

## Societal Patterns Evolution Model in Development of Economy, Society, and Environment

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### Abstract

The Societal Patterns Evolution Model (SPEM) has been developed to apply to socio-technical systems. It contains patterns representing stages of societal development. Mapping of these patterns to the development of Information and Communication Technologies (ICTs) and Information Systems was presented at FedCSIS 2022 Conference. This paper discusses the application of SPEM to model the development of three pillars of sustainability: economic, social, and environmental. An Artificial Intelligence model has been developing to evaluate scholarly papers according to the SPEM model including economic, social, and environmental indicators.

**Keywords:** society; economy; environment; development; maturity model.

**JEL Classification:** O10; O21; O44.

### Introduction

A number of maturity and development models were designed for the sphere of business development, information technologies, society, smart cities, and so on. Analysis of the structure and application domains of the models shows their specific limitations. Many models are not suited for country-wide or large international projects/businesses. Other models have a small number of components or limited usage domains (Gakh, 2023a). SPEM has been designed to be free from such limitations and be as universal as possible. Simple Learning Motivation Hierarchy Model (SLMHM) lying under SPEM has been used to model education development strategy. The model described 16 levels of development of interactions between the pupils, their parents, teachers, school, society, and environment (environment includes all external factors, not only nature) (Gakh, 2022b). Modelling of the development of interactions between society, economy, and environment (SEE), presented in this chapter is carried out in the same way.

The development of interactions between components of SEE depends to a greater extent on humans. Indeed, there is no other initiator of these interactions. Nature is not a static system and environmental events could be also considered initiators. But science cannot consider nature as a conception having consciousness. Such events are stochastic. At the same time, there are internal processes in society and the economy that are also stochastic. Technical disasters can have a similar negative impact as natural disasters. Military actions leading to death and loss of health of a large number of people are an example of a social disaster. Social events can impact the economy and vice versa. Stochastic factors should be treated as environmental factors. Thus, environment should be understood as more wide conception, not only as nature.

One way or another, we accept that humans bear full responsibility for the development of interactions between components of SEE. Thus, human qualities, such as skills, intelligence, emotions, and motivation should be also taken into account. This chapter presents the following artifacts:

- SPEM-based model of development of interactions between society, economy, and environment;
- SPEM-based model of human qualities (Theory of Human Motivation 2.0);
- AI model which used to evaluate scholarly papers according SPEM and SEE;
- Discussion of the application of these models;
- Other useful artifacts.

## 1. Literature Review

SLMHHM was initially presented at Internet-Education-Science 2020 Conference in Vinnytsia, Ukraine (Gakh, 2020). After it was improved (Gakh, 2022a) and applied to estimate education development strategy (Gakh, 2022b). SLMHHM is complex in practical applications and requires Artificial Intelligence (AI) solutions (Gakh, 2022b) but the usage methodology and software are not developed at the moment of this writing. SPEM is an easier model that was created by another methodology. 16 development levels of SLMHHM were mapped to 4 of SPAM's patterns which allowed us to integrate these models into one. One can say that SLMHHM lies under SPEM and details it. It is practically reasonable to call the integrated model SPEM.

SPEM was built on the basis of the findings from Psychology, Philosophy, Sociology, Coaching, Economy, Technology, and Different Maturity Models (Gakh, 2023a). SLMHHM levels have been mapped onto human qualities, such as physical abilities, intelligence, emotions, and creativity. SPEM patterns were juxtaposed with the Adversity, Physical, Intelligence, Emotional, and Creativity Quotients (AQ, PQ, IQ, EQ, and CQ accordingly) (Gakh, 2023a, 2023c). SPEM and SLMHHM were used to help to explain such socio-technical systems as Smart Cities and Information Society (Gakh, 2022a).

Max Tegmark stated in his open letter that a small change in technology is available at the business level, interested in the speedy implementation of the solution without proper research (Tegmark, 2023). Based on solid research the Future of Life (2023) has published an open letter with demand to pause giant AI experiments. AI systems with human-competitive intelligence can pose profound risks to society and humanity, as shown by extensive research (Abraham, 2018) and acknowledged by top. AI labs (Berardi and Dangelico, 2015) 50% of all employees will need reskilling by 2025, as the adoption of technology increases (World Economic Forum, 2020). These facts show the turbulent state of the modern economy and society. It seems that many critical processes in society and the economy are not under human control. The technological singularity does not allow forecasting inventions, their implementation, and their impact to SEE components. Time becomes a vital factor because periods between the inventions and their impact becomes shorter and shorter.

One of the technology threat problems relates to AI. AI cannot harm people if it is with people in one strongly connected system (Gakh, 2022c). One can say that any intelligent technology will not harm people being with them in one strongly connected system. The Information Age where humanity is currently living is characterized by increasing connectivity and abilities for people to express their feelings and emotions (Gakh, 2022c; 2023a). Increasing connectivity will lead to improving morale because a lack of morale will not allow people to be close to each other. One can observe this phenomenon in social media. This is an example of society-technology interaction 85 million jobs may be displaced by a shift in the division of labour between humans and machines. Self-management and working with people are two of four required types of necessary employee skills in the coming years (World Economic Forum 2020). The development of ICT and AI means that many of mentioned machines

are intellectual. It means increasing connectivity between people and machines, in other words between society and the economy (increasing the number of intellectual machines leads to it). Thereby there are people-people, people-machines, and machines-machines connections.

“Humans impact the physical environment in many ways: overpopulation, pollution, burning fossil fuels, and deforestation. Changes like these have triggered climate change, soil erosion, poor air quality, and undrinkable water. These negative impacts can affect human behaviour and can prompt mass migrations or battles over clean water.” (National Geographic, 2023). These facts relate to people-environment interaction. Society impacts the environment through the economy. The environment impacts people directly. Species have evolved over the ages. Thus, assessment of the human-nature and nature-human impact requires taking into account long-time influence. There is reason to believe that the human-nature and nature-human interactions are greatly underestimated.

