the financial market became the ECB's focal point. This provided further challenges to monetary analysis as traditional results were more difficult to interpret. At the same time the ECB had started a comprehensive research program aimed at strengthening the analytical underpinnings of its monetary analysis (Papademos and Stark 2010).

A change in ECB monetary strategy, defined by monetary expert De Grauwe as follows: "The ECB has reduced the importance of money supply (M3) in its monetary policy strategy and well done. There is no reason to pretend that money supply is the main variable to be monitored. This variable is so devalued by the great disturbance that it rarely gives the right warning signal about the threat of future inflation" (De Grauwe 2003). As noted by de Grauwe, the ECB has missed an opportunity to thoroughly modernize its strategy, remove the ambiguity, and explicitly and transparently adopt flexible inflation targeting. The Governing Council clarified that "in the pursuit of price stability, it aims to maintain inflation rates below, but close to, 2% over the medium term". The change in the definition of price stability to "below but close to 2%" is an improvement, but some completely unnecessary ambiguity remains. This is a change in the right direction, but it is not enough (Svensson 2003). According to results of econometric analysis made by Berger, Coenen and Wieland (2006) presented that current ECB decisions on interest rates were obviously influenced by considerations of the monetary pillar.

The main factors underlying the current changes in monetary policy are assessments of the future development of the real economy and prices. Most of the econometric estimates of reaction functions did not confirm (Gerlach 2004) that changes in the quantity of money influenced the ECB decisions on interest rates. The analysis of the ECB's monetary policy for the member states shows that almost all euro area member states had lower nominal interest rates in 1999-2004 as a result of their EMU membership compared to the previous monetary regime. In the absence of an EMU, these countries would have more restrictive monetary policies than the ECB regime (Hayo 2006).

## 2. Methodology

The aim of this paper is to quantify the relationship between monetary aggregates M2, M3 and selected operations of the ECB. Monetary aggregates contain information about future price developments and thus are the basis of inflation. ECB announces a reference value for M3 growth. Since 1999, the annual growth rate of M3 has been set at 4.5% per year. To identify monetary aggregates<sup>41</sup>, which are closely related to the price level and interest rates are used the following three criterias:

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<sup>41</sup> The NBS monitored the following monetary aggregates: M0 = currency outside the bank, M1 = M0 + unfinished deposits (M1- narrow money), quasi money QM = terminated deposits + foreign currency deposits, money supply M2 = M1 + QM. Since its establishment on 1 January 1993, the NBS had monitored the development of monetary aggregates in the NBS methodology by the end of 2004. In 2005, the NBS examined the development of monetary aggregates in both the ECB methodology and the national methodology. Since February 2006, the NBS has been monitoring the monetary aggregates according to the ECB.

1. The stability of money demand is defined as the level of money supply, which has a stable relationship with the price level. The ECB assesses how the growth rate of money is consistent with price stability.
2. Money is a characteristic feature of leading indicator. The monetary aggregate includes information that can predict the future price level.
3. Controllability is defined as the growth rate of the monetary aggregate that the ECB can manage through monetary policy instruments.
4. The money supply in the euro area is defined by 3 aggregates. The Eurosystem has defined a narrow M1, an intermediate M2 and a broad monetary aggregate M3. These aggregates differ with regard to the degree of liquidity of the assets they include.

Table 1. Definitions of euro area monetary aggregates

Liabilities	M1	M2	M3
Currency in circulation	x	x	X
Overnight deposits	x	x	X
Deposits with an agreed maturity of up to 2 years		x	X
Deposits redeemable at notice of up to 3 months		x	X
Repurchase agreements			X
Money market fund shares/units			X
Debt security issued with a maturity of up to 2 years			X

Source: ECB Monetary analysis.

The definition of euro area monetary aggregates is based on:

- the definition of resident sectors. The money-issuing sector contains resident institutions described as monetary financial institutions whose issued liabilities are characterized by a high degree of liquidity. The money-holding sector comprises all non-MFI euro area residents, excluding central government. This sector principally includes households, non-financial corporations, insurance corporations and pension funds and other non-MFIs located in the euro area, as well as state and local government authorities and social security funds in the euro area. Central governments are considered to be a "money-neutral" sector, with one exception: central government deposit liabilities with a monetary character are included in the definition of the monetary aggregates of the Eurosystem. The names of individual entities that create monetary aggregates are compiled in the euro area methodology from MFI and central government liabilities;
- harmonized definitions of individual liabilities from the consolidated balance sheet of monetary financial institutions - MFIs<sup>42</sup>. The consolidated balance sheet of the MFI sector is the statistical basis for the calculation of the money supply in the euro area.

Monetary analysis is a separate but also an integral part of economic policy. It is separate from the point of view of the economy as a single money flow. The integral part is an analysis of economic development in the unity and contradiction of real and monetary relations. Monetary analysis is an important part of macroeconomic analysis that evaluates the national economy as a system with specific behavior based on macroeconomic aggregates. It deals with the monetary reflection of the investigated real processes. In general, monetary flows are derived from real flows, but if money flows are created, they can affect real processes.

### 3. Models definition

The models of monetary aggregates M2 and M3 have the character of linear aggregate models for the euro area. The aim of the paper is to quantify the impact of selected ECB operations on the development of analyzed aggregates.

Monetary aggregates M2, M3 models:

- dependent variables:  $M2_t$  = Monetary aggregate M2 in mil. €;  $M3_t$  = Monetary aggregate M3 in mil. €
- independent macroeconomic variables:  $MLF_t$  = marginal lending facility in mil. €;  $MLFrate_t$  = interest rate on marginal lending facilities in %;  $DF_t$  = deposit facility in mil. €;  $MRO_t$  = Main refinancing operations in mil. €;  $MR_t$  = minimum reserves system in mil. €;  $debt_t$  = debt security issued in mil. €.

<sup>42</sup> MFIs include three main groups: The first are the national central banks. The second group consists of resident credit institutions that receive deposits and provide loans. The third group includes mostly open-end money market funds.

Using these variables, the following model of monetary aggregate M2 was defined as:

$$M2_t = \beta_0 + \beta_1 MLF_t + \beta_2 MLFrate_t + \beta_3 DF_t + \beta_4 MRO_t + \beta_5 MR_t + \beta_6 debt_t + \varepsilon_t \quad (1)$$

The model of monetary aggregate M3 was defined as:

$$M3_t = \beta_0 + \beta_1 MLF_t + \beta_2 MLFrate_t + \beta_3 DF_t + \beta_4 MRO_t + \beta_5 MR_t + \beta_6 debt_t + \varepsilon_t \quad (2)$$

The selection of these variables was influenced by following reasons: MLF- marginal lending facility- commercial banks use these operations to obtain overnight liquidity from the central bank compared to the guarantee of eligible assets; MLFrate- interest rate on marginal lending facilities - the interest rate on marginal lending facilities represents the upper limit of the overnight money market rate; DF- deposit facility- commercial banks use this operation to deposit excess liquidity at a central bank; MRO- main refinancing operations- are regular liquidity-providing reverse transactions with a weekly frequency and a maturity of normally 1 week. These operations are executed by the NCBs on the basis of standard tenders. The main refinancing operations play a pivotal role in pursuing the objectives of the Eurosystem's open market operations; MR- minimum reserves system- required amount of cash that must be deposited by each commercial bank in the central bank's account. Minimum reserves system represents an important instrument of ECB 's monetary policy; Debt- the ECB issues debt securities if there is a need to change the Eurosystem's structural position vis-à-vis the financial sector. Debt certificates express the ECB's commitment to the holder. The main purpose of this instrument is to remove excess liquidity.

The article defined a hypothesis H1:

H1: Monetary aggregates M2 and M3 were dependent on the main refinancing operations of the ECB.

In this paper were analysed monthly data of the ECB, published by the Statistical Data Warehouse, for the period from January 2016 to June of 2018.

In the process of defining the models in the R program, the regression analysis function `lm ()` was used. Models equations took the form of linear function. In this analysis, was used methodology when the basic model 1 contains a delayed value of the dependent variable M2 respectively M3. This process ensured the removal of autocorrelation, as models consist of monthly or quarterly data are often burdened with problems of autocorrelation and heteroskedasticity. The first step was to verify the statistical significance of individual variables. According to the test results several insignificant variables were identified. The models of the monetary aggregate M2 and the monetary aggregate M3 had the character of linear model. In this case, the statistical significance of each variable was tested by `coefest`. Short time series of a monthly or quarterly character are often degraded by autocorrelation and heteroskedasticity. A new estimated variation-covariance matrix through the order `vcovHAC` achieved correct estimation of coefficients. According to the individual model tests, not all variables were statistically significant.

The monetary aggregate M2 includes, in addition to monetary aggregate M1, deposits with an agreed maturity of up to 2 years and deposits redeemable at notice of up to 3 months. Deposits can be converted into components of narrow money, but certain restrictions may apply, such as the need for prior notice or payment of penalties and fees. Deposits with a maturity of up to 2 years are subjects to a positive rate in determining the amount of minimum reserves required. This fact affected the results of the analysis. In the process of model creation, statistically insignificant variables were removed first. As non-significant variables were identified: minimum reserves required, interest rate on marginal lending facilities and marginal lending facility. The defined model contained these significant variables- deposit facility, main refinancing operations and debt security issued.

The regression analysis results are in the following table.

Table 2. Results of the regression analysis of the monetary aggregate M2

	Estimate	Std.Error	t value	Pr(> t )	
(Intercept)	5.361e+06	1.852e+05	28.943	2e-16	***
DF	-1.927e-01	6.074e-02	-3.173	0.00424	**
MRO	8.082e-01	1.205e-01	6.709	7.63e-07	***
Debt	1.012e+00	6.566e-02	15.406	1.31e-13	***
Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

Source: author's own elaboration

The first statistically significant determinant was deposit facility. The coefficient belonging to this determinant was -0.1927 that represented a negative impact on the development of the monetary aggregate M2.

If deposit facility would be 1 m € higher monetary aggregate M2 would decrease by 0.1927 m € with a probability of 99%. Statistically significant were the main refinancing operations. This tool of ECB characterized the ECB monetary policy. There are two different ways how ECB leads the partners of choice – standard tender and two-sided operations. The main refinancing operations affected the development of the monetary aggregate M2 positively. If the volume of main refinancing operations increased by 1 m € M2 would increase by 0.8082 m € with a probability of 99%. The regression coefficient  $\beta_6$  was 1.012. If the security debt issued increased by 1 m € M2 would increase by EUR 1.012 m €.

The model of monetary aggregate M2 had the final form as:

$$M2_t = 5\,361\,000 - 0.1927DF_t + 0.8082MRO_t + 1.012debt_t + \varepsilon_t \quad (3)$$

The model of monetary aggregate M2 was not impaired by any problem those individual tests of autocorrelation, heteroskedasticity and multi-collinearity demonstrated.

Table 3. Monetary aggregate M2 model test results

	jB test	Bgtest	dWtest	Vif
Model M2	0.192	0.6275	DW=1.83	< 5

Source: author's own elaboration

Based on the value of the coefficient of determination  $R^2$  we can assert that the model explained 96.24% of total variability. In this case 96.24% correctly explained the explanatory variable monetary aggregate M2 and the remaining 3.76% was a random component. According F-statistic (p-value  $< \alpha$  (4.955e-16  $< 0.05$ )), the model M2 was statistically significant.

The ECB pays the most attention to the monetary aggregate M3. The composition of this aggregate contributes to the fact that it is less affected by the substitution between different forms of liquid assets, so it is more stable.

Table 4. Results of the regression analysis of the monetary aggregate M3

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	8.146e+06	1.224e+05	66.553	2e-16	***
MLFrate	5.821e+05	5.850e+04	9.950	1.32e-09	***
MRO	1.777e+00	2.281e-01	7.791	9.14e-08	***
Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

Source: author's own elaboration

In creating the model of monetary aggregate M3, the statistical significance of the variables was tested first. The result of the coeftest showed that the model also contains insignificant variables as: marginal lending facility, deposit facility, minimum reserves system and debt security issued. Two determinants were statistically significant and influenced the development of the monetary aggregate M3. If interest rate on marginal lending facilities increased by 1% it would come to growth of monetary aggregate M3 by 582 100 m €. If ECB decided to realize the main refinancing operations monetary aggregate M3 would increase by 1.777 m € with a probability of 99%.

The final form of monetary aggregate M3 model:

$$M3_t = 8\,146\,000 + 582\,100MLFrate_t + 1.777MRO_t + \varepsilon_t \quad (4)$$

Table 5. Monetary aggregate M3 model test results

	jB test	Bgtest	dWtest	Vif
Model M3	0.699	0.7566	DW=1.869	< 5

Source: author's own elaboration

According to the coefficient of determination  $R^2$  is stated that the model explained 91.12% of the total variability. In this case, 91.12% correctly explained the explanatory variable monetary aggregate M3 and the rest 8.88% was a random component. If we looked at F-statistic we would see that p-value  $< \alpha$  (7.717e-11  $< 0.05$ ), the model was statistically significant. The statistical significance was also confirmed by the reset test where: p-value  $> \alpha$  (0.802  $> 0.05$ ).

According to the results of the regression analysis it is shown that the hypothesis H1, which identified the main refinancing operations to be statistically significant for the development of monetary aggregate M2 and monetary aggregate M3 was confirmed.

The monetary policy strategy can be defined as a coherent structured description of the monetary policy decision-making process. The strategy represents two important roles. It defines the precise structure of the monetary policy-making process. In practice, it means that the Governing Council of the ECB has the information and analysis necessary to make the right decisions. It is the internal dimension of the strategy. Secondly, the strategy is a framework to justify the decisions to the public. It creates the outer sphere of strategy. Changing the monetary policy strategy when economic analysis was the first pillar and the second pillar monetary analysis was considered as the right step by De Grauwe (2003).

The monetary aggregate M3, which was analysed by De Grauwe and Svensson (2003) was devalued by external information and did not provide the correct data to identify the threat of future inflation. Econometric analysis used by Berger (2006) pointed out that the ECB's interest rate decisions weren't based on the monetary pillar. The opposite results of monetary aggregates analysis were published in ECB's paper *Interpreting Monetary Developments since mid-2004*. Monetary analysis was defined in details as the second pillar of the monetary strategy. ECB examined the structure of monetary aggregates, mainly M3, short and long-term causality between M3 and euro area inflation (ECB Monthly Bulletin, July 2007).

According to Brunnermeier and Sannikov (2014) researchers can decide to analyse monetary aggregates from money view or credit view. Two schools of thought have fought over the two different prime quantities. Tobin and Brainard (1963) approach focused on credit on the asset side of banks' balance sheets. Banks may shift their asset and loan allocation, in times of crisis they may be unwilling to provide credit and instead park their funds in safe assets. In contrast, monetarists following Friedman and Schwartz (1963), focused on the liability side of banks' balance sheets. This money view reflects the link between broad money supply and inflation that matters. This view focuses on the transaction role of money. On the other hand, there exists a portfolio rebalancing effect in crises. This effect leads to artificial distortions in statistics: M3 growth becomes artificially overstated. There may be also an accompanying shift to safer forms of savings, which shows up as an increase in M2. Implicitly, the ECB has already modified its monetary growth decision criteria by resolving to ignore M3 growth in 2001-2003. In contrast, after 2004, M3 growth correlated more strongly with credit expansion. The ECB indirectly applied a modified M3 growth criterion during that period.

## Conclusion

The aim of this paper was to quantify the relationship between monetary aggregates M2, M3 and ECB 's operations. The ECB pays attention to the monetary aggregate M3. The composition of this aggregate is less affected by the substitution between different forms of liquid assets. The monthly ECB data for the period from January 2016 to June 2018 were examined by using a linear regression analysis. According to model test results was confirmed the hypothesis that the main refinancing operations were statistically significant for monetary aggregates M2 and M3. If the volume of main refinancing operations increased by 1 m € M2 would increase by 0.8082 m €. If ECB decided to realize the main refinancing operations monetary aggregate M3 would increase by 1.777 m €. The ECB relies on the monetary analysis to extract long-run inflationary signals from monetary aggregates. It was confirmed by research published in ECB's paper *Interpreting Monetary Developments since mid-2004*. In contrast, De Grauwe, Svensson, Stark considered monetary analysis less important than economic analysis, which has become 1st pillar of monetary policy.

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## An Analysis of the Educational Structure of the Population in the Slovak Republic on the Basis of Selected Macroeconomic Indicator

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### Abstract:

The aim of the article is to evaluate the educational structure of the population of Slovakia and its educational potential in relation to gross income at the level of NUTS III (at regional level). Trusted information on household and population incomes is among the most important for many economic and political reasons in each country. Revenue data is tracked by multiple sample surveys and the data is analyzed by various methods, which in our case is the definition of the Educational Potential of Society (EPS) indicator from the SODB (Statistical Database of the Slovak Republic) collected every 10 years. The article provides the results of such generalizations assuming there is a statistical correlation between the average gross wage and the educational level within the regions of the Slovak Republic. The analysis of the results obtained with the help of correlation and regression analysis points to the possible dependence between the studied variables, which, on the basis of selected methods, bring a characteristic and coherent picture of the problem under consideration.