Interactions between SEE components are stochastic, complex, and have long-time inter-influence. Modelling their development requires taking into account many quantitative and qualitative parameters and intensive calculations. Modern ICTs, such as AI models, networks, Internet of Things allow for providing proper data gathering and processing. SPEM is capable to model all development of the SEE interactions. “Kaggle AI Report - Maturity at a glance” (Gakh, 2023b) is the first prototype of AI model showing the possibility to evaluate the maturity of SEE components by the textual description. ChatGPT (2023) being a Large Language Model (LLM) demonstrates how text-based AI model can become an AI leader in the world.

## 2. Research Methodology

The purpose of this study is to inspire researchers and developers to apply SLMHM/SPEM in solving SEE interaction development problems. The research was carried out according to the recommendations of (Walliman, 2011). It has a descriptive design. The research describes the application of SLMHM/SPEM to model the development of the interactions between society, the economy, and the environment. It is an extension of previous research (Gakh, 2020, 2022a, 2022b, 2022c, 2023a, 2023c) to SEE. These papers describe SLMHM/SPEM and their application to the development of education, ICT, Smart City, Sustainable Information Society, management, and business. Application of the models to SEE issues is presented as the research findings. A discussion of the findings is presented in the course of the description. Last paragraph “Conclusions” summarizes the research.

The following research questions relating to SLMHM/SPEM are set:

- RQ1: How SLMHM/SPEM can be used to model SEE interactions?
- RQ2: Can be the economic, social, and environmental issues modelled?
- RQ3: Can be human qualities, such as intelligence and morale modelled?
- RQ4: How can the models be practically implemented?

## 3. Economy, Society, and Environment Interaction Model

### 3.1. The Highest Aim

The first step in SLMHM/SPEM modelling is defining what we would like to have as the best result. It does not have to be a practically achievable result. This may be the ideal goal to aim for. Originally the highest aim for a society in SPEM is God. At the same time, for organizations, the mission is proposed as the highest aim (Gakh, 2023a). Assuming that society and economics are human-driven conceptions, but the natural environment is not, setting the highest aim for the environment is a specific problem. At the same time, we do not need to model the environment itself but rather the whole system including all three components: economic, social, and environmental, and their interaction. In this case, we do not need to define the highest aim for the environment. Thus, we need to

set the highest aim for this 3-component system. A similar approach has been used in modelling education development (Gakh, 2022b).

The SLMHM Level 16, Totality defines the highest aim of the model. In our case, it should be set to the complete fusion of all SEE interactions into something infinite and overall. It is not necessary to imagine what it is. It should be as higher aim as possible. The model does not suppose achieving this level – this is the ideal level. This approach allows us to put the responsibility on humans and operate by conceptions accepted by all (for example it is not necessary to accept God as the highest aim because atheists do not accept it. At the same time the model does not exclude believers because they are a part of society and their participation can be taken into account at the SLMHM Level 7, Alternatives, and higher.).

### 3.2. Initial Formation Pattern

The idea of SPEM is based on the historical evolution of human society. Society evolved from one pattern to another, where human life changed dramatically and qualitatively. Initial Formation Pattern (IFP) is the first societal pattern characterized by living standalone or in small groups. It is a pattern characterized by chaos and survival (Gakh, 2023a). In application to SEE development, it is the level where there is no managed interaction between society, economics, and the environment (SEE). Such interactions take place randomly. It could be a situation where society-economy interactions relate to the higher pattern, but society-environment or economy-environment interactions are random and chaotic. In this case, no one can say about the development level of SEE is higher than IFP.

Nowadays IFP is represented by unemployed people and those who are in a state of survival. One can surely say that poverty and misery relate to this pattern. It can also be concluded that poverty and misery refer to random and chaotic interactions with the environment. Here we see both the chaotic influence of people on the environment and the chaotic influence of the environment on people. As a result, at this level, there is complete insecurity of man in front of the environment and the environment in front of the man.

### 3.3. Primary Society Pattern

IFP cannot relate to society because people have no organization or something common. People come together to solve problems together and move into the Primary Society Pattern (PSP). PSP relates to a basic societal structure. From a historic perspective, this pattern relates to the Agrarian Age. The ideal for cities, society, and the economy here is defensiveness (Deguchi et al., 2020; Gakh 2023a). It means that in PSP society-environment interactions change qualitatively. Undoubtedly, other interactions of the SEE system also change significantly. Society is becoming more resilient to the negative impact of the environment than in IFP.

Four first SLMHM levels relate to PSP:

- *1.1. Desire.* This is the first level relating to society. In our case, it relates to all three SEE components: society, economy, and environment and all their interactions. A conscious understanding and desire to ensure interaction between SEE take place here. Undoubtedly conscious understanding and desire belong to man. And accordingly, the man drives the development of the system. Desire takes place at all subsequent levels;
- *1.2. Intention.* People have a preliminary vision and are ready to spend resources to ensure the interaction. Intention as well as desire takes place at all subsequent levels. Intention encourages people to look for opportunities (through feasibility studies for example);
- *1.3. Feasibility.* The level at which the feasibilities are identified and prepared for the actions takes place;
- *1.4. Action.* The level at which the controlled SEE interactions take place.

Requirements of each level take place at all subsequent levels. History shows that society and the economy did not significantly impact the environment in the Agrarian Age. At the same time, the economy was undeveloped and society remained highly susceptible to random adverse factors such as drought, floods, disease, etc. PSP is the basic pattern where interactions between all SEE components take place. At a glance, one can tell that there is no imbalance in interactions between the three SEE components. However, the impact of natural conditions on society and the economy exceeds other interactions.

At the same time, desire and intention are human qualities. Since the conditions of any level also take place at subsequent levels, the desire and intentions of society are the main driving forces for the development of the system. The economy gives humans the opportunity to fulfil their desires and intentions.

### 3.4. Adaptive Society Pattern

PSP provides a basic societal structure. Being in the structure, people strive to improve their lives even more. There is a desire to receive benefits based on facts and logic. People move into the Adaptive Society Pattern (ASP). ASP relates to the Industrial Age, profitability, and adaptation to sudden changes (Gakh, 2023a).

SLMHM levels here are:

- 2.1. *Evaluation*. At this level, all interactions are evaluated;
- 2.2. *Improvement*. Evaluation achieved at the previous level allows a regular improvement of the interactions;
- 2.3. *Alternatives*. Evaluation and improvement allow us to consider possible alternatives. There is also the ability to create new alternatives that help in improvements;
- 2.4. *Innovations*. Continuous improvements lead to the emergence of innovations.

History shows that the rapid growth of the economy has led to an increase in the welfare of society and at the same time has led to significant environmental pollution and the disappearance of many species of flora and fauna. First of all, it is a result of an imbalance caused by the significant negative impact of the economy on nature. One can say that this imbalance takes place at levels 2.1 and higher. Observations show that humanity paid much attention to evaluation and improvement (levels 2.1 and 2.2) at the level of interactions between society and the economy. The interactions between society and nature, as well as the economy and nature, have not been given due attention. In recent decades, attention to interactions with nature has been growing, which translates into the search for alternative sources of energy and production (level 2.3. Alternatives) that do not seriously harm the environment. There is a high interest in innovations (level 2.4), but the achievement of this level in our days is not easy.

Industrial revolutions take place at the level of this pattern and significantly develop this pattern. Innovations can be considered a driver of these revolutions. It should be taken into account that the industrial revolutions themselves and the development of this pattern are dictated by the desire for profit and benefit. The catastrophic state of nature required attention to environmental problems. The development of the economy has led to the emergence in society of opportunities to pay attention to these problems (that is, the interaction of the economy and nature, as well as the interaction of society and nature).

### 3.5. Information Society Pattern

The striving for profit leads to an increase in the disproportion in well-being between different people and the stratification of society. Connectivity allows them to reduce the "distance". The observations show that the economic development at ASP led to growing of connectivity represented by the transportation system and information computer networks. Connectivity leads to an increase in the good and information flow between people

and allows them to get closer to each other. Social media can be an example of information convergence of people. Such convergence leads to an increase in the ability of people to express their feelings and emotions.

Increased connectivity leads to moving society into the Information Society Pattern (ISP). ISP relates to the Information Age and connectivity growth (Gakh, 2023a). SLMHM levels here are:

- 3.1. *Reward*. This level is characterized by rewarding all SEE parties due to their interactions;
- 3.2. *Optimization*. All interactions are continuously increasing benefits and reducing harm at all interactions;
- 3.3. *Synergy*. It is a level where the synergy between all SEE components takes place;
- 3.4. *Extraordinary*. This is a level of specific innovations, a level of innovation whose benefit is shared by all components of the system over a long time.

Observations show that humanity develops predominantly interactions of society-economy type. It is because ASP developed under the influence of ideologies such as Marxism and Freudianism (Küçükalp, 2017). Connectivity which is the fundamental property of ISP contributes to decentralization (Distributed applications relate to the SLMHM level 3.3, Synergy (Gakh, 2022c)). Such decentralization is one phenomenon leading to the emergence of a new type of humanism – neo-humanism. In SEE interactions neo-humanism should treat human-related and environment-related phenomena with equal significance.

In the case of SEE development, connectivity should include all society, economy, and environmental interactions. Increasing the ability to express their feelings and emotions should apply to all SEE interactions. First of all, the expression of feelings and emotions is characteristic of a human. This property should apply to other living organisms, including animals and plants. There are researches showing that plants have a complex system of reactions to external irritants (Appel and Cocroft, 2014; Monshausen and Gilroy, 2009; Nichols, 2023). Avoiding taking into account this information is evidence of noncompliance at level 3.1. *Reward*.

### 3.6. Creative Society Pattern

Connectivity and the ability of people to express their feelings and emotions led to growing of abilities to share their ideas and realize their creativity. Society moves into Creative Society Pattern (CSP). CSP presents a style of living where people can share their ideas and realize their creativity. Currently, humanity lives in the Information Age (ISP) and has entered the Era of Creativity (CSP). One evidence of the Era of Creativity approaching is the development of AI. Stable Diffusion (2023) is a latent text-to-image diffusion model capable of generating photo-realistic images given any text input, cultivates autonomous freedom to produce incredible imagery, and empowers billions of people to create stunning art within seconds.

SLMHM levels here are:

- 4.1. *Information*. It is a level where the information is the primary factor. The information flows are real-time. This is the level of information generation or gathering in real-time;
- 4.2. *Streamlining*. It is a level of real-time information processing. Real-time knowledge is extracted from the information flows;
- 4.3. *Expansion*. Streamlining allows expanding the interaction between SEE;
- 4.4. *Totality*. This is a level of the highest aim.

Stable Diffusion relates to the SLMHM level 4.1. Information, and can be used in solutions relating to the SLMHM level 4.2. Streamlining (Gakh 2022c; Stable Diffusion, 2023). Such solutions are evidence of stepping the technologies into CSP. In the SEE system all natural creatures, objects, and phenomena should be considered as something unique and unrepeatably. The development of ICT systems for gathering real-time information relating



to the environment, processing it, extract knowledge is a way to improve the society-environment and economy-environment interrelations.