**Keywords:** EPS (Educational Potential of a Society); educational structure; levels of education; average gross wage.

**JEL Classification:** N34; H50; I21; E60; O15; J30

### Introduction

The trend of decreasing income inequalities in Slovakia during the period of growth of production and employment was interrupted by the onset of the economic crisis. Since 2010, wage inequalities have begun to increase. The slowdown in economic growth, coupled with the uncovering of labor market problems, was accompanied by an increase in inequality for the first time since the end of the transformation of the Slovak economy. The development of the inequalities in the gross wages of the Slovak Republic population has been influenced by factors such as developments in employment and wages or persistent problems of structural and long-term unemployment that have hindered the growth of wages (Pauhofová *et al.* 2016).

In recent years, Slovak and Czech authors have published several interesting articles focused on household income analysis based on micro-census data, EU SILC micro-data, or Eurostat databases. Modeling of household incomes was done by Pacáková *et al.* (2012), in the Czech Republic Bartošová (2007); factors affecting household income by Šoltés and Labudová (2008); regional differences by Vojtková and Labudová (2010) as well as Petr *et al.* (2010).

Statistical analyzes of sample data and the generalization of results in the basic set provide sufficiently accurate and reliable information on the level and variability of the highest gross monthly salaries of employees in the Slovak Republic in 2010, as well as on the factors causing their differentiation. Such information can be useful for a number of economic and political decisions, for example at the moment when deciding on higher tax burden on top earners (Pacáková *et al.* 2012).

Measuring the quality and skill levels of the workforce in society as a whole, as well as measuring regional development from a variety of perspectives, represents a long-term socio-economic problem, as confirmed by a number of scientific studies (Stefko *et al.* 2010, Dubravská and Širá 2014, Fazekašová *et al.* 2014, Adamišín and Vavrek 2015, Huttmanova *et al.* 2015, Mura *et al.* 2015, Sira *et al.* 2016, Suhányiová *et al.* 2016, Mustafin and Gira 2016, Valentiny *et al.* 2017).

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## 1. Literature review on the educational structure from the perspective of the statutory provisions

Education and training in kindergartens, elementary schools, secondary schools, primary schools of arts, language schools, schools for children and pupils with special educational needs and school facilities is carried out in accordance with Act no. 245/2008 Coll. on education and training (the Education Act) and on the amendment and supplementation of some laws as amended. They are governed by Act No. 61/2015 Coll. on Vocational Education and Training and on amendments to certain acts, Act No. 596/2003 Coll. on state administration in education and school self-government and on the amendment and supplementation of some laws as amended and Act no. 597/2003 Coll. on the financing of elementary schools, secondary schools and school facilities, as amended. In the past, basic education, secondary education and higher education have been used to classify grades. At present, Slovak school legislation already uses a classification derived from the international ISCED classification (MESRandS).

ISCED is an international standard that serves as a tool for compiling, assembling and presenting comparable indicators and statistics on education both within countries and internationally (Steinmetz 2012). Regional education as a system has several components. Its main role is provided by educational programs in the following types of schools: Pre-primary education is obtained in kindergartens (in terms of international classification it is ISCED 0), primary schools, grades 1-4, which form the first level of elementary school, primary education (ISCED 1) is obtained and grades 5 to 9, which form the second level of primary school, receive lower secondary education (ISCED 2). Secondary schools provide several levels of secondary education – lower secondary education (ISCED 2C), ISCED 3 higher secondary education: secondary vocational education (ISCED 3C), full secondary general education (ISCED 3A), full secondary vocational education (ISCED 3A ) and ISCED 4 post-secondary education below tertiary, ISCED 5, first level of tertiary education, e.g.: higher vocational education (ISCED 5B), ISCED 6 second level of tertiary education (European agency); (Riddell *et al.* 2012).

The topic of higher education development in Slovakia is very current in recent years. The majority of the professional public understands the need for quantitative growth of higher education, especially in the context of increasing the educational level of society. The development of higher education in the Slovak Republic and, in particular, its rapid development after 1989 resulted in a rather dense network of colleges at present. However, their size, focus, level, or tradition varies. These are parameters that, besides the main parameters of their availability, play a role in the relationship of college - the place of permanent residence of students. From the point of view of public education, it is the total number of students enrolled in public higher education institutions in the Slovak Republic, a slightly downward trend can be observed. While there were 195,194 students enrolled in 2008/2009, there are only 180,149 students in 2010/2011. On average, for the other two years, there can be seen a year-on-year decrease in the number of students. The causes may be many, from demographic to competitive (outflow of students to non-public colleges), (Gurňák *et al.* 2011).

### 1.2. Wage inequality versus income situation

Wage is legally characterized by § 118 (2) of Act no. 311/2001 of the Labor Code as "cash performance or payment of the monetary value (natural wage) provided by the employer to the employee for work. The following are not included in the wage: wage compensation, severance payments, severance allowances, travel allowances, including non-refundable travel allowances, social fund contributions, supplementary pension savings allowances, employee life insurance contributions, capital gains or bonds, tax bonus (Majtán *et al.* 2005).

The terms of the impact of the minimum wage in the V4 countries were focused on by Nademlelová *et al.* (2017). Wage inequality issues and the relevance of wage (regional) inequality are one of the serious issues and concerns of Central and Eastern European countries. In many countries in the region, the rise in wage inequalities and, at the same time, very low wages lead to the rejection and non-use of the economically active population, the rise in unemployment, or to its departure for work abroad. In Slovakia too many people refuse offered jobs or leave for work abroad, which indicates that the labor price, *i.e.* wage policy also has some shortcomings in our country. Relative wages are in many cases not adapted to the needs and requirements of the population (in terms of inflation, basic living costs, travel and commuting costs, *etc.*), while not reflecting relative productivity, possibilities of employers and regions (Michálek 2007).

Gonda (2015) considers investment in human capital to be uncompromising from the aspect of minimum wage and labor market functioning. It means that people with higher human capital (with a higher level of education) have higher levels of economic activity, lower unemployment rates and higher income levels than those with lower levels of education. Unemployment rates, in particular, are a phenomenon of low-skilled people. In this context, investment in human capital and education brings higher personal and social returns. An active

labor market policy is considered more effective in terms of reintegration of jobseekers and emphasizes the need to invest in education, training and skills development with the emphasis on raising the monthly wage in employment.

### 1.3. Concepts of Income

Income is, according to economists, in contrast to wage, the amount one literally gets. Income is therefore the receipt of money, which is also achieved by exchange, income is what is valued at the prices normally used at the given place and at a given time - according to the type, quality, or the degree of wear. The income is, for example, the amount received from renting the property.

In income distribution analyzes, a distinction is usually made between two income concepts. The first is post tax post transfer (disposable income), which is the net income after deduction of benefits, taxes and levies. This is the income that the household has at its disposal. The second concept is the so-called market income of the household (market income). This is the income that will arise if people do not pay any taxes and levies and receive no benefits. In such a situation, the household income would only come from earnings in the labor market, capital income, savings or other sources produced by the private sector (Gerbery 2010).

According to Luluha *et al.* (2005), the income situation of household members in Slovakia is strongly dependent on the size and composition of the family, from the life cycle stage in which it is located. Young families with more dependent children, families of the unemployed and retirees are among the lowest-income and high-risk of poverty categories. For an objective assessment of the income situation, it is important to distinguish the individual person managing separately and more individuals who manage together in one household. The form of income and its stability also play its role.

## 2. Methodology

The aim of the article is to evaluate the educational structure of the population of Slovakia and its educational potential in relation to gross income at the level of NUTS III (regional level). From the data collected from the PHHC (Population, Housing and Home Census), the Educational Potential of the Society (EPS) for each region has been identified. As the Statistical Office of the Slovak Republic carries out such complex censuses only once in 10 years, the data used is from the last two censuses in 2001 and 2011 when measuring the dependence between EPS and the selected macroeconomic indicator (average gross wage).

The hypothesis to be verified is:

**H<sub>1</sub>:** It is assumed that there is a statistical dependence between the average gross monthly wage and the educational structure of the population within the regions of the Slovak Republic.

An alternative hypothesis H<sub>0</sub> to this hypothesis has been created, which claims that there is no statistical dependence among the studied variables. Data processing and all analyzes were performed using the Gretl statistical software and MS Excel.

To measure the dependence between average gross wages and the educational level of the population, it was necessary to define an indicator that will help to quantify the educational level of the country's population in this case the Slovak Republic. There are several ways to measure the educational level of the population:

- education index, which is also one of the components of HDI;
- the education coefficient (EC1), which represents the sum of four times the relative share of the population with university education, twice the relative share of the population with secondary education and the one-fold the relative share of the population with basic education or without education;
- education potential of society, the advantage of which is that it attaches a higher weight to a higher level of education than a lower one, and this weight does not increase linearly.

In order to quantify the educational level of the population, the EPS indicator, which seems to be the most relevant, was chosen in our research. The educational potential of the society is expressed by the equation (Kulčár 2009):

$$EPS(r) = \frac{1}{r - \sum_{k=0}^r fk.k} \quad (1)$$

where:  $r$  – maximum value of set of values  $k$ ,  $fk$  – the relative representation of the population who have achieved the highest level of education the  $k$  level of education, and  $k$  – a rank number assigned to the appropriate level of education that can be obtained in the education system of the country concerned.

However, one of the problems in using this relationship is that the  $r$  parameter acquires different values in different countries. Therefore, when setting the set  $r$  it is recommended to harmonize different education systems in individual countries (Kulčár 2009).

From the original data for each of the 8 regions of Slovakia, the EPS was determined. It is clear from the above sign that for the grades of the educational structure the following 5 degrees were chosen as follows:  $k = 0$  (population without education or without stated education),  $k = 1$  (population with basic education or unfinished education),  $k = 2$  (population with secondary education without school-leaving certificate),  $k = 3$  (residents with secondary education with a school-leaving certificate or post-secondary education studies),  $k = 4$  (population with all three degrees of tertiary education - Bachelor's, Master's and PhD).

As the source provides data on the number of inhabitants per county, broken down by system based education level of the International Standard Classification of Education ISCED97, it was necessary to transform the relevant population numbers into the categories used in the calculation of the EPS indicator as follows:

Table 1. Mutual assignment of ISCED97 values and values  $k$

ISCED97	0-1	2	3	4	5-6
k	0	1	2	3	4

Source: (Kulčár 2009), own processing

The correlation and regression analysis was used to measure the dependence between the average gross wage and the educational level of the regions in Slovakia.

### 3. Results

The results of several scientific studies have shown that wages are in many cases not adapted to the needs and requirements of the population (in terms of inflation, basic living costs, commuting and travel costs, etc.), while not reflecting relative productivity, employers' regions. The basic socio-economic indicators that can assess the differentiated development of the regions include the average gross monthly wage. The average monthly wage increased over the entire monitored period 2001 - 2010 within the SR as a whole. However, the regional level increase was significantly different, resulting in the growth of regional disparities in this indicator.

Table 2 below shows the development of the monthly minimum wage, also in terms of the statistical survey of the average monthly wage (AW) and the valid legislation from 2001-2010.

Table 2. Development of monthly gross minimum wage and average wage, including developments since 2001

Year	Monthly gross minimum wage (MW)				The statistically determined average monthly wage for the year in question (AW)		MW/AW
	Sk/ month	€/ month	valid since	according to	Sk monthly	€ monthly	
2010	9 270	307.70	1.1.2010	441/2009 Coll.	23 167	769.00	40.01
2009	8 902	295.50	1.1.2009	422/2008 Coll.	22 429	744.50	39.69
2008	8 100	268.87	1.2.2008	663/2007 Coll.	21 782	723.03	37.19
2007	8 100	268.87	1.10.2007	450/2007 Coll.	20 146	668.72	40.21
2006	7 600	252.27	1.10.2006	540/2006 Coll.	18 761	622.75	40.51
2005	6 900	229.04	1.10.2005	428/2005 Coll.	17 274	573.39	39.94
2004	6 500	215.76	1.10.2004	525/2004 Coll.	15 825	525.29	41.07
2003	6 080	201.82	1.10.2003	400/2003 Coll.	14 365	476.83	42.33
2002	5 570	184.89	1.10.2002	514/2002 Coll.	13 511	448.48	41.23
2001	4 920	163.31	1.10.2001	411/2001 Coll.	12 365	410.44	39.78

Source: Own processing based on Statistical office of the Slovak Republic, 2012.

When measuring the relationship between the average gross wage and the educational level of the Slovak regions, the first step in the process will be the analysis for 2001.

### 3.1. Measuring the relationship between average gross wage and educational level of the Slovak Republic - Analysis for 2011

For the calculation of the correlation analysis, data on the average nominal wage and the levels of education level shown in Table 3 were used.

Table 3. Indicators of average gross wage and educational level for the regions of Slovakia for 2001

Region	AGW in €	ISCED 0-1	ISCED 2	ISCED 3	ISCED 4	ISCED 5-6	EPS
Bratislava	488	0.1881	0.1518	0.1917	0.2980	0.1704	0.5293
Trnava	340	0.2059	0.2286	0.2650	0.2401	0.0604	0.4386
Trenčín	342	0.2076	0.1888	0.2690	0.2651	0.0695	0.4545
Nitria	321	0.1985	0.2480	0.2487	0.2400	0.0647	0.4394
Žilina	334	0.2264	0.2001	0.2524	0.2521	0.0690	0.4419
Banska Bystrica	325	0.2176	0.2321	0.2225	0.2577	0.0701	0.4406
Prešov	304	0.2571	0.2181	0.2226	0.2415	0.0608	0.4221
Košice	356	0.2394	0.2094	0.2154	0.2607	0.0751	0.4391

Notes: AGW – average gross monthly wage, ISCED – the relative representation of the population for each ISCED category (International Standard Classification of Education), EPS – the educational potential of society

Source: (SOSR and SODB), author's calculation

For verification, the Pearson correlation analysis performed using MS Excel analytics tool was used. The results of the Pearson correlation analysis, which contain the correlation coefficients of all pairs of variables, are shown in Table 4.

Table 4. Correlation analysis of Average Gross Wage and educational level for 2001

	AGW	ISCED 0-1	ISCED 2	ISCED 3	ISCED 4	ISCED 5-6	EPS
AGW	1.0000						
ISCED 0-1	-0.5657	1.0000					
ISCED 2	-0.8240	0.2535	1.0000				
ISCED 3	-0.5954	-0.1036	0.4142	1.0000			
ISCED 4	0.9107	-0.4398	-0.8870	-0.6068	1.0000		
ISCED 5-6	0.9772	-0.5140	-0.8082	-0.6888	0.9128	1.0000	
EPS	0.9747	-0.6626	-0.8209	-0.5191	0.9195	0.9737	1.0000

Notes: AGW – average gross monthly wage, ISCED – the relative representation of the population for each ISCED category (International Standard Classification of Education), EPS – the educational potential of society

Source: (SOSR and SODB), author's calculation

Pearson's correlation coefficient reached 0.97468, which represents a very strong direct relationship. Since the p-value (.0000) is lower than the test level  $\alpha = 0.05$ , the  $H_0$  hypothesis is rejected and the correlation coefficient is considered statistically significant.

In the regression analysis, the statistical significance between the dependent variable  $y$  - the average gross wage and the independent variable  $x$ , which is an indicator of the EPS level of education, is detected. Using the GRETL analytical tools, the point estimates of the regression function parameters listed in the following Table 5 are processed.

Table 5. Point estimation of regression function parameters

Point estimation of regression function parameters	Coefficients	Standard error	t Stat	P-value
Locating constant / Intercept	-414.1	71.8605	-5.763	0.0012
EPS	1698	159.075	10.68	0.00004

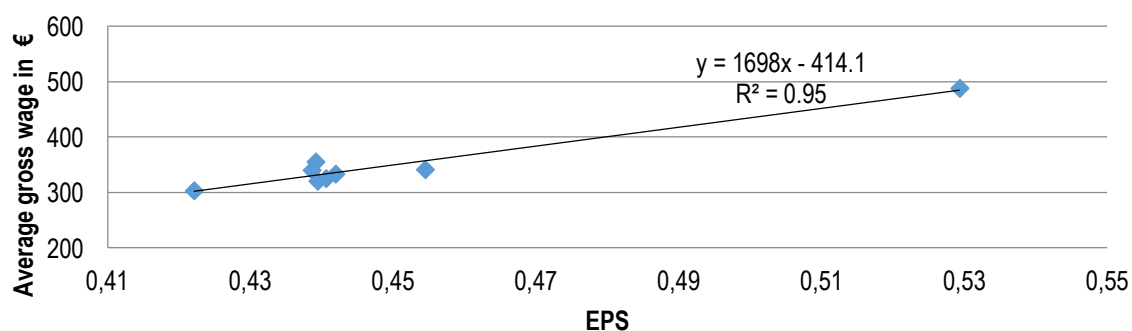
Source: author's calculation

Based on the data from Table 4 can be identified the coefficient  $b_1$  (EPS), whose value is 1698 and the locating constant  $b_0$ , whose value is -414.1. Based on these facts, it is possible to formulate a linear regression equation:  $AGW = 1698EPS - 414.1$ .

The correlation coefficient of 0.97468 points to a correlation, and the 0.95 determination coefficient indicates that 95% of the unemployment rate is dependent on the increase (decrease) in the educational level. The locating constant -414.1 represents the expected value of the unemployment rate at the zero level of the educational level. The regression coefficient 1698 indicates by how many units of measure the average gross monthly wage will change when the EPS changes by one unit.