#### 4. The Questionnaire

The questions, presented in this chapter and structured according to SLMHM/SPEM and SEE development allow us to better understand the way to achieve the Highers Aim (HA). These questions are given as an example of what a developed system should comply with. When implementing specific projects related to the development of the system, this list can be changed and supplemented. The questions are structured according to the SPEM patterns and SLMHM levels as it is described below.

In Initial Formation Pattern (IFP), the current situation and problems are not recognized. There are no questions. In PSP, the current situation and problems are recognized. The process to solve the problems is identified and started. From the human perspective, this pattern is characterized by discipline. SLMHM levels are:

- 1.1. Is HA recognized by society and economy (for Level 4.4. Totality)? Can HA be formulated for each sector/area/branch/country/organization/team? How can the desire to achieve HA (solve the problem) and fulfil the mission be initiated (through marketing, advertising, and propaganda)?
- 1.2. Are society and the economy ready to solve the problem? How can society and the economy be motivated/stimulated to solve the problem?
- 1.3. Is the initiative feasible? What facts (data) should be collected to answer this question? Do society and the economy have the necessary resources?
- 1.4. Are the initiatives being implemented? Are society and the economy acting?

In ASP, there are regular improvements in the process to solve problems. Adaptation to changes is achieved. From the human perspective, this pattern is characterized by intelligence. SLMHM levels are:

- 2.1. Are the initiatives, their steps, and their progress being evaluated? Are the data being analysed to get the grade? Is the evaluation quantitative or qualitative? In what units the initiatives/progress are/is evaluated (currency, goods, human/animal/plant lives, the mass of waste/contaminators, and so on)?
- 2.2. How are the initiatives being improved? How the quality is assured? How are the processes being optimized?
- 2.3. What are the alternatives (methods, materials, energy sources, and so on)? How are the alternatives being managed? How are the alternatives being presented as knowledge?
- 2.4. How do the initiatives deal with sudden troubles and changes? How is disaster recovery implemented? How unforeseen circumstances are handled and risks managed? How are agile methodologies being used?

ISP is characterized by connectivity, synergy, and symbiosis. From a human perspective, this pattern is characterized by feelings, emotions, morale, and humanism (neo-humanism). Proactive actions to changes are in place. SLMHM levels are:

- 3.1. How do all parties get a reward? How open, mobile, electronic, and other relevant technologies are used? How the connectivity is implemented?
- 3.2. How the reward for all parties is maximized with simultaneous cost reduction? How can these benefits take place for a long-time perspective? How the connectivity is strengthened? How transportation systems and trade are being optimized?
- 3.3. How synergy and symbiosis between all parties are achieved? How distributed applications, cloud solutions, and other relevant technologies are used here?

- 3.4. How proactivity in dealing with sudden troubles and changes is implemented? How the system is adapted to climate change and other modern challenges?

Creative Society Pattern (CSP) is characterized by creating real-time knowledge and achieving goals. From the human perspective, this pattern is characterized by awareness, mindfulness, and creativity. SLMHM levels are:

- 4.1. What real-time data sources can be being used? How automatic data acquisition from such sources as sensors, random number generators, artificial neural networks (ANNs), and so on are implemented?
- 4.2. How the real-time data are streamlined? How the knowledge is extracted from real-time data? Which data stream compression/optimization technologies, ANNs, and other streamlining technologies are implemented?
- 4.3. How the initiatives are expanded? What geography, communities, economies, and so on are (will be) covered by the initiatives?
- 4.4. What is HA at its maximal manifestation?

## 5. Theory of Human Motivation

Society and economics are human-driven conceptions. One can say that interactions between SEE components are dependent on human qualities, such as adversity, physical, cognitive, emotional, and creative intelligence. These qualities relate to Adversity Pattern/Quotient (AP/AQ), Physical Pattern/Quotient (PP/PQ), Intelligence (cognitive) Pattern/Quotient (IP/IQ), Emotional Pattern/Quotient (EP/EQ), and Creative Pattern/Quotient (CP/CQ). Adversity intelligence does not play an explicit role in SEE interactions. But a balanced combination of all intelligence types, including adversity intelligence can be considered a success factor to develop the SEE interactions. Adversity intelligence corresponds to the ability of a person to face any unfavourable situation in his/her life, to the science of human resilience, *i. e.* an ability to handle different adverse situations as and when required (Biswas 2018). It seems that without adversity intelligence negative situations cannot be handled properly and higher types of intelligence cannot be developed.

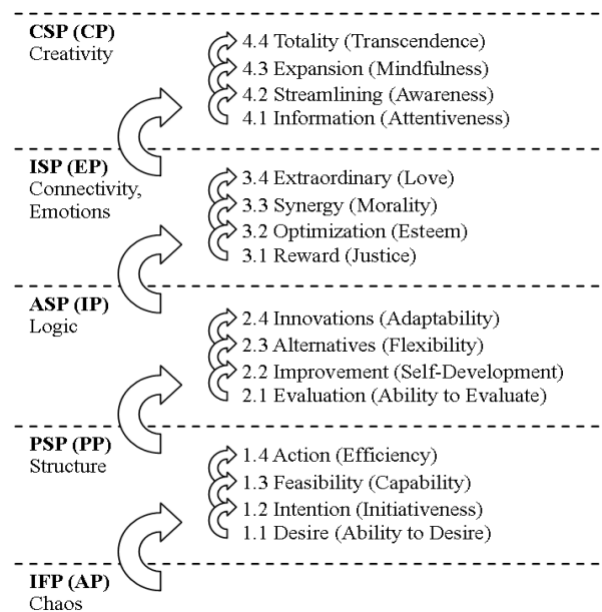
World Economic Forum has defined the top 10 job skills of tomorrow 50% of all employees will need reskilling by 2025, as the adoption of technology increases. Critical thinking and problem-solving top the list of skills employers believe will grow in prominence in the next five years. Newly emerging are skills in self-management such as active learning, resilience, stress tolerance, and flexibility (World Economic Forum 2020). Such dramatic changes in the labour market impact society and the economy.

Physical Quotient (PQ) is calculated by the muscular abilities of the athlete such as time to activate after stimulus, speed of limb movement, duration of muscular activity, and muscular power. «To measure emotionality, it has to be measured to what maximum extent a person can be emotional with respect to a particular emotion» (Kumar 2016). The physical Intelligence Quotient takes into account motor skills, alertness, physical speed, strength, endurance, calisthenics, game dancing, and neural and physical health (McCurdy, 1924). All mentioned peculiarities can be also applied to intelligence.

Application of SPEM/SLMHM to the sphere of human motivations (referred to in the further text as Theory of Human Motivation 2.0 / THM 2.0 (Gakh, 2023c)) can structure human qualities in a way of development of the human potential and with compliance with all SPEM compatible models (see Figure 1).



Figure 1. SLMHM and THM 2.0 levels



Note: THM 2.0 patterns and levels are in brackets

Physical intelligence includes the following THM 2.0 levels (corresponding to the SLMHM levels) (Gakh, 2023c):

- **1.1. Ability to Desire.** It is the first and fundamental quality that shall take place at all levels. Desire can be awakened by extrinsic motivation through marketing, advertising, propaganda;
- **1.2. Initiativeness.** Success depends on the ability to take the initiative. Initiatives and projects are planned and designed at this level;
- **1.3. Capability.** The capability allows realizing the desire and *initiativeness*. This is a level of provision of feasibility to implement the initiatives and projects;
- **1.4. Efficiency.** This quality relates to the ability to implement the initiatives. This is a level of action – a process of thinking and doing.

Intelligence is the ability to think rationally, learn effectively, understand complex ideas, and adapt to the environment. The IQ test is a good predictor of many life outcomes, including educational and career success, health, longevity, and even happiness (Gottfredson, 1998; Matzel and Sauce, 2017). Cognitive intelligence includes the following THM 2.0 levels (Gakh, 2023c):

- **2.1. Ability to Evaluate.** This is an important quality of cognitive intelligence. This quality allows one to recognize and evaluate;
- **2.2. Self-Development.** The ability to evaluate achieved at previous levels allows improvements including the self-development;
- **2.3. Flexibility.** Flexibility allows one to act by choosing the best way from several ones;
- **2.4. Adaptability.** Flexibility allows one to achieve adaptability, which is the quality of being able to adjust to new conditions.

Despite the rapidly growing interest in Emotional Intelligence, measuring Emotional Intelligence using specific behaviours is still in a pioneering phase (Burcea and Sabie, 2020). Information Society Pattern, relating to the Informational Age is characterized by connectivity and networks. The main values of this pattern relate to human

feelings, in other words to Emotional Intelligence. That's why social media and networks have become so popular nowadays. (Gakh, 2022c). Emotional intelligence includes the following THM 2.0 levels (Gakh, 2023c):

- 3.1. *Justice*. A sense of justice is the fundamental quality of emotional intelligence. This is an emotional equivalent of the Ability to Evaluate presented at level 2.1;
- 3.2. *Esteem*. Esteem is based on the sense of justice;
- 3.3. *Morality*. Morality allows one to achieve the highest level of connectivity;
- 3.4. *Love*. This is the highest quality of emotional intelligence.

Nussbaum (2013) investigates how individuals, corporations, and nations are boosting their creative intelligence – CQ - and how that translates into their abilities to make new products and solve new problems. Ultimately, Creative Intelligence shows how to frame problems in new ways and devise solutions that are original and highly social. Creativity has been defined as an idea that is novel, surprising, and valuable (Abraham, 2018; Boden, 2004; Chen, 2020; Runcon, 2012; Stein, 1953). Creative intelligence includes the following THM 2.0 levels (Gakh, 2023c):

- 4.1. *Attentiveness*. Attentiveness is the fundamental quality of creative intelligence;
- 4.2. *Awareness*. Attentiveness leads to developing higher quality – awareness;
- 4.3. *Mindfulness*. Mindfulness is the process of actively noticing new things (Harvard Business Review, 2017);
- 4.4. *Transcendence*. This is the highest and unachievable level, where all qualities are developed maximally.

## 6. Emotional Intelligence

Soft skills are important for maintaining interpersonal relationships and effective communication. Soft skills include interpersonal and personal attributes that enhance an individual's interactions, job performance, and career prospects. Emotional intelligence is a part of soft skills used in the workplace (Vasanthakumari, 2019). Thereby emotional intelligence is directly related to connectivity, Information Era, and THM 2.0 levels 3.1, 3.2, 3.3, and 3.4.

THM 2.0 levels can be presented as emotional competencies (Gakh, 2023c; Serrat, 2017):

- 3.1. *Justice*. Personal competence relates to emotional awareness, accurate self-assessment, self-confidence, self-control, trustworthiness, conscientiousness, emotional adaptability, and emotional innovativeness;
- 3.2. *Esteem*. Personal competence relates to the emotional achievement drive, emotional commitment, emotional initiative, and emotional optimism;
- 3.3. *Morality*. Social competence relates to empathy, service orientation, developing others, leveraging diversity, political awareness, influence, communication, leadership, change catalyst, conflict management, building bonds, collaboration and cooperation, and team capabilities.