Figure 1. Dependence of the unemployment rate on the level of education for 2001



Source: author's calculation

### 3.2. Measuring the relationship between average gross wage and educational level of the Slovak Republic - Analysis for 2011

To calculate the correlation analysis, data on the average nominal wage and the levels of education level listed in Table 6 were used.

Table 6. Indicators of average gross wage and educational level for the regions of Slovakia in 2011

Region	AGW in €	ISCED 0-1	ISCED 2	ISCED 3	ISCED 4	ISCED 5-6	EPS
Bratislava	972	0.1521	0.0955	0.1712	0.3194	0.2617	0.6423
Trnava	692	0.1671	0.1651	0.2648	0.2880	0.1150	0.5047
Trenčín	647	0.1649	0.1293	0.2693	0.3115	0.1251	0.5270
Nitra	629	0.1642	0.1698	0.2576	0.2885	0.1199	0.5077
Žilina	670	0.1892	0.1390	0.2476	0.2946	0.1296	0.5093
Banska Bystrica	613	0.1852	0.1643	0.2247	0.3025	0.1233	0.5036
Prešov	569	0.2200	0.1700	0.2179	0.2752	0.1170	0.4761
Košice	684	0.2180	0.1549	0.2018	0.2947	0.1306	0.4914

Notes: AGW – average gross monthly wage, ISCED – the relative representation of the population for each ISCED category (International Standard Classification of Education), EPS – the educational potential of society

Source: (SOSR and SODB), author's calculation

The hypothesis  $H_1$  is still being verified (It is assumed that there is a statistical dependence between the average gross monthly wage and the educational structure of the population within the regions of the Slovak Republic). The  $H_0$  hypothesis has been re-created, which asserts that there is no statistical dependence between variables.

Table 7. Correlational analysis of the Average Gross Wage and educational level for 2011

	AGW	ISCED 0-1	ISCED 2	ISCED 3	ISCED 4	ISCED 5-6	EPS
AGW	1.0000						
ISCED 0-1	-0.5402	1.0000					
ISCED 2	-0.8494	0.4999	1.0000				
ISCED 3	-0.6135	-0.2128	0.4534	1.0000			
ISCED 4	0.6999	-0.6168	-0.8471	-0.3075	1.0000		
ISCED 5-6	0.9524	-0.4549	-0.8580	-0.7360	0.6928	1.0000	
EPS	0.9458	-0.6729	-0.8974	-0.5309	0.7994	0.9603	1.0000

Notes: AGW – average gross monthly wage, ISCED – the relative representation of the population for each ISCED category (International Standard Classification of Education), EPS – the educational potential of society

Source: (SOSR and SODB), author's calculation

For verification, the Pearson Correlation Analysis was used, constructed using MS Excel's analytical tools. The results of the Pearson correlation analysis, which contain the correlation coefficients of all pairs of variables, are shown in Table 7.

Pearson's correlation coefficient reached 0.9458, which represents a very strong direct relation since the p-value (, 0000) is lower than the test level  $\alpha = 0.05$ , the  $H_0$  hypothesis is rejected and the correlation coefficient is considered statistically significant. Since the correlation analysis confirmed the relationship between variables



in both cases, *i.e.*, for both 2001 and 2011, it is possible to state the following: the hypothesis  $H_1$  has been confirmed because there is statistical dependence between the average gross monthly wage and the educational structure within the SR.

In the regression analysis, there will be detected the statistical significance between the dependent variable  $y$  - the average gross wage and the independent variable  $x$ , which is an indicator of the EPS level of education. Using the GRETl analytical tools, the point estimates of the regression function parameters listed in the following Table 8 have been processed.

Table 8. Point estimation of regression function parameters

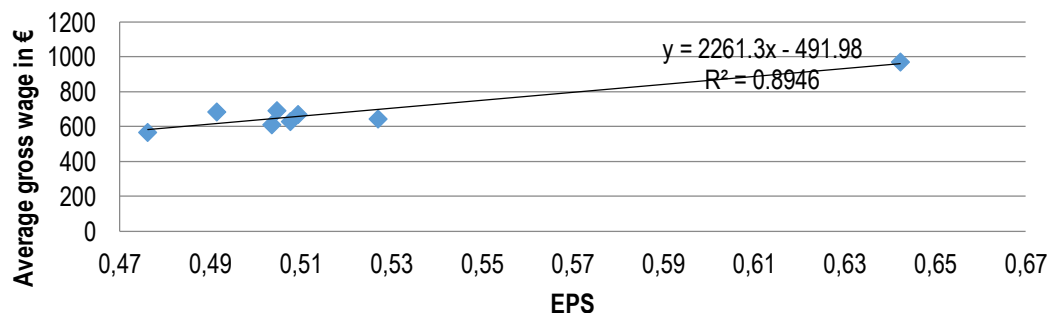
Point estimation of regression function parameters	Coefficients	Standard error	t Stat	P-value
Locating constant / Intercept	-491.9	165.578	-2.971	0.0249
EPS	2261	316.907	7.136	0.0004

Source: author's calculation

Based on the data from Table 7, a coefficient  $b_1$  (EPS) whose value is 2261 and a locating constant  $b_0$  whose value is -491.9 can be identified. Based on these facts, a linear regression equation can be formulated in the form:  $PHM = 2261EPS - 491.9$ .

The correlation coefficient of 0.9458 points to the strong direct relationship, and the 0.894 determinant coefficient indicates that 89% of the unemployment rate is dependent on the increase (decrease) in the educational level. The locating constant -491.9 represents the expected value of the unemployment rate at the zero level of the educational level. The regression coefficient 2261 indicates by how many units of measure the average gross monthly wage will change, when EPS changes by one unit.

Figure 1. Dependence of the unemployment rate on the level of education for 2011



Source: author's calculation

## Conclusion

In the presented text the educational structure of the population in the Slovak Republic was analyzed based on a selected macroeconomic indicator. The selected macroeconomic indicator is the average gross monthly wage within the regions of the Slovak Republic. The analysis used a defined indicator of the educational potential of the company (EPS) from SODB (Statistical Database of the Slovak Republic).

The Pearson Correlation Coefficients results (2001) show a value of 0.97468, which represents a very strong direct relationship. Since the  $p$ -value (.00004) is lower than the test level  $\alpha = 0.05$ , the  $H_0$  hypothesis is rejected and the correlation coefficient is considered statistically significant. Measuring the relationship between the average gross wage and the educational level of the SR, *i.e.* year relationship analysis (2011) where Pearson's correlation coefficient reached 0.9458, which represents a very strong direct relationship. Since the  $p$ -value (.0004) is lower than the test level  $\alpha = 0.05$ , the  $H_0$  hypothesis is rejected and the correlation coefficient is considered statistically significant.

Since the correlation analysis confirmed the relationship between variables in both cases, *i.e.*, for both 2001 and 2011, the following can be stated: the  $H_1$  hypothesis has been confirmed, therefore it can be concluded that there is statistical dependence between the average gross monthly salary and the educational structure within the SR.

Attempts to restore training to competition character are currently led by the Ministry of Education of the Slovak Republic to various reforms, the application of which should ultimately contribute to the reduction of education institutions and education animosities caused by errors in the past.

Further research will also focus on the area of elasticity of employment and labor productivity in order to extend the knowledge in the field of research, taking into account historical development and more objectivizing of the results obtained.

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## Procedural Justice of Government Agencies in Banyumas Regency

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### Abstract:

This research has two objectives: 1) identifying perceptions of justice in government agencies on the process of performance appraisal and participation in decision making; 2) Identifying the perception of justice in Banyumas Regency of local government agencies from the employee's point of view. Data analysis was conducted by performing a regression analysis. The sample of this research was generated from SKPD in Banyumas Regency; conducting the survey did data collection. A total of 137 respondents participated in this study that was a representation of 23 SKPD in Banyumas Regency. The results of this research indicate that formalities in incentive system on local government have a significant effect on perceptions of distributive justice of employees in their agencies, but participation in performance evaluation was found not to affect employee perceptions of local government in Banyumas Regency. The implication, formal methods have a more significant impact on employee such as on with written form, objective and clear.

**Keywords:** procedural justice; performance evaluation; employee participation

**JEL Classification:** D23; D90

### Introduction

The topic of performance evaluation system still dominates the research on management accounting (Harris and Durden 2012). Furthermore, Harris and Durden (2012) explain that the performance evaluation system still mastering both the practice and research on management accounting. This condition leads the researcher to conduct deeper analysis on performance evaluation system by focusing on both the aspect of performance measurement and the process of performance evaluation, which in this case related to how top directors complete a performance evaluation. The performance evaluation system develops by considering not only the financials information/ accounting but also non-financial information as performance measurement. Those aspects are observed by Franco-Santos, etc. (2012) by developing conceptual concepts to understand the consequence of contemporary performance measurement system that consists of performance measurement of financial and non-financial and the basic theory in these consequences.

The literature on organisations explains that participants in organisation establish perception regarding fairness about the procedure conducted by organisation to them which later this perception will explain the outcome of the important job such as motivation, commitment and task performance (Hartmann and Slapnicar 2012). One of the procedure in an organisation that is perceived as fair is the practice of performance evaluation. Hartmann and Slapnicar (2012) state that the characteristic, which leads to fair performance evaluation, is limited.

Normatively, the principle of procedural fairness consists of consistency and accuracy. Therefore, top directors with those characters in conducting the evaluation will be assessed as more fair in the evaluation process. However, Hartmann and Slapnicar (2012) argue that there is still a lack of literature in explaining the behaviour or actual procedure that may lead to the enhancement of consistency and accuracy to obtain fairness. Lack of theoretical basis causes inconsistent result in predicting the influence of fairness on the characteristic of performance evaluation in previous researchers. The example of a characteristic of performance research, in this case, is the non-financial measurement, which is considered accurate but inconsistent.

This research attempts to find out the performance evaluation not on measurement metrics (financial and non-financial), but more into the process of performance evaluation, which is conducted in the organisation. The trade-off that occurred between consistency and accuracy causes fairness is valued no longer from the measurement of performance evaluation but the process of performance evaluation. Characteristics of evaluation process cover the formality of performance evaluation and junior participant in the process evaluation. This research tests the influence of the process of performance evaluation on the perception of fairness procedural.

It is substantial for the organisation to design the performance evaluation by the organisation's objectives and apply it to obtain the strategic objective of the organisation. It has been presented that the design of performance evaluation has been developed along with the development of the organisation and influenced by both the culture and behaviour of the individual in the organisation. This aspect can be observed from the current researches, which find out the performance evaluation not only from the organisation but also the individual in it.

The replication in this research is completed by testing the generalisation level in all the findings in previous researches on a different context. Leung (2005) in Agritansia and Sholihin (2011) argued that fairness procedural need to be tested in a different context. It indicates that the influence of fairness procedural cannot be generalised in all contexts. Previous research, Hartmann and Slapnicar (2012) find out the impact of the performance evaluation process in the banking industry. The result shows that participation (voice) affects the perception of fairness procedural.

Fairness perception may impact the behaviour of the individual in running his job. The higher the fairness perception may increase the motivation, commitment and performance; therefore this research aims to confirm the prediction that the performance evaluation process affects the fairness perception. The research is conducted in Local Government of Banyumas Regency by assuming that evaluation system has been built to assess employee performance. However, thus far there is still no evaluation to find out how far the performance evaluation is rated as fair by the employee as of increase their motivation and commitment. The result of this testing is expected to confirm that the correct performance evaluation process may result in a fair assessment by employees who are willing to increase their motivation and commitment.

The system of performance evaluation is used by the organisation to motivate their member based on regulation and target that have been set. Local government is entrusted agent of the provincial government in conducting some government activities, while province government is representative of a central government that is located in the province. Achievement of the target from central government could be achieved when local government can reach the target for each area. The contribution of performance evaluation system as the control to the employees' behaviour of the local government is gaining target from each region.

Banyumas Regency has 27 local government work units (SKPD) based on Peraturan Daerah No. 25, 26 and 27 in 2009. SKPD in Banyumas Regency is the representative from province government in Semarang. Existing research regarding fair performance evaluation system is conducted in the non-government organisation. This research aims to test the fairness perception of a civil servant in Banyumas Regency that will contribute to the performance evaluation system of a civil servant in Banyumas Regency. This research is the basic research in the first year that is expected could identify the condition of local government employees in assessing the performance evaluation system in their institute. Formality and involvement in preparing the performance target are two independent variables, which are used in this research to identify the condition of those two variables in SKPD in Banyumas Regency. Further, if this research finds that employees feel fair enough, further research will develop the performance evaluation system, which is more competitive. While if this research finds that employee does not feel fair enough, further research will focus on the performance evaluation system which more fair and feasible in local government.



Research regarding the performance evaluation was first developed by Hartmann and Slapnicar (2009) who test if the formality of performance evaluation influences the trust level of the individual to their top directors. Hartmann dan Slapnicar (2009, 2012) view performance evaluation not from the performance measurement metrics but rather from performance evaluation process which in this case is the formality level of performance evaluation in organisation and role of junior's participation (voice). Hartmann dan Slapnicar (2009) tests the impact of performance evaluation process, which are formality level, to the trust through procedural fairness perception and feedback quality. Hartmann dan Slapnicar (2012) add characteristic in the performance evaluation process, which is not only formality level but also the participation of junior (voice). Both characteristics of the evaluation process are tested whether they have a significant impact on fairness procedural. The result of the research by Hartmann dan Slapnicar (2012) indicates that in uncertain condition, voice has a more significant impact on fairness procedural.

In Indonesia's context, research which focuses on fairness procedural perception has been developed by Agritansia and Sholihin (2011) and Desriani and Sholihin (2012). Agritansia and Sholihin (2011) develop previous research of Lau and Moser (2008) who test the impact of non-financial performance evaluation to the managerial performance which is mediated by fairness procedural, by adding individual trust as influence mediation of non-financial measurement and managerial performance. While Desriani and Sholihin (2012) develop research of Hartmann dan Slapnicar (2009) by adding a factor of distributive justice and test the influence of trust on the budget gap.

This research contributes to the testing of the influence of working evaluation's process on the perception of procedural fairness in the Government's organisation. Desriani and Sholihin (2012) research the aerospace industry, which has different characteristics compared to this research. Evaluation of the working system is one of an important factor in the development of human resources in local government. The graduate students of the college in Indonesia are interested in contributing in Central Government Agency or Non-Government Organization because that agency provides fair performance evaluation for all of its members. If this research could be done, it is expected that the Local Government Agency provide more fair performance evaluation. It is predicted that by evaluating performance evaluation system, therefore Local Government could be one of the favourite workplaces for graduate students of the college in Indonesia. The domino effect from fair performance evaluation system is the equalisation of human resources with great quality for both in Central and Local Government Agency. Therefore the development of both agencies may move forward quickly to obtain the country's purpose.

The general purpose of this research is to investigate how the process of performance evaluation may influence the perception of procedural fairness. Specifically, this research purposes:

- evaluate the impact of performance evaluation formality to the procedural fairness;
- evaluate the impact of junior participation in the performance evaluation process to procedural fairness;
- identify the fairness condition of performance evaluation system in local government of Banyumas Regency.

## **1. Literature review**

### **1.1. Prior research**

The purpose of a performance evaluation system is to implement the strategy. The strategy defines an important factor in designing performance evaluation system is that if the factor is measurable and valued; it will motivate individuals to obtain it (Anthony dan Govindarajan 2007). In designing the performance evaluation system in the organisation, the clear objective organisation is needed to fulfil the interests of every stakeholder.

Merchant and Otley (2007) state that in the organisation, the job can be evaluated in many forms. One of the methods of classifying the performance evaluation is by differentiating the measurement, which is financial and non-financial. Some evaluation criteria are being proposed by Merchant and Otley (2007), which are congruence, informativeness, objectivity and timelines that could be used to differentiate some job measurement as good or bad. The general thing in defining whether the measurement is good or bad is whether the measurement is reflecting the progress in obtaining the organisation's objective.

Procedural fairness referred to the social psychology consequence from fairness variation that emphasises on procedure effect in fairness evaluation (Thibaut and Walker 1975 in Lau and Moser 2008). It is explained that: perception of procedural fairness will increase satisfaction; procedural fairness is the most important determinant in procedure choices; high procedure of process control leads into high fairness valuation.



Related to the job measurement, junior will assess a job as fair if: performance evaluation is based on accurate and complete information; reflect the long-term concerns; contain conditions that refuse unfair evaluation; reflect control job; protect its interest; indicate polite and courteous behaviour (Lau and Moser 2008).

The procedure will be perceived as fair when it is consistent during a period and between individuals, free of bias, accurate, contain mechanism in repairing wrong decision, related to the concept of common morality and represent an individual opinion. The control system of management has an aspect of procedural fairness because the control system of management is based on the procedure that defines how far objective could be applied, job measurement and awards (Langevin and Mendoza 2013).

The previous researches find out the impact of procedural fairness to the individual behaviour that will increase their performance. However, the impact may vary whether direct or indirect (Supriyadi 2010). Procedural fairness in performance evaluation has been found influence job satisfaction through confidence level to top directors, organisation commitment, and fairness of outcome (Lau *et al.* 2008). Model in this research is re-testing by using different subject to evaluate the generalisation of research results by Sholihin and Pike (2009). The result shows that there is no difference compared to previous research by Lau *et al.* (2008). However, there is an inconsistent result regarding the testing of the influence of performance measurement on the perception of procedural fairness. While Lau and Moser (2008) indicate that perception of procedural fairness manager is fairer in non-financial performance measurement because it is assumed to be more complete and accurate. One of the reasons for the inconsistent aspect of this research is the importance of the performance evaluation process.