Love is the highest emotional state and is not presented as Serrat's emotional competencies. Emotional intelligence links strongly with concepts of love and spirituality (Serrat, 2017). Spirituality relates to the highest THM 2.0 levels.

People are unequal in intellectual potential - and they are born that way, just as they are born with different potentials for height, physical attractiveness, artistic flair, athletic prowess, and other traits (Gottfredson, 1998). At the same time, experts say soft skills training can improve intellectual potential if it begins when individuals are students (Vasanthakumari, 2019).

One can assert that contemporary philosophies and the ensuing world of everyday life under capitalism (ASP), which stresses the decentralization of the subject in line with the radical critique of humanism, created a new type of humanism or at least legitimized the emerging neo-humanism. Ideologies such as Marxism and Freudianism nourish capitalism. The practice of everyday life under capitalism, which grew and progressed owing to the assistance of science over time and which, in parallel with globalism, emerged as the absolute decisive power over human desires all around the world, provided the fertile soil and climate needed by the aforementioned neo-humanism (Küçükalp, 2017).

The universe does not consist only of human beings; other creatures, other animals, and plants also have the right to live (Sarkar, 2011). Traditionally, humanism has focused on man's relations to man, and this viewpoint was instrumental in advancing the cause of social justice throughout the world. In the current era of environmental crisis, an expanded form of humanism, neo-humanism, also considers humanity's relationship with other living beings and the entire ecosystem (Vedaprajananda, 2011).

## 7. Poverty Alleviation

There are many definitions of poverty. It is defined as "a state of being in which we are unable to meet our needs", "a scarcity, dearth, or the state of one who lacks a certain amount of material possessions or money", "a deprivation of basic human needs, which commonly includes food, water, sanitation, clothing, shelter, healthcare, and education", "an economic inequality in the location or society in which people live", "a condition involving some deprivations and adverse occurrences that are closely associated with inadequate economic resources", "an inadequacy of income to support a minimum standard of living", "a lack the resources to obtain the types of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or approved, in the societies in which they belong". Such different definitions exist because poverty is a social concept (Oviasuyi, 2020).

SPEM supposes that developed ASP allowed to achieve adaptation to different negative influences of random events. It means also alleviation of poverty relating to the satisfaction of basic physiological needs. Developed ISP leads to satisfaction of emotional needs and developed CSP leads to satisfaction of spiritual needs. The lowest SPEM pattern is IFP characterized by chaos and survival. The second SPEM pattern is PSP characterized by a structure. Terms such as "emotionally poor" and "spiritually poor" most likely relate to literature or street talk. But SPEM allows categorizing poverty according to the patterns:

- IFP. No human need is satisfied;
- PSP. Belonging to the group is satisfied. Basic physiological needs are not satisfied;
- ASP. Basic physiological needs are satisfied. Human needs in an expression of their feelings and emotions are not satisfied;
- ISP. Human needs in an expression of their feelings and emotions are satisfied. Human needs in sharing their ideas and realizing of their creativity are not satisfied;
- CSP. Human needs in sharing their ideas and realizing their creativity are satisfied.

SPEM not only allows us to expand the concept of poverty but, taking into account neo-humanism, shows the importance of satisfying the emotional and spiritual needs of people. A developed society is characterized by the following:

- Absence of phenomena (people, events, etc.) related to IFP;
- The basic provision of food, water, sanitation, clothing, shelter, healthcare, and education;
- Opportunities and promotions to achieve esteem, growth, and development;
- Opportunities and promotions to express of individual's feelings and emotions;

- Opportunities and promotions to share individuals' ideas and realize their creativity.

Taking into account all SEE components poverty alleviation should not harm the environment. The first step is the elimination of phenomena related to chaos and survival (IFP). This can be achieved by the implementation of a basic society structure (PSP). Movement from IFP to PSP also eliminates the occasional impact on nature from such events as poaching, dumping of hazardous substances, forest fires, and so on.

Because poverty is a social phenomenon, the question of what is the basic physiological needs cannot be answered definitely. One way or another, the provision of basic needs should provide a way out of IFP. It should be noted that due to randomness and issues of survival, IFP poses a certain threat to all components of SSE. Society should by all means ensure that no components of SEE are found in IFP.

The provision of basic physiological needs relates to PSP. It may lead to the growth of bureaucracy and put society under bureaucratic control. The development of society allows the prevention of falling under control and dystopia (Gakh, 2023a). At the same time, the development of society can be considered a driver of SEE development. It should be noted that not all individuals need to achieve esteem, growth, and development, expressing their feelings and emotions, or sharing their ideas and realizing their creativity. But opportunities and promotions should be provided. Moreover, such opportunities and promotions should take into account all SEE components. As it was mentioned above society and economy are human-driven conceptions. The development of SEE is based on the development of society. As it was mentioned above, globally, society is in the Information Age (ISP) and has entered the Era of Creativity (CSP). At the same time, many people continue to be in IFP. The level of poverty and the uncontrolled depletion of nature indicate the significance of the proportion of the population that is in IFP.

The depletion and pollution of nature is the main negative indicator in the interaction between the components of SEE. The entry of society into a dystopia through any kind of control (Gakh, 2023a) and the impossibility of any groups of the population being in their own pattern (except for IFP) is also a serious negative indicator. The role of the economy is to enable society and the environment to be in the appropriate patterns.