Formality construction of performance evaluation was first built by the research of Hartmann and Slapnicar (2009), which test the model of the performance evaluation system that is being used by top directors and their junior. Formality construction of performance evaluation was developed by Hartmann and Slapnicar (2009), based on the result of previous researches which indicate that performance evaluation system has potential impact to the belief, and also raise the question regarding which performance evaluation system aspect that impacts the belief and its impact. Based on this, Hartmann and Slapnicar (2009) interest to test the performance evaluation process to understand how formal performance evaluation is conducted in the organisation.

Hartmann and Slapnicar (2012) suggest second characteristics in the performance evaluation process that is the participation of junior in performance evaluation process. Hartmann and Slapnicar (2012) bring up the characteristic of participation in the performance evaluation process to increase the consistency and accuracy of the performance evaluation process. Leventhal (1980) in Libby (1999) defines participation as the ability of junior to participate by communicating their opinion to top directors. Voice is applied in previous researches (Libby 1999, Lindquist 1995) to test the fairness perception in budgeting setting.

## 1.2. Theory

Hopwood (1972) focused on the performance evaluation by testing the role of accounting data in performance evaluation. In this research, Hopwood (1972) found out that top directors used accounting information as a formal information source for evaluating the performance of junior. Performance evaluation system is developed by considering not only financial/accounting information but also non-financial information as the performance measurement. That aspect was also tested by Franco-Santos *et al.* (2012) by developing a conceptual framework to understand the consequences of contemporary performance evaluation system that consists of financial and non-financial performance measurement and theoretical background of these.

Previous researches were conducted to find out the impact of performance evaluation on the behavioural consequences of the individual from the measurement matrix that is being applied. Lau and Buckland (2001) found out the impact of performance measurement by applying financial dimension to the job pressure by using trust and participation. Lau and Buckland (2001) find that performance measurement, which focuses on the financial measure indirectly affects the job pressure through trust and participation. Lau and Sholihin (2005) tested the impact of the non-financial measure on job satisfaction through fairness and trust. An important finding in Lau and Sholihin (2005) is that both financial and non-financial performance measurement has an indifferent impact on job satisfaction. Hall (2008) tested the impact of a comprehensive performance measurement system to the performance through role clarity and psychological empowerment. This research focuses on the role of cognitive mechanisms and motivation in explaining the impact of management accounting to the managerial performance.

Hartmann and Slapnicar (2009, 2012) assessed performance evaluation based on performance evaluation process (not from performance measurement matrix), which in this case is the formality level of performance evaluation in the organisation and junior participation role (voice). Hartmann and Slapnicar (2009) tested the impact of performance evaluation process that is formality level to the trust through the perception of procedural

fairness and feedback quality. Hartmann and Slapnicar (2012) add characteristic in the performance evaluation process, which is not only formality level but also junior participation (voice). Both characteristics in the evaluation process were being tested its impact on the perception of procedural fairness. The result of their research indicated that under the uncertain condition, the voice was found to be more significant in affecting procedural fairness.

This research follows the research of Hartmann and Slapnicar (2012) that mentioned two characteristics of the evaluation process, which are performance evaluation formality and the importance of voice or involvement of junior in the decision-making process in performance evaluation process. In Indonesia, the research was completed by Desriani and Sholihin (2012), but participation was not added in performance evaluation.

This research expects that a formal approach in performance evaluation will affect the perception of procedural fairness when junior is given a chance to participate in the performance evaluation process. Formality will increase the consistency; while the voice is expected to increase accuracy in performance evaluation process because of the belief that junior is considered to be abler in controlling the outcome process (Hartmann and Slapnicar 2012). Langevin and Mendoza (2013) also state that participation is a communication tool between junior and top directors, which enables junior to earn information from top directors. Information sharing in participation will increase the accuracy of data being used in decision-making. Thus, the hypotheses were formulated as follows:

*H1: Formality affects the perception of procedural fairness*

*H2: Participation in performance evaluation affects the perception of procedural fairness*

## 2. Methodology

This research was completed by using a survey method in which a questionnaire is being distributed to the civil servant in Banyumas Regency. There are two reasons why the survey method was being applied in this research. Firstly, there is no public data documentation about the construct that will be used in this research. Secondly, study about fairness is being considered as private data, which requires data collection to be anonymous, applying the survey method easily attains this condition. (Hartmann and Slapnicar 2009)

This research will be accomplished in Local Government Work Units of Banyumas Regency that has already applied the performance evaluation system for their employees. There are some reasons why this research is completed in regency. Firstly, by focusing on regency, the researcher will be able to collect detail information for both individual and qualitative information. In this case, this research may relate detailed information in performance evaluation formality from the individual employee. Secondly, Local Government Work Units of Banyumas Regency has 27 agencies in the form of agency, inspector, hospital, and secretariat that may affect the variation in research variable; moreover, this research is completed at individual level.

Sample selection method in this research applies purposive sampling, with three criteria, which are:

- have already officiated in that position for at least a year to ensure their familiarity to the performance evaluation system;
- some top directors evaluate their performance;
- have already been evaluated.

There are two independent variables in this research, which are formality and participation. Formality variable of performance evaluation system is measured using an instrument that is developed by Hartmann and Slapnicar (2009). This instrument measures performance evaluation system as a latent construct. This construct is developed into three different sub-formality systems, which are:

- target setting formality is measured using 2 question items, namely whether target setting is made by top directors in written form and quantitative (more formal) or in vice versa;
- performance evaluation formality use 2 question items about how top directors conduct performance assessment, whether it is based on objective and quantitative (more formal) information or vice versa where they use self-assessment and qualitative (less formal);
- rewarding formality is measured using 4 items, that indicate objectivity in deciding reward. All of these instruments are stated in the Likert scale of 5 points with numerical scaling, which in this case when the value is close to 1 means less formal, and vice versa, when the value is close to 5 means more formal.

Participation in performance evaluation is measured using an instrument that is developed by Hartmann and Slapnicar (2012). In this research, participation is measured by the extent to which individuals are allowed to

take part in deciding the objectives and actively giving feedback in the performance evaluation process. Three question items are developed, which are:

- asking whether the job's objective is defined by considering junior's suggestion;
- whether in evaluating the performance, top directors consider the junior's explanation;
- whether in deciding the job's objective, top directors consider uncontrolled factors.

The dependent variable in this research is procedural fairness that is measured by four questions items, which are developed by Hartmann and Slapnicar (2009). Question items include the extent to which the respondent believes that the subsystem from the target setting, performance measurement and rewarding, and the overall system, are directed to the determination of fair salary.

Hypothesis testing 1 and two are completed to find out whether performance evaluation formality and participation may impact procedural fairness perception, which later completed by having multiple regression analysis. To test each hypothesis, the t-test is completed to find out whether there might be a linear impact between independent and dependent variables. The result of t-test can be seen from its significant level, if the significant level is under error level that is 0.05 or 5%, therefore, it is concluded that the independent variable affects the dependent variable.

Determination coefficient is applied to test the goodness-fit from regression model (Ghozali 2009). The value of determination coefficient is between zero and one. The low value of R<sup>2</sup> indicates that the ability of independent variables in explaining the variation of dependent variables is limited. When the value is close to one, means that the independent variables explain almost all of the information needed to predict the variation in the dependent variable. The basic weakness in using the determination coefficient is the bias to the number of independent variables in the model. Every addition of one independent variable will increase the value of R<sup>2</sup> without looking the fact whether that variable significantly affects the dependent variable or not. Therefore, many researchers suggest applying the adjusted value of R<sup>2</sup> in evaluating a regression model (Ghozali 2009).

F-test is completed to find out whether all independent variables in the model affect the dependent variable. Null hypothesis (H<sub>0</sub>) that will be tested is whether all parameters in the model are equal to zero or:  $H_0 = \beta_1 = \beta_2 = \dots = \beta_k = 0$ , means that the independent variables are not significantly affect the dependent variable. While the alternative hypothesis (H<sub>a</sub>) =  $\beta_1 = \beta_2 = \dots = \beta_k \neq 0$ , means all of the independent variables are significantly affect the dependent variable (Ghozali 2009). The method that can be applied to recognise whether the alternative hypothesis is being rejected or not is by conducting F-test. If the result of significant F-test < 0.05, H<sub>0</sub> is rejected, and H<sub>a</sub> is accepted. This indicates that the independent variables have statistic probability that is significant to the dependent variable.

### 2.1. Data collection

This research is completed by involving civil servant in Local Government Work Units (SKPD) of Banyumas Regency. The questionnaire is distributed to all of the Local Government Work Units (SKPD) of Banyumas Regency, in total 26. In total, 23 of SKPD become the sample of the research as they respond to the questionnaire. Total of 260 questionnaires are distributed to all of SKPD in Banyumas Regency, and later 145 questionnaires are returned, from 145 questionnaires, only 137 questionnaires are complete and can be used for the research. It relates to the completeness of the participant in answering the questionnaire.

The period for distributing and obtaining the data is sixty (60) days. To obtain the participant's seriousness in answering the questionnaire, the researcher gives an incentive in the form of goods and voucher for those people who meet the standard of responding, which mean valid answer. Table 1 shows the number of participants in this research.

Table 1. Number of participants

Sent to target Participant	260
Responded Questionnaires	145
Valid Questionnaires	137

Source: Primary Data

### 3. Results

The research instrument that was applied in the questionnaire had already been tested using a pilot test. The objective of the pilot test was to find out whether the research instrument is applicable in the research related to

its understanding in research instrument and validity test and reliability. Participants in the pilot test were different participants compared to the participants in the survey.

The pilot test involved 25 participants who were post-graduate students of FEB Unsoed. There are some reasons why post-graduate students were selected as the participants that (1) they have work experience. Therefore, they understand incentive system in their office, (2) understand the complexity of the research method. Thus, the participant in the pilot test may give feedback and suggestion related to the instrument used in the pilot.

### 3.1. Classical assumption test

#### 3.1.1. Multicollinearity test

The result of multicollinearity shows that the correlation between variables is under 0.6, indicating that there is no correlation between variables.

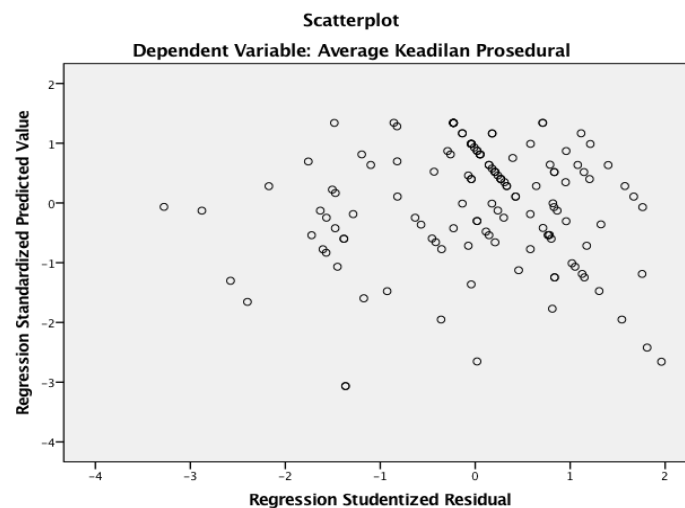
Table 2. Correlation test result

		Average Procedural Justice	Average Formality	Average Participation
Pearson Correlation	Average Procedural Justice	1.000	.446	.267
	Average Formality	.446	1.000	.288
	Average Participation	.267	.288	1.000
Sig. (1-tailed)	Average Procedural Justice	.	.000	.001
	Average Formality	.000	.	.000
	Average Participation	.001	.000	.
N	Average Procedural Justice	137	137	137
	Average Formality	137	137	137
	Average Participation	137	137	137

#### 3.1.2. Heteroscedasticity

The result of Heteroscedasticity Test is shown in the scatterplot graph below. The picture indicates that the data distribution does not tend to gather and to form a certain pattern. It shows that there is no heteroscedasticity in the data.

Figure 1. Heteroscedasticity test



#### 3.1.3. Autocorrelation Test

Autocorrelation test was conducted by applying Durbin-Watson and resulted in a score of 1.872. It shows that there is no autocorrelation in regression mode. Term and requirements of Durbin-Watson test to be free of autocorrelation is as follow: (1) there is positive autocorrelation if DW is under -2 ( $DW < -2$ ), (2) there is no autocorrelation if DW is between -2 and +2 or  $-2 < DW < +2$ .

### 3.2. Normality Test

The result shows that the score of asymptotic significant is  $0.827 > \alpha$  ( $\alpha = 0,05$ ). Therefore, we can conclude that the data is normally distributed. It indicates that the dependent variable is normally distributed in each category of independent variables.

### 3.2.1. Hypothesis testing

After all of the assumptions are fulfilled, hypothesis testing is conducted by applying a regression test. A regression test is completed to find out the impact of the independent variable on the dependent variable. There are two hypotheses in this research, which are H1: formality in performance evaluation affects the perception of procedural fairness, and H2: participation in performance evaluation affects the perception of procedural fairness. Multiple regression tests are completed to prove the hypothesis. The result of regression analysis can be seen in Table 3.

Table 3. Coefficients

Model	Unstandardized Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics		
	B	Std. Error	Beta			Tolerance	VIF	
1	(Constant)	1.036	.428		2.419	.017		
	Average Formalitas	.600	.119	.403	5.053	.000	.917	1.091
	Average Partisipasi	.149	.079	.150	1.887	.061	.917	1.091

Note: a. Dependent Variable: Average Procedural Justice

Based on the result of regression analysis table, it shows that first hypothesis that expects the correlation between formality and perception of procedural fairness is supported with the obtained sample data, while the second hypothesis that expects to test the relation between participation and procedural fairness is not supported with the obtained sample data.

## Conclusion

The result of this research shows that formality is seen by a civil servant in local government as an important thing in evaluating procedural fairness in its agency. An agency where its top directors do a formal performance evaluation is perceived as the existence of fairness in the agency by their employees. It is different from the result on hypothesis two; it shows that there is no correlation between employees' participation during the performance determination to the perception of procedural fairness. The finding on hypothesis two is interesting to get a future observation, to understand why employees' participation does not impact the perception of procedural fairness. This might be caused by the absence of participation in the making of performance incentive.

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## State Management of the Education System in the Conditions of Knowledge Economy Formations

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### Abstract:

The article discusses the role and importance of public administration of the education system in Kazakhstan, as the main factor of social and economic progress needed to support a competitive research base on a global scale and spread knowledge for the benefit of society. Based on a two-factor regression model, it is determined how the number of graduates of secondary schools and the number of colleges influence the number of universities in Kazakhstan. In addition, based on the results of a general assessment of the autonomy of state higher educational institutions of Kazakhstan, conclusions were drawn and priority directions of state administration were presented in modernizing the higher education system.

**Keywords:** education system; innovation; competitiveness; economically active population; government; public policy

**JEL Classification:** I25; I21; C51

### Introduction

The key for the future of any country is the skills and abilities of people, which testify to the priority of education and economic activity of the population in the world and in the long run the competitiveness of each country.

Higher education is the main driver of economic competitiveness in a globally expanding knowledge economy, and also contributes to social cohesion and well-being. In the context of globalization, higher education institutions need to develop the skills necessary to support a competitive research base on a global scale and spread knowledge for the benefit of society.

In the world community, the role and importance of education in recent years had considered as the main factor of social and economic progress. According to experts of the Organization for Economic Cooperation and Development (OECD), "the pace of basic long-term economic growth in OECD countries depends on maintaining and expanding the knowledge base. The comparative advantages of countries are less and less determined by the wealth of natural resources or cheap labour and, increasingly, technical innovation and the competitive use of knowledge. Economic growth today is as much a process of knowledge accumulation as a process of capital accumulation". N.A. Nazarbayev in his messages to the people of Kazakhstan.

The development of the intellectual potential of young people through improving the quality of education is one of the main priorities of the state policy of the Republic of Kazakhstan. Since independence, the national education system has been consistently modernized through the introduction of International Education Classification Standards. The main priorities for the development of the Kazakhstani education and science system until 2020 were: ensuring equal access to quality education, systematically increasing the professional competencies of students and strengthening the relationship between education and science.

### 1. Research background

In the his Mironov (2017) *Education as a sphere of state policy* noted that the state educational policy is the directing and regulating activity of the state in the field of education, carried out by it to achieve relevant strategic goals and objectives of national and global importance.

Vakhshayn V.S. in his scientific publications notes that higher education is often consider by employers as a necessary initial level for the development of the profession. The need for lifelong learning at the mass level is becoming one of the priorities of the educational policy of OECD countries (Vakhshayn and Zhelezov 2015). A serious challenge for the state in this regard is the need to fully integrate into the emerging global educational

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space and at the same time take into account national interests, characteristics and traditions of the development of education systems.

The state administration of education in Kazakhstan, which at all times is a complex and multifaceted process, at the present stage faces serious difficulties caused by the need for fundamental changes in the system. On the one hand, being a state priority and the most important factor in the development of the country's economy and its competitiveness, the sphere of education has always been under strict state control. The state regulated the education system through legislative, fiscal, administrative and other levers.