Based on SPEM, it can be hypothesized that there are the following types of poverty that have a negative impact:

- Survival poverty (IFP) – lack of means and conditions necessary for survival;
- Structural poverty (PSP) - lack of order, laws, and rules;
- Opportunity poverty (ASP) - lack of opportunities for development and employment in the society of a stable position, lack of confidence in the future;
- Emotional poverty (ISP) - the lack of opportunities to realize feelings and emotions. This category also includes moral poverty - the absence of moral relations;
- Creative poverty (CSP) - the lack of opportunities to implement ideas and creativity. This category also includes spiritual poverty - the lack of opportunities for the development of spiritual qualities.

These poverty types are equally harmful (this equivalence is qualitative and comparing the real harm from any type of poverty is not an easy task). In the case of SEE, it is necessary to pay special attention to these types of poverty. As an example, emotional poverty, which entails a lack of a moral attitude towards nature, will not allow the development of society-environment and economy-environment interactions. Neo-humanism is the only means of maintaining these interactions at the proper level (ISP) and fighting emotional poverty.

## 8. Sustainability and Sustainable Development

### 8.1. Digital Transformation, Smart City, and Information Society

Digital transformation is “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” (Vial, 2019). The digital transformation of organizations is a sign of their maturity. At the same time, its practical implementation is a complex puzzle. The one view of the conceptual framework of digital transformation shows that the leveraging of digital technologies enables value generation taking antecedents as input and improving societal, economic, and environmental performance (Mikalef and Parmiggiani, 2022).

In the case of Norway, the evolution of ICT systems and infrastructures has been largely driven by pragmatic concerns related to specific applications, aimed to ensure the competitiveness of industrial and service organizations in the country against a very dynamic global market. This has also happened through public-private initiatives. A crucial aspect in this process is indeed the role of the state in maintaining a trust-based relationship with its citizens and organizations, for example, by investing significantly in the digitalization of its public services (Parmiggiani and Mikalef, 2022).

Smart City (SC) and Information Society have emerged as a result of the development of ICT. Ecological, economic, socio-cultural, and political components were proposed to be considered as ones of the Sustainable Information Society (Ziemba, 2017). Technological, economic, occupational, spatial, and cultural elements of the Information Society were selected (Webster, 2014) 17 UN sustainable development goals (United Nations, 2023) can be achieved by the synergy between society and the environment. ICTs provide valuable tools for such harmonization allowing intensive information processing and control (Gakh, 2022c).

Cities worldwide play a prime role in social and economic aspects and have a huge impact on the environment (Albino et al., 2015). “The coronavirus pandemic highlights the difficulty in facing an uncertain and unpredictable future. Although smart city resilience is not a new concept at this time, it must be updated considering the disruptive impact of the COVID-19 crisis for a robust recovery approach”. (Apostu et al., 2022).

The environment made itself smart to be self-aware by using the Internet of Things and ICTs and E-Governance tools based on existing environmental legislation and E-Democratic management practices are applied for environmental resource management by the smart community to intervene 24h and 7 days a week (Kumar, 2020). To satisfy the specific model level all SEE interactions should comply with this level. If any of the interaction between society-economy, society-environment, or economy-environment does not comply with a level, we cannot say about the satisfaction of SEE at this level.

### 8.2. Development of Society and Economy

Sustainability is the highest achievement of ASP and sustainable development is a peculiarity of ISP (Gakh, 2022c; 2023a). Thereby sustainability and sustainable development of the SEE system relate to SLMHM and THM levels 3.X and 4.X accordingly.

The circular economy is a way of creating value, and ultimately prosperity by extending product lifespan through improved design and servicing, and relocating the waste from the end of the supply chain to the beginning - in effect, using resources more efficiently by using them over and over, not only once (UNIDO, 2023). In SLMHM the circular economy relates to level 3.2. Optimization that creates a base for synergy between industry and environment. The circular economy relates to ISP.

Innovations are the highest result of developed ASP. SEE development requires estimating the innovations from the perspectives of society, economy, environment, and their interactions. In this case, if innovation is useful

only for society and the economy and does not contribute to the environment, it cannot be considered as complying with ASP (SLMHH level 3.1, Reward requires contribution for all SEE components). Proper evaluation of the innovations requires the meeting of evaluators' qualities to THM 2.0 level 3.1, Justice.

There is reason to believe that society can be under two motivating factors – intrinsic and extrinsic. Intrinsic motivation is an internal driver of humans. Extrinsic motivation for humans includes factors relating mainly to technology and the environment. According to THM 2.0, technologies allowed humans to evolve. The development of transportation infrastructure and the Internet helps people to develop their communication qualities relating mainly to feelings and emotions. The development of abilities to gather and generate real-time information promotes people to express their ideas and creativity (for example ANNs allowed now to paint pictures by a textual description which does not require manual drawing skills from a person and allows more people to paint pictures).

Combining SLMHH and THM 2.0 and applying them to technical, economic, environmental, social, and other studies allows us to achieve two main aims: structure of indicators from different domains and building a combined structure of these indicators. This structure can be used to evaluate the current situation and plan the future development of the whole system. This holistic approach is very useful in the case of SEE interaction modelling.

## 9. Education and Knowledge Management

The macroeconomic research on growth and development in the late 1980s and 1990s emphasized human capital, often approximated by educational attainment, in theoretical and empirical work. Growth accounting attempted to decompose long-run growth across countries into a set of proximate causes, including human capital. This technique required measuring the returns to human capital, which was largely done by running cross-sectional Mincer regressions that linked wages to educational attainment (Nobel Committee 2019).

Modelling of education development strategy using SLMHH based on interactions between the pupils, their parents, teachers, school, society, and environment showed interesting results (Gakh, 2022b). As was mentioned above, training students to develop their emotional intelligence is a success factor in their work. In the context of SEE development education should include additional components, relating to society, the economy, and the natural environment. And in this case, education should cover all populations, not only pupils and students.