On the other hand, the transition to a market-oriented economy, the course towards building a market for educational services, the development of market mechanisms for managing the sphere of education led to changes in the public administration of this sphere and outlined a downward trend in government intervention. Comparing and analysing the concept of modernization of Russian education, Belyakov and Ivanova (2016) as one of the conditions for the implementation of its provisions called the transition from the management of higher educational institutions to the management of educational programs, where such management functions as control, financing and assessment of the quality of activities are carried out in relation to educational programs.

While the development of new governance mechanisms with more institutional autonomy is an important part of the modernization process for the ministry, it is necessary to ensure institutional autonomy, accompanied by the development and implementation of effective accountability mechanisms and good governance at the institutional level. That is why the state cannot stay away from the development of higher education and regards the system of higher education as a priority object of government, while linking the interests of the population and the economy of the states as a whole, adopting laws and other regulatory legal acts in the field of educational activities of the state its directions (Mamedov 2017). Schools should increase their capacity for self-government. One example of a workable management model that can be implemented in other universities in Kazakhstan is Nazarbayev University. As noted in the scientific publication Pilipenko (2016), the western experience of organizing universities shows the basic principles of state policy in higher education and the methods for its implementation. For example, the system of American universities is very similar to the system of building the state itself, where the main content loads in the formation of organization methods and carries delegation of authority and decentralization of responsibility.

Globalization, the radical changes taking place in the world, have a great impact not only on the development of the material, technical and scientific and theoretical foundations of social progress, but also on the sociopolitical and ideological processes, the formation of a progressive and free social consciousness. Over the past decade, significant changes have occurred in the organization of education management in the post-Soviet space: a legal framework has been formed, a departmental approach to the management of educational institutions is being overcome, the interaction of state and public education management forms is growing, the role of educational associations is increasing. A new approach to understanding modern education has been formed in society, based on its quality and the introduction of the latest innovative educational technologies. Education has become one of the main state priorities of many countries that are striving to create a flexible mobile higher education system that meets the new requirements in the face of global competition.

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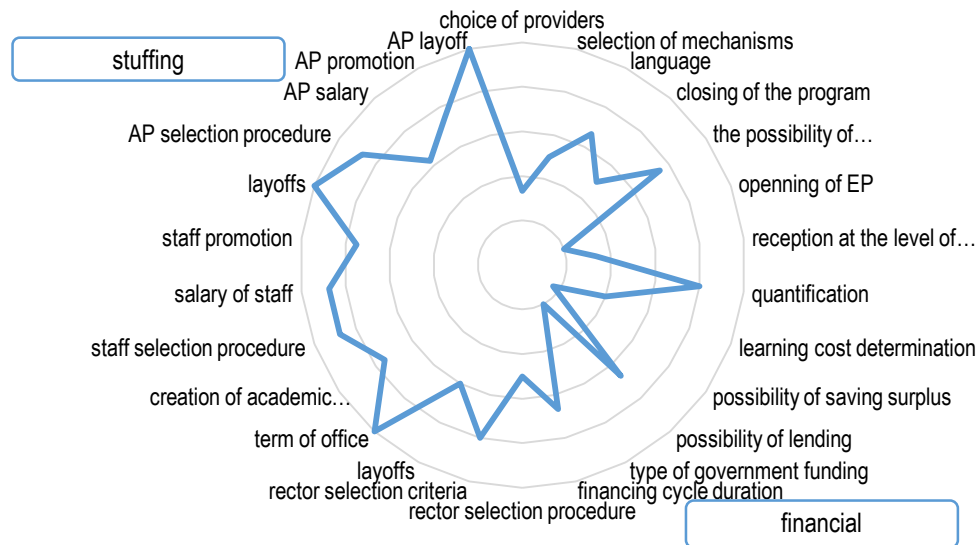
While the development of new governance mechanisms with more institutional autonomy is an important part of the modernization process for the ministry, it is necessary to ensure institutional autonomy, accompanied by the development and implementation of effective accountability mechanisms and good governance at the institutional level. Schools should increase their capacity for self-government. One example of a workable management model that can be implemented in other universities in Kazakhstan is Nazarbayev University.

## **2. Methodology**

Based on the data of the information and analytical centre, a picture was drawn of the results of a general assessment of the autonomy of state higher education institutions in Kazakhstan, according to which we can say that Kazakhstan is lagging behind the international trend in replacing centralized state control and regulation of

management forms that emphasize the importance of policy, the establishment of national goals, decentralized institutional management and use of financial policies (for example, financing performance and) to guarantee the timely response of institutions to public policy priorities (Figure 1).

Figure 1. General assessment of the autonomy of state higher education institutions of Kazakhstan



Source: compiled by authors

Obviously, academic and financial autonomy covers those areas in which Kazakhstan faces the greatest challenges. The rationale for providing greater autonomy to educational institutions is to improve the response of higher education institutions to the needs of the country and society. This should lead to more innovative capacity and efficiency. By continuing its transition from control to management strategy, the state can also stimulate the development of a productivity culture.

The goals of Kazakhstan regarding the education system are clearly reflected in a number of political statements that link education with the broader goal of becoming one of the leading nations in the world. Three of these statements have a direct impact on the provision of high-quality higher education by Kazakhstan:

- Strategy - 2050, which highlights the crucially important role of higher education in the process of training skilled labour;
- The State Program for the Development of Education (GPRO) for 2011-2020 (2010) and the State Program for the Development of Education and Science for 2016-2019. (2016) MES RK, which emphasize (among many other statements) the need to prepare students and undergraduates to meet the needs of industrial-innovative development, the importance of independent assessment of the qualifications of graduates and the importance of integration into the European higher education area;
- Plan of the nation: 100 concrete steps. The main points of this document are the creation of a group of ten leading institutions of higher education, which will receive additional resources and autonomy in order to transfer their experience to other institutions of higher education, gradually eliminate centralized education management and introduce English as a widely used language of instruction.

The objectives set out in these documents are ambitious, but often, in the first place, contribute to the improvement of quality. They include the desire to be included in the "top 30 countries" in the Global Competitiveness Index (GIC) and the emergence of two of its higher education institutions in the top row of international university rankings.

The government of Kazakhstan plays a very important role in the development of the country's education and training system:

- The executive branch, in the person of the government, determines the main educational strategies and develops key initiatives, such as the network of Nazarbayev Intellectual Schools, which train gifted students. The government also monitors progress in achieving the goals that are embedded in the education strategy;
- The Ministry of Education and Science of the Republic of Kazakhstan (MES RK) manages, implements and monitors the work in the field of education, science, protection of children's rights and youth policy;

- MES RK has several subordinate organizations that work in specific areas (for example, quality assurance, statistics, or management of international projects). For example, the Information and Analytical Center provides analytical support to the MES RK and is responsible for a variety of projects, such as international projects of the Ministry (including educational system reviews like this). The National Center for Advanced Studies presents a second example. He is responsible for developing and providing professional development opportunities for teachers and school leaders;
- The Ministry of Education and Science of the Republic of Kazakhstan reports to the Presidential Administration of the Republic of Kazakhstan, undergoes an assessment of the effectiveness of the activities of the Ministry of National Economy of the Republic of Kazakhstan (MNE RK) and the control of budget execution by the Ministry of Finance.

In reviewing the statistical analysis of legislation in the field of education and science, we should note a tendency to increase the intensity of adoption of legal acts that change and supplement the Law "On Education", which is a characteristic feature of the development of the modern educational system at this stage. Regarding the laws "On Science", "On the State Educational Cumulative System", "On the Status of Nazarbayev University", "Nazarbayev Intellectual Schools" and "Nazarbayev Foundation" it should be noted that these legislative acts have made a small number of changes, which indicates to the stable development of legislation in the field of science (Table 1).

Table 1. Review of statistical analysis of legislation in the field of education and science

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Amounts of law	1	1	2	7	3	6	6	10	2	7	45
2015 year											
January		May		July		October		November		December	
LRK № 276-V		LRK № 315-V		LRK № 337-V		LRK № 376-V		LRK № 398-V LRK № 403-V, LRK № 419-V, LRK № 421-V		LRK № 433-V, LRK № 435-V	

Source: compiled by authors according to [www.zakon.kz](http://www.zakon.kz)

The analysis shows that the maximum number of changes / additions was made in the period from 2011 to 2017. It should be emphasized that the maximum number of changes and additions made to the Law on Education was adopted in 2015. Stable economic growth of the country allowed adopting the State Program for the Development of Education for 2011–2020, and later the Program for Integrated Program of Education for 2011–2020 was integrated into the new State Program for the Development of Education and Science for 2016–2019. All of this is aimed at making production and consumption sustainable, developing the skills required to create a green industry and reorienting higher education and research to the use of green innovation, since education results are long-term, predetermining the country's economic prosperity in the future.

During the years of independence of Kazakhstan there has been a consistent development of the country's education system. Revenues from oil and gas exports gave a powerful impetus to economic development and allowed to invest in improving the education system. But the question of financing higher education remains crucial (Table 2).

Table 2. Government spending on education

Years	Technical and vocational education		High and post education	
	mln. tenge	in % to GDP	mln. tenge	in % to GDP
2001	3.018	2,1	9.344	0,1
2002	3.910	2,2	11.783	0,1
2003	5.299	2,1	12.763	0,1
2004	11.874	2,7	17.421	0,1
2005	17.914	2,2	33.755	0,1
2006	21.171	2	48.297	0,1
2007	29.194	2,1	61.160	0,2
2008	35.708	1,9	68.501	0,2
2009	41.730	2,1	77.989	0,2
2010	49.099	2	93.974	0,2
2011	66.179	2	106.097	0,4
2012	77.937	1,9	126.243	0,4

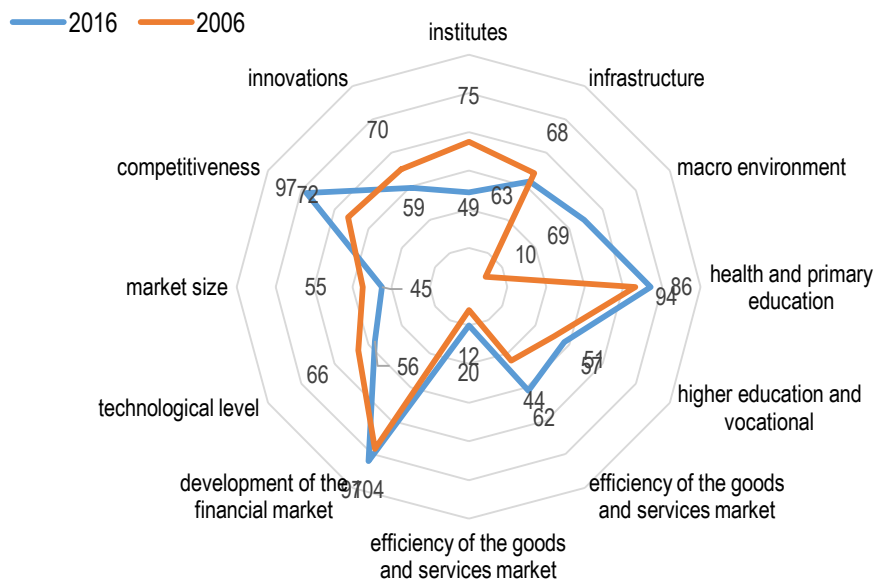
Years	Technical and vocational education		High and post education	
	mln. tenge	in % to GDP	mln. tenge	in % to GDP
2013	93.871	1,7	141.262	0,4
2014	103.376	1,7	144.514	0,4
2015	105.503	1,7	140.037	0,5
2016	107.707	2	187.986	0,5

Source: compiled by authors according to OECD Integrated country review

For example, the United States of America spends over 8% of its gross national product on education, Japan - 6.5, the United Kingdom – 5%. Over the 11 years period Kazakhstan demonstrates the positive dynamics of 5 indicators of the GIK - these are: “Institutes” (+26), “Innovation” (+11), “Technological Level” (+10), “Size of the Labor Market” (+10), “Infrastructure” (+5) (Figure 2).

OECD experts note that the education of Kazakhstan needs to improve the work on training highly qualified specialists, offering to go beyond formal education, improve management and strengthen the formation of professional skills, taking into account the development of small and medium-sized businesses (Mironov 2017, 297-305). However, there is no positive dynamics in terms of the quality of education and the cooperation of science with industry, as employers emphasize the need to update educational programs.

Figure 2. Dynamics of Kazakhstan positions in the GIK rating



Source: compiled by authors

In this regard, on behalf of the Head of State, in 2017, in 318 colleges, the project “Free VET for All” is being implemented, which provides for free first working qualification and social support in the form of scholarships, travel and one-time hot meals. In the V&T organizations, there is a government order for more than 100 thousand places, including 21 thousand under the “Free V&T” project. Updated 130 model curricula, programs and developed 53 educational programs. The classifier of professions and specialties of VET has been revised. 500 units of foreign literature were translated into the state and Russian languages; the library fund of 288 colleges was replenished.

New educational programs on international standards WorldSkills are being introduced. From September 1, 2017, according to 260 qualifications, new modular programs have been launched, where up to 3 qualifications will be received. The SES of technical and vocational education has been amended, allowing colleges to change educational programs up to 80%. In 2017, according to these programs, 5,200 teaching staff, including 300 heads of colleges, received advanced training. A pool of managers with innovative management approaches was prepared.

There is a positive trend towards the introduction of elements of the dual education system. In 2017, dual training was implemented in 460 colleges with participation of 3055 enterprises in 80 specialties and 165 qualifications. The contingent consisted of 31,607 students. To improve efficiency in planning and financing of the VET system, a new methodology for per capita financing has been approved. Higher and postgraduate education



in Kazakhstan goes up rapidly, so in the ranking of the best universities in the world Quacquarelli Symonds World University Rankings in 2017, eight Kazakhstani universities were noted.

As part of the implementation of trilingual education, 50% of academic disciplines are taught in the language of instruction (Kazakh or Russian), in the second language (Russian or Kazakh, respectively) - 20%, in English - 30%. In 76 universities, 30 thousand people study in three languages in all areas of training in 2.5 thousand special groups. Together with 51 foreign universities in 50 universities, two-degree educational programs are taught. 10 educational programs in English are being introduced. A draft law has been drafted which provides for norms for expanding the academic and financial independence of universities. It should be noted that while the number of students enrolled in such programs is small (0.1%), however, this trend is becoming more and more popular.

In 2017, 600 faculty members underwent advanced training in language courses. Corporate secretaries of the Supervisory Councils of 30 universities of the country had trained. Trained 94 members of the Supervisory Boards of state universities. In 2017, over 30 foreign top managers were attracted to the management of universities.

International experience shows that modern management, strategic planning in universities is one of the factors for the success of universities. Collective management bodies that include stakeholders are a tool for ensuring transparency, accountability, equality and responsibility. For this purpose, supervisory councils have been established in 10 large universities (L.N. Gumilyov ENU, Al Farabi Kazakh National University, Abai Kazakh National Pedagogical University, K. Satpayev KazNRTU, KazNAU, E.A. Buketov, KarGTU, SKSU named after M.A. Auezov, TarSU named after M.Kh. Dulati, ARSU named after K. Zhubanov). In the new State program, this issue has given special attention. It is planned to further implement the principles of corporate governance through the gradual expansion of the academic, managerial and financial independence of universities, and a mechanism will be developed for the formation of university endowment funds.

As part of the transition to a new model of economic growth, the project "Development of an educational hub as a driver of new economy 3.0" has being implemented. One of the priorities of the project is to attract foreign students. About 13 thousand (3%) foreign students study at universities. In 2017, 200 marketing campaigns were conducted in this direction. JSC "Center for International Programs" conducted six educational PR-events in Tajikistan, Kyrgyzstan, Uzbekistan, China, India and Turkmenistan. Following the exhibition, 20 memorandums of cooperation were signed.

In 2017, more than 84 billion tenge of private investment was attracted (of which 71 billion due to the provision of paid services and 13 billion due to the development of start-ups and co-financing). In technical and vocational education, work will continue on the implementation of the Vocational Education for All project, the development of educational programs on credit-modular technology, the continuation of work on the introduction of dual training, the advanced training of IPR and enterprise experts, the creation of 20 centers of competence, the educational process, educational programs taking into account the WorldSkills standards, improving the positions of VET students in the international WorldSkills championship and continuing to transfer foreign students ebnikov.

Government supports (basic, grant and program funding, innovation grants) and commercialize the results of scientific and technical activities, positively evaluated by both entrepreneurs and scientists of the country, according to the Law of the Republic of Kazakhstan "On the commercialization of scientific and scientific and technical activities".

Since independence, Kazakhstan has been an active participant in authoritative ratings, as evidenced by the openness of the country's socio-economic policy. On January 1, 2016, 193 countries of the world, including Kazakhstan, began implementing sustainable development goals until 2030, the main thesis of which is "Development belongs to people, is carried out by people and for people". In this regard, the value and significance of international education ratings and human capital in general will only grow.

UNESCO in the Education 2030 Concept outlined the task 4.3 "to ensure by 2030 equal access for all men and women to low-cost and high-quality technical, vocational and higher education, including university education". The enrollment rate in higher education has considered in three aspects: access; affordability; quality.

So, in 2016, the rate of coverage of the economically active population of the country with higher education is higher than 2004 by 9.6%. A significant increase was recorded in 2015 (Table 3).

Table 3. Share of economically active population with higher education

Indicator	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	15,9	16,4	17,6	18,4	18,9	21,1	21,5	22	25,2	24,9



Source: compiled by authors according to data of Ministry of education and science of the Republic of Kazakhstan

At the same time, it should be noted that the popularity of secondary special education is decreasing, and more and more citizens are trying to get a higher education. If they do not go immediately to universities after graduation, then a significant part of graduates from secondary schools in the future go to universities. Thus, it is necessary to say that higher education, as a form of education after school, is still the most important form of education. And its importance is increasing. Therefore, we need to pay special attention to the quality of the system of management of higher education, as the basis of the educational potential (in addition to school).

According to the Ministry of Education and Science of the Republic of Kazakhstan, in recent years, the number of universities has decreased. There is also a reduction in the number of students (Table 4).

Table 4. Number of universities and the number of students in Kazakhstan

Indicator	Unit	2011	2012	2013	2014	2015	2016	2017
Number of universities	Units	146	139	128	126	127	130	127
Contingent of trainees	thousands of people	629,5	571,7	527,2	477,7	459,4	477,1	496,2

Source: compiled by authors

### 3. Application functionality

The decline in the number of universities is mainly due to the closure of private institutions. We will determine how the number of graduates of secondary schools and the number of colleges influence the number of universities in Kazakhstan. To do this, we construct a two-factor regression model. The necessary data has presented in the following Table 5.

Table 5. Data on the number of graduates of secondary schools and the number of colleges in Kazakhstan

Year	Number of universities, units	Graduation of 11 grades from secondary schools, in thousand people	Number of colleges, units
2006	176	199	442
2007	167	182	460
2008	143	152	470
2009	148	143	480
2010	149	151	494
2011	146	173	494
2012	139	169	610
2013	131	149	785
2014	126	133	775
2015	125	129	780
2016	130	127	803
2017	127	138	808

Source: compiled by authors

We introduce the following notation:  $y$  - number of universities (units);  $X_1$  - graduation of 11 grades from secondary schools, in thousand people;  $X_2$  - number of colleges, units. The desired two-factor regression model will be:

$$y = a + b_1x_1 + b_2x_2 \quad (1)$$

We will estimate the parameters of the two-factor regression equation using the Regression analysis tool (Data Analysis in Excel). As a result of data approximation, we obtain the regression analysis protocol, which is presented below:

Regression Statistics				
Multiple R	0,929108039			
R- square	0,863241749			
Normal R-square	0,832851026			
Standard error	6,681235382			
Observations	12			
Analysis of variance				
	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>

Regression	2	2535,9165110	1267,95825500	28,4047790
Remainder	9	401,7501561	44,63890623	
TOTAL	11	2937,6666670		
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-Statistics</i>	<i>P-Value</i>
Y- intersection	116,913298100	29,707107970	3,935532811	0,0034291
x1	0,367180651	0,131124904	2,800235808	0,0207047
x2	-0,050588823	0,018658081	-2,711362622	0,0239440

As a result, we obtain the following equation of multiple linear regression:

$$y = 116,913 + 0,367x_1 - 0,051x_2 \quad (2)$$

The coefficient of multiple correlation is  $R=0,93$ , which indicates a close relationship between the resultant trait and two factor signs at the same time. The coefficient of determination is  $R^2 = 0,86$ , those 86% of the variation of the dependent variable is due to the regression obtained.

Check the statistical significance and reliability of the obtained regression equation and its coefficients. From the data of the protocol for performing the regression analysis, we find that the observed value of the Fisher criterion is  $F_{набл.} = 28,40$ . Critical Fisher criterion values at significance level  $\alpha = 0,05$  and the number of degrees of freedom  $k_1 = m = 2$ ,  $k_2 = n - m - 1 = 9$  (where  $n$  is the number of observations,  $m$  is the number of factors) is equal to  $F_{крит.}(0,05; 2; 9) = 4,26$ . As  $F_{набл.} > F_{крит.}$  ( $28,40 > 4,26$ ), then we can conclude about the statistical significance and reliability of the resulting regression equation.

The statistical significance of the individual coefficients of the equation will be determined using the Student's t-statistics. The observed values of this statistic for individual coefficients are respectively equal to:

$$t_a = 3,93, \quad t_{b_1} = 2,80, \quad |t_{b_2}| = 2,71. \quad (3)$$

The critical value of student's criterion at the level of significance  $\alpha = 0,05$  and the number of degrees of freedom  $k_1 = n - m - 1 = 9$  equally  $t_{крит.}(0,05; 9) = 2,26$ . Since the observed values of t-statistics for all coefficients are greater than the critical value of Student's criterion, it can be concluded that the coefficients of the regression equation are statistically significant and reliable. Analyze the resulting equation of the multiple linear regression:

$$y = 116,913 + 0,367x_1 - 0,051x_2 \quad (4)$$

- with an increase in the output of pupils of 11 classes from general education schools by 10 thousand people, the number of universities increases by 4 units. Since the number of graduates has decreased in the last decade, it is better to draw the opposite conclusion: a decrease in graduates of general education schools by 10 thousand people entails a decrease in the number of universities by 4 units;
- the additional opening of 100 colleges leads to the closure of 5 universities.

Determine the average aggregate coefficients of elasticity:

$$E_{y,x_1} = b_1 \cdot \frac{\bar{x}_1}{\bar{y}} = 0,367 \cdot \frac{153,75}{142,17} = 0,40\%, \quad (5)$$

$$E_{y,x_2} = b_2 \cdot \frac{\bar{x}_2}{\bar{y}} = -0,051 \cdot \frac{616,75}{142,17} = -0,22\%.$$

After analyzing these elasticities, we obtain the following conclusions:

- when increasing the number of students in grades 11 from secondary schools ( $x_1$ ) at 1% of the average level, the number of universities ( $y$ ) increased by 0.40% of its average level with a constant number of colleges. Reverse: while reducing graduates of secondary schools ( $x_1$ ) at 1% of the average level, the number of universities ( $y$ ) reduced by 0.40% of its average level with a constant number of colleges;
- with an increase in the number of colleges ( $x_2$ ) at 1% of the average level, the number of universities ( $y$ ) decreases by 0.22% of its average level with a constant number of graduates of secondary schools.

Now we will determine which of the two factors considered has the greatest influence on the change in the number of universities, for this we calculate the pairwise correlation coefficients using the Correlation analysis tool (Excel data analysis). The result is:

	y	x <sub>1</sub>	x <sub>2</sub>
Y	1		
x <sub>1</sub>	0,86691	1	
x <sub>2</sub>	-0,86261	-0,73262	1

Thus, we can conclude that the number of universities is insignificant, but still it is more influenced by a factor - graduation of 11 grades from general education schools, than a factor - the number of colleges.

In the future, the number of universities and educational programs participating in the accreditation process will increase, as a quality culture is gradually being formed in the country, which is the basis of the desire of universities to increase competitiveness. In addition, with the adoption of the Law of the Republic of Kazakhstan "On Amendments and Additions to Certain Legislative Acts on Education Issues No. 398-V of November 13, 2015", additional incentives for the development of accreditation were introduced. Firstly, this is an exemption from the procedure of state certification of programs that have passed institutional and program accreditation. In addition, from January 1, 2017, state-issued education certificates will be issued to students who have successfully mastered the educational programs of universities that have passed international accreditation with foreign or national accreditation bodies entered in the National Register. As a result, private universities also began to be active in the passage of accreditation to obtain the possibility of issuing a state diploma. However, from 2021, all universities, regardless of the form of ownership, will issue students with their own diplomas. Currently, the national quality assurance system for higher education consists of two parts: the procedures carried out by the Committee on the Control of Education and Science of the MES RK and the procedures carried out by independent non-governmental organizations.

According to the analysis of the EUA, which we considered, the level of autonomy of higher education in Kazakhstan is far from ideal and is well below the average level of autonomy of 28 European countries. Kazakhstan is lagging behind the international trend in the replacement of centralized state control and regulation of management forms that emphasize the importance of policies, the establishment of national goals, decentralized institutional management and the use of financial policies. As the process of providing schools with greater autonomy develops, the government and national financial institutions should ensure that there are guarantees.

Since the ability to make cash management decisions is fundamental to any other management area, ensuring financial flexibility combined with accountability for results is an important first step in helping educational institutions become more efficient and innovative in their missions. As Kazakhstan moves forward in building a higher education system that takes into account the knowledge needs of a modern economy and society, it is necessary:

- Strengthen governance at the institutional level to ensure deeper decentralization and greater financial, academic, and organizational flexibility, as well as the freedom to operate in higher education institutions: the government should support the development of the governing council system in the selection of managers within the public sector, ensure control of institutional operations, support and improve the efficiency of institutions and ensure the successful implementation of the mission of each educational institution;
- To increase the transparency of management in public and private institutions of higher education:
  - the government must adhere to an audit approach to ensure financial integrity. Conducting rigorous financial audits based on common standards should be a means of ensuring integrity and transparency;
  - focus on intermediate and final results;
  - it is necessary to develop a national system of higher education data for analyzing the results of higher education and providing information to the process of developing national policies and funding strategies.
- Within the academic community itself, develop and implement a reliable accreditation system and a national qualifications framework as the basis for ensuring and improving the quality of education, which will provide a rationale for the need for academic operational autonomy: to formulate a quality assurance process based on certification and inspections, as well as the use of accreditation, which will ensure the further development of high-quality education and research;
- Clearly distinguish between the respective goals of the public and private sectors of the higher education system.

## Conclusion

Thus, at the present stage in the Republic of Kazakhstan, an integral multi-level national system for assessing the quality of education has emerged, which is a comprehensive system of state control and independent assessment of the quality of education. Enabling mechanisms for accreditation support have been created and legally secured. At the same time, given that the country's integration into the European Higher Education Area sets the task of entering accreditation agencies into European structures, such as ENQA and EQAR, the national quality assurance system should be improved to meet European standards and guidelines.

In the system of management of Kazakhstani higher educational institutions, it is necessary to realize potential opportunities in ensuring the priority development of the economy. And to solve the existing problems when graduating specialists, purposeful work is needed to increase the competence and motivation of teachers, improve the material and technical base of educational institutions, make wide use of international experience, modern educational technologies and information resources, improve educational programs, implement management mechanisms stimulating the work of institutions.

Over the past decade, the Kazakhstani system of higher education has undergone significant structural transformations: universities have a greater degree of autonomy in managing their activities, greater freedom in determining educational policies, the direction of specialization of universities has changed, and a competitive environment has been created. However, the increasing demands of society for the quality of higher education, the deepening of disparities between the offer of educational services and the needs of the labor market, the inefficient use of society's resources directed to the higher education system, resulting from the lack of mechanisms for coordinating the goals and results of higher education institutions with the needs of the state and society, upgrading learning technologies, changing organizational and economic mechanisms for managing images institutions-inflammatory, increased competition in the market of educational services, creating the need to search for new strategic approaches in the management of higher education.

Currently, there is an objective need in the republic to form a model of state-public management of the higher education system. On the one hand, this is dictated by the need to accept the challenges of global changes in the requirements for training specialists fixed in the documents of the Bologna Agreement. On the other hand, the program of reforming Kazakhstan education stimulates the transition of universities to a new education management policy based on a system for improving its quality. At the same time, in the process of integrating higher education in Kazakhstan into the world educational space, it is necessary to find the optimal balance between international educational trends and the need to preserve and develop the national system of higher education.

The processes of globalization and technological modernization contribute to the emergence of new directions of knowledge and the obsolescence or practical uselessness of existing ones. This may lead to the fact that in the coming decades a certain part of the existing professions will disappear. In such conditions, universities should offer new training formats aimed at a qualitatively new level of training of Kazakhstani specialists adapted to global competition in the field of knowledge.

The mission and functions of universities as significant subjects of the socio-economic development of states are changing. They become the engine of development not only of the educational system, but also of society as a whole. Modernization of the modern Kazakhstani education system began with the country's accession to the Bologna process, which highlighted the problem of creating a European region of higher education as a key point for the development of citizens' mobility, their relevance and the global development of the continent.

Today, competition between universities, both domestically and between states, has changed, filled with new content. Academic globalization encourages universities to be more entrepreneurial and take an active part in the struggle for students, the most successful teachers, to compete for research grants, and for this they must have managerial and academic independence in the implementation of their activities.

Therefore, for higher and postgraduate education in 2018, work will continue:

- to expand the academic and managerial independence of universities;
- conducting an independent ranking of educational programs of universities and compiling a register of the best educational programs;
- organization and holding of educational exhibitions in foreign countries;
- study of the issue of opening representative offices of the Centre for International Programs in China, India, Uzbekistan and Turkmenistan;

- continuation of work on attracting foreign students through the implementation of double-diploma education, the implementation of educational programs in English;
- study of the issue of opening new universities in IT, pedagogical, medical, and technical areas;
- development of 10 new programs in English.

The priority areas for the modernization of the higher education system in Kazakhstan include:

- introduction of programs of professional competence approach in higher education, taking into account the social order in the framework of the creation of an innovative educational system of international type;
- providing real multilevel higher education, creating modern university complexes;
- transition to a qualitatively new model of education (optimization of teaching methods, active use of open education technologies);
- deepening in the higher school of integration and interdisciplinary programs, combining them with breakthrough high technologies, practical orientation of the educational process at the university;
- an individual approach to the organization of the learning process taking into account the personal capabilities and needs of the student in the context of the conditions determined by the university;
- openness and rationality of the organizational structure of the university;
- improving the competitiveness of educational institutions in the market of educational services (to this end, the development by the university of an effective image policy and marketing strategies for its implementation);
- improvement of university management on the principles of openness and democratization and the formation of a high corporate culture;
- further internationalization of education in the university through the processes of academic mobility of students and teachers, the internationalization of the student contingent and innovative teaching experience;
- raising the status of university science in the framework of the expansion of the processes of commercialization of scientific achievements, the integration of university science, the business environment and production.

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## Econometric Assessment of Sustainable Development and Status of Health among the Population

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### Abstract:

The Republic of Kazakhstan has achieved significant economic growth and significant results in the country's socio-economic development. However, the implementation of the Programs for Forced Industrial-Innovative Development, the Business Roadmap 2020 and others within the framework of the traditional production and consumption scheme causes a multiple increase in anthropogenic pressures on the regions. Thus, an increase in the seizures of mineral, hydrocarbon, water, land, energy resources, emissions and volumes of pollutants, the growth of new industries and infrastructures, determine their uneven development and increasing the degree of desertification of territories. Authors had considered in the regional aspect such a factor as the health of the population, taking into account the environmental problems and the environmental situation in the region. The article presents the economic and mathematical model of sustainable development management in the context of the regions of the Republic of Kazakhstan.

**Keywords:** econometric model; assessment, health; sustainable development

**JEL Classification:** C51; Q56; I15

### Introduction

To date, a number of environmental problems remain unresolved in Kazakhstan, which requires a different approach to the development of state environmental policies and sustainable development management models.

There are many factors hampering the country's sustainable development: inefficient resource management; excessive consumption of natural resources (anthropogenic impact); commodity orientation of the economy; excessive urbanization of territories; deterioration of public health; human capital; imbalance of regional development; low productivity of economic sectors; increase in the number of industrial zones; deficiency of water resources and desertification of territories; environmental pollution; energy intensity of production; low land productivity and crop yields and other factors.

### 1. Research background

The issues of environmental and economic development of the regions within the framework of the transition of Kazakhstan to a "green" economy are engaged by foreign and domestic scientists: Grossman (2014), Krueger (2014), Kuznets (2013), Shabanova (2018), Agubaev (2018), Antonova (2014), Popov (2015) and others.

Many factors play a role in the implementation of the Concept of Sustainable Development of the Republic of Kazakhstan. Among others, we would like to note, such as: ineffective management of mineral, land, water and biological resources characteristic of our country will ultimately lead to an increase in the scale and rate of loss of

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the resource potential, which will accordingly limit the economic development and export potential of regions and the republic in whole. Specialists in the field of mineral resources have concluded that the growth in energy consumption will continue in Kazakhstan, and it has believed that in the next 50 years the volume of mining operations will increase more than five times, mainly due to new deposits with processing ores by old technology. Until 2025, there may be an almost complete exhaustion of the explored reserves of oil, gas and other energy resources.

The next, much important factor hampering sustainable development is the low productivity of land resources. The productivity of land and the yield of basic crops (wheat, barley) in Kazakhstan are three times lower than in Canada due to their considerable degradation. Half of the country's agricultural lands are degraded, of which 50% of arable land, because of which the yield of wheat fell by 36% (Shabanova and Agubaev 2018). Such a huge amount of land unsuitable for farming is caused by inefficient use, lack of water, anthropogenic impact.

Very low economic productivity of water use in agriculture, which is almost 5 times lower than in Russia, while the cost of water for irrigation of rice fields is 10 times higher than in Russia and Canada. Given the current assessment of water demand, Kazakhstan may face an acute shortage of water resources. According to the Committee of Water Resources, by 2030, less than 1/5 of the water resources will be available for economic use. According to international research, about 2 billion US dollars will be needed to meet water needs in cities, settlements, agrarian and industrial sectors.

In addition, a certain danger for Kazakhstan is the pollution of the environment by toxic substances. According to international experts, more than 40 thousand children under the age of 10 suffer from neurological disorders due to exposure and significant amounts of lead in the body. Kazakhstan ranks second among Central Asian countries and Eastern European countries in terms of environmental pollution by organic substances. Air pollution in Kazakhstan is the main cause of more than 6000 deaths per year.