Social Adaptive Case Management is a Knowledge Management system based on group work support, social networking, feedback, and interactions (ISP). Knowledge workers are responsible for the utilization and exchange of knowledge, generation, and implementation of new ideas allowing them to generate and verify innovations daily (CSP). "Allowing operators to dynamically modify their processes (and business rules, too), the enterprise management system as a whole opens up to creative initiatives from the staff at large, while at the same time preventing chaos that could be wrought by uncontrolled changes to the operating properties" (Osuszek and Stanek, 2016).

Knowledge-based organizations understand the importance of knowledge in the process of creating a competitive edge and focus on creating value-added based on the effective use of knowledge. Creating knowledge (SLMHH Level 4.1, Information) and refine knowledge (SLMHH Level 4.2, Streamlining) are two of six steps in Turban's Knowledge Management Cycle. Knowledge generation (acquisition, creation - SLMHH Level 4.1, Information) and knowledge storage (capturing, refinement - SLMHH Level 4.2, Streamlining) are two of four phases of the knowledge management cycle for e-health. Knowledge search and retrieval systems enable search and retrieval and have some knowledge discovery abilities (Maier, 2007; Żytniewski et al., 2016) that also relate to SLMHH levels 4.1 and 4.2.



As it was mentioned above SEE should exclude all that relates to IFP. In this context, the whole population should satisfy the SLMHM level 1.1 (THM 2.0 level 1.1) as the minimum. Marketing, advertising, and propaganda should take place for the whole population. These techniques can be part of the education process.

The education strategy development model based on SLMHM has many parameters and requires a lot of calculations. Artificial intelligence can be used to automate modelling (Gakh, 2022b). In the case of SEE modelling number of parameters is enormous for manual calculations. But automation of data gathering by the Internet of Things, through prosumers (ICT solution users can produce and consume data), and data processing by AI seems to be very effective. Today humanity has the necessary technologies and can start the development of such models. An example is ChatGPT (ChatGPT, 2023) which can generate quite informative text. Another example is “Kaggle AI Report - Maturity at a glance” project (Gakh, 2023b).

It's important to note that sustainable development is a complex and dynamic process that requires collaboration and cooperation across multiple sectors and stakeholders, including government, private sector, civil society, and communities. Evaluation of maturity of scholarly papers, in other words knowledge presented in the textual form, was demonstrated by “Kaggle AI Report - Maturity at a glance” (Gakh, 2023c) project.

## **Conclusion**

All research questions are answered. Modelling by SLMHM/SPEM is a complex, but structured and holistic approach. The complexity of SLMHM/SPEM reflects the complexity of SEE interaction development. SLMHM/SPEM is unlimited and fractal. This peculiarity allows us to represent the system at different detail levels. The complexity can be handled by ICT solutions, such as Internet of Things and Artificial Intelligence. Economy and technology can be modelled by the SLMHM and society can be modelled by the THM 2.0. SPEM, SLMHM, and THM 2.0 have a similar structure (see Figure 1) that allows building holistic models taking into account almost all spheres of human life and the environment (the author cannot imagine which sphere cannot be modelled by these models, however, scientific research on the impossibility of modelling any sphere has not been conducted).

Humans and society are the main driving force behind SEE interaction development. Human intelligence plays a significant role in this process. Development of SEE in ISP (the Information Age where people live today) is not possible without neo-humanism (in the author's interpretation), because neo-humanism considers interactions society-environment and economy-environment equal in importance to interactions society-economy. THM 2.0 is useful to model society development, including poverty alleviation. The very concept of poverty needs to be rethought. It is necessary to realistically assess the destructive impact of the following types of poverty (see text above): survival poverty; structural poverty; opportunity poverty; emotional poverty; creativity poverty.

The model can be used at different scopes - from organization up to national and even global levels. It is very convenient because allows people to start its implementation at the scope of organizations and local governments, then unite the parts into the next generation model.

The questionnaire presented above is a useful tool for modelling SEE development strategy. The questionnaire could be used as a list of research questions for future studies. Synthetic researches of SEE development on the base of psychology, sociology, management, and technology are of special interest.

Research of THM 2.0 shows that there is a problem with the terminology and meaning of the terms. Human qualities relating to THM 2.0 levels 1.1, 1.2, and 2.1 could not be named by one well-known word and they were named as close to the necessary meaning as possible: “Ability to Desire”, “Initiativeness”, and “Ability to Evaluate”. The solution to this problem lies in the sphere of psychology and the further development of THM 2.0. Currently, such tools as AI models can be used to mitigate this problem by properly processing fuzzy information.

“Kaggle AI Report - Maturity at a glance” (Gakh, 2023c) project demonstrated the possibility of evaluation of maturity of SEE system by processing its textual description. The project can be considered as a prototype for the development of the production AI model. Complexity of the model and its theoretical level are the main disadvantages of this research. At the same time complexity of the model allows to model complex SEE interactions. “Kaggle AI Report - Maturity at a glance” (Gakh, 2023c) project based on the model and SEE interactions has the practical value in automatic ranking of texts.

The future research should include first of all development “Kaggle AI Report - Maturity at a glance” (Gakh, 2023c) project and getting practical results (At the time of this writing, the AI model has demonstrated the ability to assess the maturity of SEE interactions by the textual description. However, getting reliable results requires updating the training database and model architecture.). More deep research including the participation of sociologists, economists, and ecologists promises to give interesting results such as elaboration of practical methodologies.

#### Credit Authorship Contribution Statement

This research was carried out without third-party author's participation. D. G. solely contributed to all aspects of this research paper, including conceptualization, data collection, analysis, methodology, writing, and final approval of the manuscript. This statement underscores that the single author is responsible for the entirety of the research process, from conceptualization to the final draft.

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The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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