The lack of a waste management system leads to uncontrolled landfills of more than 97% of household and construction waste. The problem of radioactivity remains very serious. The greatest pollution by toxic substances has observed in the cities of Zhezkazgan, Temirtau, Balkhash and Karaganda. This is due to the location in these settlements of the largest enterprises operating in the field of ferrous and non-ferrous metallurgy (JSC ArcelorMittal Temirtau and JSC Kazakhmys). Obsolete production technology, inefficient cleaning plants and equipment, poor quality of used fuel, and weak use of renewable energy sources have led to the fact that air pollution indicators are so high (Shabanova and Agubaev 2015).

For the Republic of Kazakhstan, the problems of atmospheric air pollution have been and remain relevant. Emissions to the atmosphere of harmful substances from stationary sources are about 2.5 million tons per year; transport emissions exceed 1 million tons / year. Today, about 5 million Kazakhstani people live in polluted atmospheric air, while at least 2 million people live in conditions of extremely high pollution levels. In addition, the layout of settlements, primarily because many cities and towns were formed as satellites of large industrial facilities, often lead to the inevitable pollution of the urban atmosphere by industrial emissions.

From the point of view of possible health effects of the population, the most significant is the air pollution of populated areas with dust, sulfur dioxide, nitrogen dioxide, phenol, lead, formaldehyde, chlorine, hydrogen fluoride, ammonia, dioxin, furan, carbon monoxide, hydrogen sulfide and hydrogen chloride. It should be noted that each of these pollutants has its own specifics in terms of impact on public health.

Thus, Kazakhstan scientists estimated the damage to the health of the population due to the deterioration of the ecological situation, taking into account the overall costs of treatment, diagnosis and prevention of the pathology of the population, the average life expectancy, the cost of payments for sick leave, and the cost of retirement for disabled people. According to experts from the Center for Health Protection and Eco Projecting, Kazakhstan's losses amount to 55.7 US dollars per inhabitant per year or US \$ 60 per tonne of air emissions. This means that the negative effect on the health of the population of Kazakhstan against air pollution is about 1.5 billion US dollars per year.

## **2. Methodology**

Many factors play a role in the implementation of the Concept of Sustainable Development of the Republic of Kazakhstan. Among others, we would like to note, such as: ineffective management of mineral, land, water and biological resources characteristic of our country will ultimately lead to an increase in the scale and rate of loss of the resource potential, which will accordingly limit the economic development and export potential of regions and the republic in whole. Specialists in the field of mineral resources have concluded that the growth in energy consumption will continue in Kazakhstan, and it is believed that in the next 50 years the volume of mining

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In the Karaganda region, the largest volumes of pollutant emissions are observed in the Abai region, which can be explained by the existing production enterprises there (Abai Central Enrichment Plant, Coal Department of Mittal Steel Temirtau JSC, Kazakhmys State Regional Power Station, Abay Foundry-Mechanical LLP factory", PKF "Karaganda Textile Line", etc.).

Thus, under the strong anthropogenic press is Karaganda region, which is located within the region of Central Kazakhstan and covers an area of 4220.9 thousand hectares. Specificity of the region consists in the features of geomorphological characteristics - allocation of a special area of the Kazakh shield - Sary-Arka and high biodiversity of ecosystems. The region is unique in terms of the variety of soil types caused by zonal-provincial features of climatic conditions and relief, which determines the specificity of the diversity of flora, fauna and ecosystems. In Central Kazakhstan, 67 ecosystems have been identified, which characterizes a significant natural diversity. At the same time, the areas of disturbed territories and ecological risk zones, including habitat loss of rare plant species and ecosystems, are more than 50%. A high degree of danger in Central Kazakhstan,

according to the data of ecological zoning, was noted for 32 ecosystems, on an area of 22,457.2 thousand hectares.

The analysis of the ecological risk zones of the Republic of Kazakhstan demonstrates a rather complex and diverse situation of ecosystem degradation in terms of hazard and risk of loss of species, ecosystems, tree and shrub thickets, the degree of internal danger of desertification of ecosystems, their soil cover under intense anthropogenic impact. In general, for Kazakhstan, according to the analysis of the developed map of ecological zoning, five degrees of danger have been identified, in principle corresponding to the degree of desertification - land degradation, ecosystems and, especially, soil and vegetation cover.

Because of the ecological zoning of Kazakhstan, the general picture of the current situation of desertification of ecosystems and the degree of danger in the further destabilization of the environment underlines the prevalence of a moderate degree of danger - 42.3% of the area of the republic. Nevertheless, even this is the ultimate limit of anthropogenic impact and further withdrawal of resources (soil and plant in particular) should be limited in a number of ecosystems. Reduction of the norms of use up to 10-20% is necessary for self-regulation of ecosystems and preservation of the reproducibility of resources. Moderate hazard conditions represent the limit of ecosystem resilience to a number of anthropogenic impacts, for example, to the removal of plant biomass. And with the additional factor of drought in arid years and seasons of rare species, the drying up of soils, the reduction of the species diversity of ecosystems, productivity and the change of ecosystems.

### 3. Application functionality

To assess the level of sustainable development, both at the regional and national level, as well as its modeling, a system of indices and indicators has used, which includes various components. In view of the enormous diversity in the definition of the term "sustainable development" in the interpretations of domestic and foreign scientists dealing with sustainable development management, we will mean sustainable development as a governance model that will ensure a decent level of the well-being of the population and the dynamic development of the economic and social system with the environment. Antonova (2014), with reference to the social and economic system, defines "stability" in the most general form as the ability of the system to return to the initial state relatively quickly or to reach a new, higher point on the trajectory of its development.

In connection with this, the issue of public administration arises sharply in conditions of instability, *i.e.* creation of the Kazakhstan model of sustainable development management. Based on the analysis, it can be argued that environmental problems accumulated by more than one generation in the foreseeable future will lead to a deterioration in the living conditions of not only future generations, but also of current residents, the quality of their lives, an increase in morbidity in the RK regions, which cannot affect the social sphere of the country. In such conditions, the country's economic development cannot be sustainable. This is the triune unity of the economy, ecology and social sphere.

This has confirmed by the work of the American economist and Nobel laureate Simon Kuznets. In his work *Economic Growth and Income Inequality* of 1955, he argued that economic growth leads first to an increase, and then to a decrease in inequality (Kuznets 2013). About the ecological curve Kuznets started talking in the early 1990's with the filing of Princeton economists Gin Grossman and Alan Krueger, who studied the effects of free oil trade. Instead of an inequality in the ecological curve of Kuznets, pollution of the environment has substituted. The pattern is the same - the growth of GNP at first the ecology worsens: the factories are smoky and the forests are cut down. Then there is a turning point, which the World Bank report explains: "With the increase in revenues, the demand for improving the environment is rising and there are more resources that can be invested in it." In other words, wealthy citizens, firstly, are keenly interested in breathing clean air and swimming in clean water, and secondly, they can afford to spend extra money on the environment.

The ecological curve of Kuznets has something to love: in order to save the environment, it is necessary not to strangle the economy, but, on the contrary, to develop it as intensively as possible, without exchanging ecology. If the Kuznets curve works, then developed and developing countries will sacrifice part of their GDP. Not just for the sake of abstract humanism, but for the sake of further economic growth. The global economy will continue to develop, and greenhouse gas emissions will go down. A turning point will appear on the world ecological curve of Kuznets (Kuznets 2013). In our work, we attempted to analyze the relationship between the level of environmental pollution and the volume of GDP in Kazakhstan.

The simplified regression equation of the ecological curve has the form:

$$Y_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GDP_{it}^2 + \beta_4 \overline{GDP}_{it} + \beta_5 \overline{GDP}_{it}^2 + u_{it}, \quad (1)$$

where:  $Y_{it}$  – pollution;  $\overline{GDP}_{it}$  - three-year moving average values of gross domestic product.

In this case, moving averages are usually included in the model to smooth out short-term fluctuations and highlight major trends or cycles. Estimate the coefficients of the regression equation by the least squares method. As a result of approximating the data on GRP volumes and air emissions of pollutants in 16 regions of Kazakhstan for the period from 2004 to 2017, the following equation was obtained:

$$Y_{it} = 81,47 + 0,13GRP_{it} - 0,00004GRP_{it}^2 + 0,03\overline{GRP}_{it} - 0,000005\overline{GRP}_{it}^2, \quad (2)$$

where:  $Y_{it}$  – emissions of pollutants emitted from stationary sources into the atmosphere, measured in thousand tons;  $GRP_{it}$  - GRP, billion tenge;  $\overline{GRP}_{it}$  – three-year moving average values of gross regional product, billion tenge.

Since the coefficient  $\beta_2 = -0,00004 < 0$ , and the coefficient  $\beta_1 = 0,13 > 0$ , then we have a convex upward ( $\cap$ -shaped) curve that changes its direction with respect to the point of inflection from growth to fall.

By differentiating the GRP index and equating the result to zero, we calculated the gross domestic product in Kazakhstan, for which the pollution volume reaches its maximum. We have received that the peak of pollution comes at a GRP level of 1677,05 billion tenge. Further increase of this indicator in the RK leads to a reduction in emissions of pollutants into the atmosphere.

However, this trend is not traced for a longer period. As a result of processing data on GRP volumes and air emissions of pollutants, it can be seen that in 16 regions of Kazakhstan for the period from 2004 to 2017, we obtained the following regression equation:

$$Y_{it} = 119,8 - 0,07GRP_{it} + 0,00001GRP_{it}^2 + 0,15\overline{GRP}_{it} - 0,00003\overline{GRP}_{it}^2, \quad (3)$$

In the equation, the coefficient  $\beta_2 = 0,00001 > 0$ , and the coefficient  $\beta_1 = -0,07 < 0$ , therefore, The curve is convex downward (U-shaped) and changes its direction with respect to the point of inflection from falling to growth.

In this case, using in the equation the moving averages of gross domestic product volumes, which are usually included in the model to smooth short-term fluctuations and highlight the main trends or cycles, we see a slightly different picture, analyzing the long trend. This, perhaps, is related to the cyclical development of the economy in the long run, which in itself does not contradict the principles of sustainable development.

Since economic growth reflects quantitative changes (in the form of gross domestic product); and sustainable development reflects qualitative positive changes aimed at growth, transformation and transition from one state to another.

Cyclical development of the economy can be defined as a form of its development, as a movement from one macroeconomic equilibrium to another, *i.e.* transition from one state to another. In this context, the U-shaped curve represents, on the one hand, the phases of the business cycle. However, since cyclicity itself is a form of economic development, the crisis (manifested at the point of recession), in turn, appears as a form of economic development.

Further, it is of practical interest to study the impact of economic development on the level of pollution in various regions of Kazakhstan. To do this, first we will cluster all regions according to two indicators: the amount of emissions of pollutants emitted from stationary sources (thousand tons) into the atmosphere, and the volume of the gross regional product (billion tenge). Table 1 presents all regions of Kazakhstan and indicators of the region's environmental and economic development in 2017.

Table 1. Ecological and economic development of the regions of the Republic of Kazakhstan in 2017

Regions	Amount of emissions into the atmosphere(thousand tons)	GRP volume (billions of tenge)
Akmola region	83,8	942,2
Aktyubinsk region	125,4	1816,3
Almaty region	68,4	1665,5
Atyrau region	138,4	3635,1
West Kazakhstan region	60,4	1845,8
Zhambyl region	33,6	864,0
Karagana region	572,6	2690,7
Kostanai region	115,4	1309,7
Kyzyl Orda region	31,2	1374,0
Mangistau region	77,5	1880,0

Regions	Amount of emissions into the atmosphere(thousand tons)	GRP volume (billions of tenge)
South Kazakhstan region	56,3	2062,6
Pavlodar region	650,4	1539,1
North Kazakhstan region	71,4	747,5
East Kazakhstan region	124,9	2050,3
City of Astana	60,6	3245,4
City of Almaty	12,4	6471,8

Source: compiled by authors

To classify regions, we use cluster analysis, which allows us to divide objects into homogeneous groups or clusters for a number of features. Uniform objects are considered, the observed signs of which are in close proximity to each other. The norm of proximity is the distance metric. To solve our problem, we used the usual Euclidean metric, according to which the distance between observations is calculated by the formula:

$$d_{i,j} = \sqrt{\sum_{k=1}^p (x_{ki} - x_{kj})^2} \tag{4}$$

Based on the Euclidean metric, the distance between regions 1 and 2 is:

$$d_{1,2} = \sqrt{(83,8 - 125,4)^2 + (942,2 - 1816,3)^2} = 875 \tag{5}$$

It is obvious that  $d_{1,2} = d_{2,1}$ , a  $d_{1,1} = 0$ .

Similarly, we find the distances between all 16 regions and build a distance matrix (Table 2 and Table 3).

Table 2. The matrix of distances between objects 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1		875	723	2693	904	93	1816	369	435	938	1121	823	195	1109	2303	5530
2	875		161	1819	71	957	982	507	452	80	256	594	1070	234	1431	4657
3	723	161		1971	180	802	1142	359	294	215	397	596	918	389	1580	4807
4	2693	1819	1971		1791	2773	1039	2326	2264	1756	1575	2158	2888	1585	397	2839
5	904	71	180	1791		982	988	539	473	<b>38</b>	217	665	1098	214	1400	4626
6	93	957	802	2773	982		1905	453	510	1017	1199	914	122	1190	2382	5608
7	1816	982	1142	1039	988	1905		1455	1424	950	813	1154	2007	781	755	3822
8	369	507	359	2326	539	453	1455		106	572	755	582	564	741	1936	5163
9	435	452	294	2264	473	510	1424	106		508	689	641	628	683	1872	5098
10	938	80	215	1756	<b>38</b>	1017	950	572	508		184	667	1133	177	1366	4592
11	1121	256	397	1575	217	1199	813	755	689	184		792	1315	70	1183	4409
12	823	594	596	2158	665	914	1154	582	641	667	792		981	733	1805	4974
13	195	1070	918	2888	1098	122	2007	564	628	1133	1315	981		1304	2498	5725
14	1109	234	389	1585	214	1190	781	741	683	177	70	733	1304		1197	4423
15	2303	1431	1580	397	1400	2382	755	1936	1872	1366	1183	1805	2498	1197		3227
16	5530	4657	4807	2839	4626	5608	3822	5163	5098	4592	4409	4974	5725	4423	3227	

Source: compiled by authors

Table 3. The matrix of distances between objects 2

	1	2	3	4	5+10	6	7	8	9	11	12	13	14	15	16	
1		875	723	2693	938	93	1816	369	435	1121	823	195	1109	2303	5530	1
2	875		161	1819	80	957	982	507	452	256	594	1070	234	1431	4657	2
3	723	161		1971	215	802	1142	359	294	397	596	918	389	1580	4807	3
4	2693	1819	1971		1791	2773	1039	2326	2264	1575	2158	2888	1585	397	2839	4
5+10	938	80	215	1791		1017	988	572	508	217	667	1133	214	1400	4626	5+10
6	93	957	802	2773	1017		1905	453	510	1199	914	122	1190	2382	5608	6
7	1816	982	1142	1039	988	1905		1455	1424	813	1154	2007	781	755	3822	7
8	369	507	359	2326	572	453	1455		106	755	582	564	741	1936	5163	8
9	435	452	294	2264	508	510	1424	106		689	641	628	683	1872	5098	9
11	1121	256	397	1575	217	1199	813	755	689		792	1315	<b>70</b>	1183	4409	11
12	823	594	596	2158	667	914	1154	582	641	792		981	733	1805	4974	12
13	195	1070	918	2888	1133	122	2007	564	628	1315	981		1304	2498	5725	13



	1	2	3	4	5+10	6	7	8	9	11	12	13	14	15	16	
14	1109	234	389	1585	214	1190	781	741	683	<b>70</b>	733	1304		1197	4423	14
15	2303	1431	1580	397	1400	2382	755	1936	1872	1183	1805	2498	1197		3227	15
16	5530	4657	4807	2839	4626	5608	3822	5163	5098	4409	4974	5725	4423	3227		16
	1	2	3	4	5+10	6	7	8	9	11	12	13	14	15	16	

Source: compiled by authors

From the distance matrix (Table 2) it follows that regions 5 and 10 are closest to each other  $d_{5,10} = 38$ , so we combine them into one cluster and proceed to the next partition. The distance between the clusters is determined by the principle of the "far neighbor", which is described by the formula:

$$d_{r,q} = \frac{1}{2}d_{l,q} + \frac{1}{2}d_{m,q} + \frac{1}{2}|d_{l,q} - d_{m,q}|, \tag{6}$$

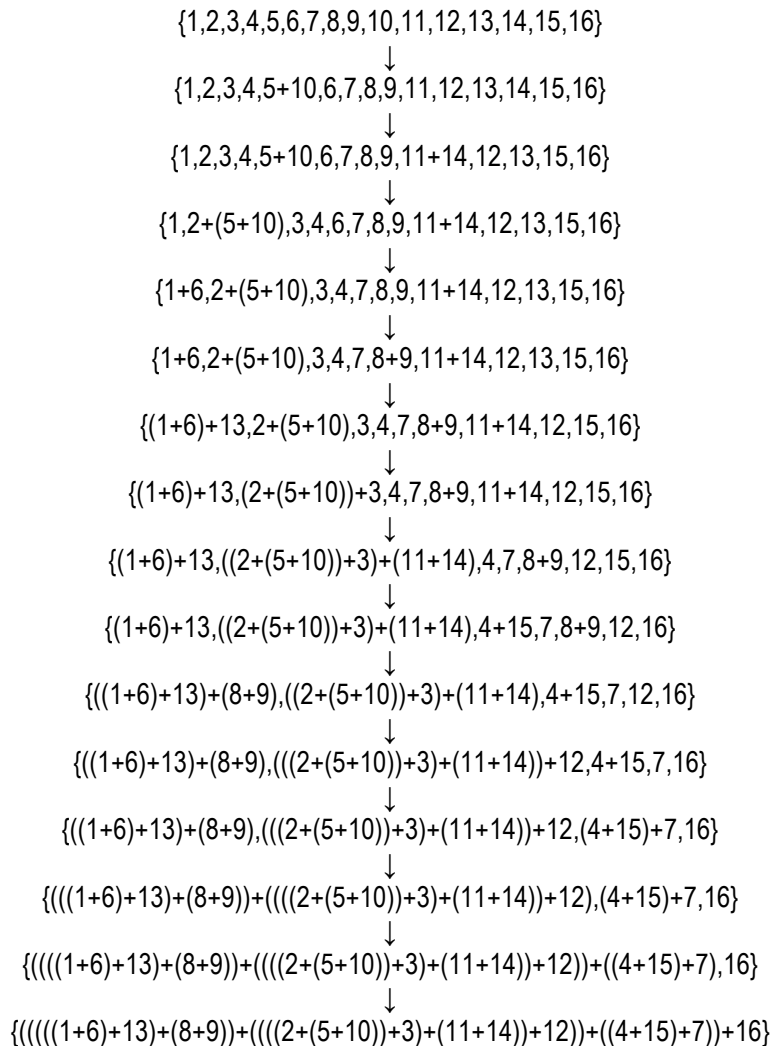
where:  $d_{l,q}$ ;  $d_{m,q}$  - geometric distances between the corresponding clusters.

Thus, the distance between region 2 and the cluster (1 + 8) is:

$$d_{1,(5+10)} = \frac{1}{2}d_{1,5} + \frac{1}{2}d_{1,10} + \frac{1}{2}|d_{1,5} - d_{1,10}| =$$

$$\frac{1}{2} \cdot 904 + \frac{1}{2} \cdot 938 + \frac{1}{2}|904 - 938| = 938. \tag{7}$$

Carrying out similar calculations, we get a new distance matrix (Table 3). Again, we find the minimum distance between the objects  $d_{11,14} = 70$ , combine them into a cluster and, by the principle of "far neighbor", determine the distance between clusters. Thus, we again construct the distance matrix. Calculations continue as long as we do not get one final cluster. The sequence of clustering is presented in the form of a scheme:





Based on the schematic representation of the results of cluster analysis, it can be concluded that all regions of the Republic of Kazakhstan for environmental and economic development are divided into four clusters:

- 1 - Akmola region (1), Zhambyl region (6), Kostanay region (8), Kyzylorda region (9), North-Kazakhstan region (13);
- 2 - Aktobe region (2), Almaty region (3), West Kazakhstan Oblast (5), Mangistau region (10), South-Kazakhstan region (11), Pavlodar region (12), East Kazakhstan region (14);
- 3 - Atyrau region (4), Karaganda region (7), Astana (15);
- 4 - Almaty city (16).

The results of the cluster analysis can be represented in the form of a dendrogram, which is depicted in Figure 1. After breaking all the regions of Kazakhstan into four clusters, we conducted a regression analysis of the dependence of the level of pollution on the economic development of the regions, as a result of which the following equations were obtained:

For the 1<sup>st</sup> cluster:

$$Y_{it} = 196,8 - 0,345BP\Pi_{it} - 0,00002BP\Pi_{it}^2 - 0,006\overline{BP\Pi}_{it} + 0,0003\overline{BP\Pi}_{it}^2, \quad (8)$$

For the 2<sup>nd</sup> cluster:

$$Y_{it} = 98,4 + 0,08BP\Pi_{it} - 0,00005BP\Pi_{it}^2 + 0,106\overline{BP\Pi}_{it} - 0,00005\overline{BP\Pi}_{it}^2 \quad (9)$$

For the 3<sup>rd</sup> cluster:

$$Y_{it} = 76,5 + 0,65BP\Pi_{it} - 0,00013BP\Pi_{it}^2 - 0,198\overline{BP\Pi}_{it} - 0,00001\overline{BP\Pi}_{it}^2, \quad (10)$$

For the 4<sup>th</sup> cluster:

$$Y_{it} = 11,36 - 0,032BP\Pi_{it} - 0,000007BP\Pi_{it}^2 + 0,034\overline{BP\Pi}_{it} - 0,000008\overline{BP\Pi}_{it}^2, \quad (11)$$

Thus, the first cluster has represented by the most prosperous, from the ecological point of view, regions - Akmola, Zhambyl, Kostanay, Kyzylorda and North-Kazakhstan regions. For this cluster, the Kuznets curve does not work - there is no maximum point here, but there is a minimum point, i.e. before it increases with GRP, the amount of emissions decreases, and after this point, with an increase in GRP, the amount of emissions will increase.

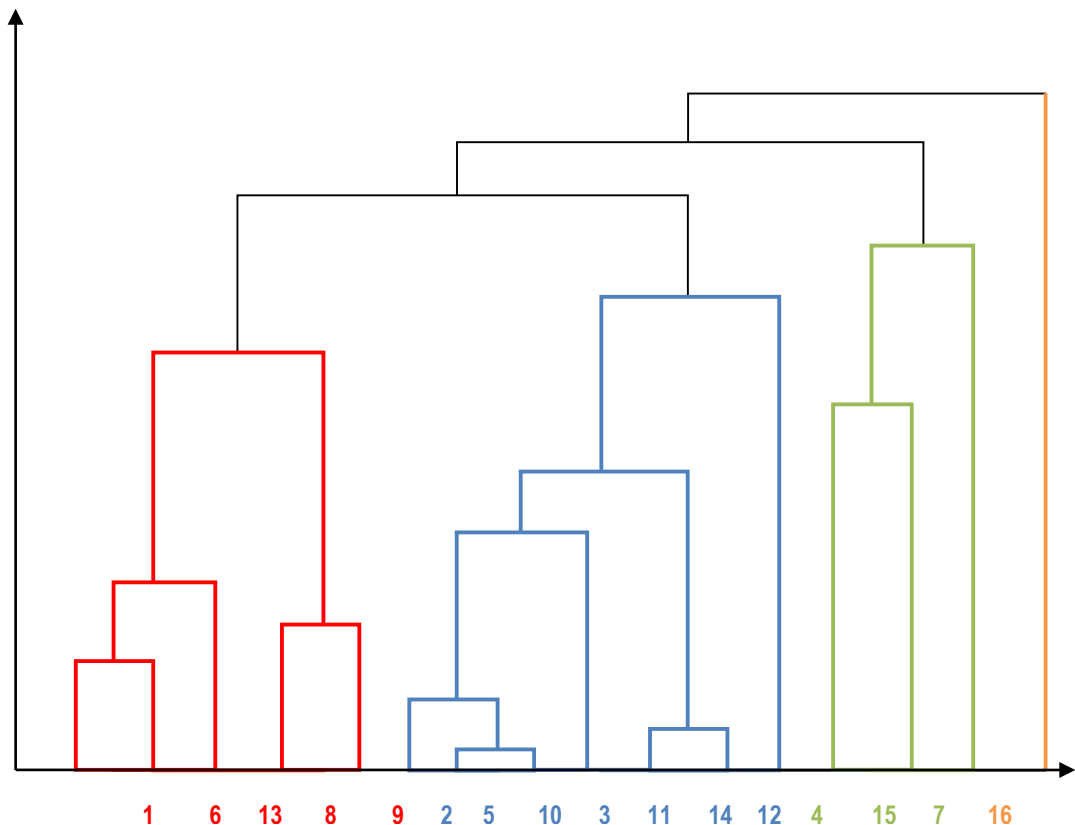
The second cluster has represented by regions that are less favorable from the ecological point of view: Aktobe oblast, Almaty oblast, West Kazakhstan oblast, Mangistau region, South Kazakhstan oblast, Pavlodar region, East Kazakhstan region. The Atyrau Oblast, the Karaganda Region, and the city of Astana represent the third cluster. The city of Almaty stands out as an independent fourth cluster.

For the last three clusters, the curve is  $\cap$ -shaped, i.e. there is a point of maximum GRP, after which the emissions are reduced. Thus, according to the environmental curve of Kuznets, along with economic development, emissions of pollutants into the environment are also reduced. For the same for the first cluster that is most environmentally friendly in Kazakhstan, the Kuznets curve does not work.

This can be explained by the fact that the growth of economic activity has a negative impact on the quality of the environment, in contrast to changes in the per capita GRP income, whose influence on the environment is positive and linear, which contradicts the results of Grossman and Kruger. A variable that measures the impact of trade is not significant in regression equations, since it can have a contradictory effect on the environment. The level of pollution increases if there is an excess of capital in the country (since in this case capital-intensive and environmentally dirty industries develop), and falls with the growth of labor-intensive industries.

In general, in countries with low income, per capita GDP produces environmentally dirty products, and the public is not yet so concerned about the state of the environment that the state carries out environmental activities. As pollution increases, the pollution reaches a critical point. Then the state, under the pressure of the public, on the one hand, begins to formulate a system for regulating the use of natural resources, and on the other hand, with the help of macroeconomic instruments, to stimulate the transition of the economy from environmentally polluting industries to high-tech industries, where modern technologies and the human factor play an important role. As a result, pollution begins to decrease.

Figure 1. Cluster analysis of the ecological and economic development of the regions of the Republic of Kazakhstan from 1995 to 2017



Source: compiled by authors

From the point of view of the incidence of the population in the least prosperous cluster - the third, it can be noted that the leader among the regions in terms of the number of occupational diseases is the Karaganda region.

According to the data of the Committee for the Protection of Public Health of the Ministry of Health of the Republic of Karelia, the incidence of occupational diseases in industrial enterprises has registered in the Karaganda region.

Thus, the indicator of occupational morbidity for 6 months of 2017 for 10 thousand workers was 12.8% (in 2016 - 7.9%) or 175 cases, which is 64 cases more than in 6 months of 2016 (111 cases). And it makes 69.2% of occupational diseases registered in the Republic.

The growth of occupational morbidity is noted in the non-ferrous metallurgy industry for 46 cases, coal industry for 15 cases, in other industries for 3 cases. The indicator of occupational morbidity per 10 000 employees for 6 months of 2017 was 12.8 (for 6 months in 2016 - 7.9). The growth of occupational morbidity is caused by unsatisfactory working conditions, which is confirmed by the results of laboratory-instrumental studies.

So at industrial enterprises there is an excess of the maximum permissible concentrations (hereinafter - MAC) of dust and aerosols, vapors and gases in the air of the working area. Dust can have fibrogenic, toxic, irritating, allergenic, and carcinogenic effects and leads to diseases of the upper respiratory tract, pneumoconiosis and chronic bronchitis.

In the first half of 2017, Karaganda Oblast registered 61 cases of silicosis (24 cases in the same period in 2016), 20 cases of bronchitis (15 cases in the same period in 2016). There is a discrepancy between the microclimate parameters (air temperature, air speed, humidity) to the maximum permissible levels (hereinafter - the remote control). Therefore, the parameters of the microclimate above the average values of the border of comfort zones can lead to uncomfortable thermal sensations, a considerable stress of thermoregulation processes, and with a high thermal load and a violation of health (overheating). The cooling microclimate causes an uncomfortable thermal sensation and stresses in the processes of thermoregulation of the body, which can lead to heat deficiency and hypothermia, which in turn can lead to diseases of the respiratory system.

The noise levels at workplaces exceed the remote control, which in turn leads to a decrease in speech intelligibility, unpleasant sensations, development of fatigue and a decrease in labor productivity and to progressive hearing loss by type of cochlear neuritis, *i.e.* to sensorineural hearing loss.

In the first half of 2017, 40 cases of hearing loss were registered in the Karaganda region (23 cases for the same period in 2016). Exceeding the levels of vibration in the workplace, combined with a set of unfavorable production factors, can lead to the development of vibration pathology with the defeat of the neuromuscular, musculoskeletal system and vascular disorders. In the first half of 2017 in the Karaganda region, 3 cases of vibration sickness were registered (5 cases for the same period in 2016).

Also at the workplaces of industrial enterprises, inconsistencies in the normative requirements for illumination are revealed, which in turn can lead to injuries. After all, one of the factors that determine the safe working conditions and contribute to higher labor productivity and production culture is a favorable light climate.

The evaluation of occurrence of the situations provoked by economic activities, technogenic failures and accidents with human casualties or infringements in functioning of geotechnical systems prevails among applied works. Thus, geologic geomorphological conditions usually act as the factor defining the probability of extreme situations. At presence of multiple observations or the historical data the probability of emergencies of this or that degree is estimated quantitatively, as a number of possible situations in a year or as an inverse value – possibility of an extreme situation occurring once in a certain number of years. The combination of natural and technogenic components of possible catastrophes allows estimating the ecologic geographical position of specific objects and the ecological risk for the corresponding territories.

As a result of the water erosion influence in the given area the size of ecologic economic risk is defined under the expression:

$$R = \sum_{i=1}^n \left( P P_0 P \left( \frac{q}{y} \right) P (IS) \right) i Y_t \quad (12)$$

where: P is the probability of a fallout of the atmospheric precipitation forming a superficial water flow (the discharge of water with probability of excess is less than 10%) and erosion; P<sub>0</sub> is the probability of unfavorable meteorological conditions (rains few days straight) promoting the occurrence of dangerous natural phenomenon; P(q/y) is the conditional probability of the developed situation for ecological objects (q) in view of quality of the environment (y); P (IS) is the probability of potential losses depending on social conditions, scale of influence and destructive force of erosive processes in the area; Y<sub>i</sub> are losses (damage) in the cost expression depending on a degree of erosion influence on ecological objects.

Quantitative characteristics of rain are: the layer, duration and intensity of precipitations, which are random variables in time and space. The factor of the eroding ability of rains assumes revealing of the correlation connection with quantity of the eroded soil or plotting of the probability distribution curves for volume of soil washout (discharge of mudflows) (Talanov 2017, 53–61).

Unfavorable meteorological conditions (UMC), when precipitations fall out during a long interval of time (two days straight), is a very rare event (P<sub>0</sub>) but such cases is possible to at tribute to the erosion hazardous. For plain territory the value is P<sub>0</sub>=0,3, for intermountain valleys and foothills P<sub>0</sub>=0,35, and for mountains P<sub>0</sub>=0,5. The probability that two independent events can happen simultaneously (by the quantity of the fallen out precipitations of today and tomorrow) is the product of probabilities of each of these events, *i. e.* P<sub>1</sub>=P·P<sub>0</sub>. Thus, characteristics of a storm rain with probability 0,0693 at UMC in the foothill territory (P<sub>0</sub>=0,35) can be expected at their joint realization with probability 0,0243, and in mountains at (P<sub>0</sub>=0,5) – 0,0346.

For cartography of ecologic economic risk in territory of economic development of Almaty area are used:

- The soil erosive map of Kazakhstan (scale 1:2500000), made in the Institute of Soil Science NAN RAC (Alimbaev 2016);
- The map of land utilization (scale 1:1000000), made by the Kazakh branch of VISHAGI;
- The map of the mudflow danger of the territory of Republic of Kazakhstan (scale 1:1000000), made by Kazakh Scientific Research Institute of Environment and Climate Monitoring (Talanov *et al.* 1996). On the soil erosive map of Republic of Kazakhstan, the non-eroded and non-deflated territories are allocated, as well as: water erosion, deflation, joint display of water erosion and deflation.

On the map of land utilization, the natural zones (subzones) and agricultural lands on the plain (A), in mountains (B) and in intermountain valleys (Ba) are all located. In our case, the arable land sites, irrigated area ble lands, pastures upland and flooded, hayfields upland and flooded, forests and other which are widely used in economic activities, are of special interest.

The map of ecologic economic risk for the territory of Almaty area (scale 1:2500000) can serve as the basis for planning and management of nature with introduction of the system of insurance in order to compensate the damage caused by the natural spontaneous phenomena, ecological and social factors of risk and the dynamic of diseases.

## Conclusion

Thus, the prediction of the transition to "sustainable" development made by our macroeconomic model is very favorable for the Republic of Kazakhstan from the economic, ecological, and social point of view. In our model, it was shown that "sustainable development" not only leads to economic development of the country as a whole, but also provides higher GRP growth rates, unevenness in regional development, and promotes self-development - one of the main indicators of the country's well-being.

At the present stage of its development, the Republic of Kazakhstan has not yet reached this point of maximum on the ecological curve of Kuznets, which explains the degradation of the environment and the aggravation of the ecological situation and the subsequent increase in the incidence of the population of the regions of the Republic of Kazakhstan. One of the most disadvantaged regions in terms of environmental quality is the Karaganda region.

The transition to sustainable development and its management is a very long process, since it requires solving unprecedented social, economic and environmental tasks. As we move towards sustainable development, the very idea of it will change and be refined, people's needs, will be rationalized in accordance with environmental constraints, and the means of meeting these needs will be improved. Therefore, the implementation of the principles of sustainable development should be considered in stages.

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