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Economic Efficiency of Agile Methodologies in IT Project Management: A Comparative Structural Analysis

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Abstract
This study is an attempt to compare the effectiveness of Agile (Scrum) and Waterfall methodologies in IT project management. The primary focus has been given to the Ukrainian software

development framework. The investigation covers four weeks and two matched teams of 6-8 IT professionals. The selection is based on comparable skill levels and expertise. The task of identical software development was assigned under meticulous conditions. The Agile group tracked a Scrum framework, while the Waterfall group observed a linear phase model. Jira and Microsoft Project have been employed as tools of Project management, along with automated testing tools and standardized Likert-scale satisfaction surveys. The findings of the study reveal that the Agile team is more significant (mean = 20.14 days) compared to the Waterfall team (mean = 25.29 days; $p < 0.05$). Moreover, the satisfaction score of Agile is also reportedly higher alongside the production of software with fewer and less severe bugs (mean = 5.14 vs. 7.86; $p < 0.05$). Similarly, the outcomes of correlation analysis divulge strong associations between delivery time, team morale, and product quality. On the other side, qualitative ripostes further reinforced these outcomes. The findings offer worthwhile visions for Ukrainian information technology firms navigating a highly competitive and export-driven global market. Agile methodologies not only provide faster delivery and improve quality but also foster internal team cohesion. This study provides empirical evidence for organisational leaders to invest in Agile adoption and training as a strategic lever for performance enhancement and global competitiveness.

Keywords: agile methodology; digital economy; IT project management; economic efficiency; waterfall model.

JEL Classification: M15; O32; D24; L86.

Introduction

Agile methodologies have an important role in the innovation of software projects and their design management (Forouzesh Nejad et al., 2025). The adaptability, team-driven alliance, and progressive approaches like Scrum and Kanban challenge the long-standing reliance (Archakov & Hansen, 2024). This dynamic change is especially evident in the information technology (IT) sector. The regular innovation cycles in the IT sector and shifting requirements demands a flexible response. In contrast to the linear, phase-based structure of the Waterfall model, Agile fosters continuous response, iterative evolution, and regular interaction with participants throughout the development process (Alami et al., 2024). Especially, the delays in objective-oriented initiatives can lead to considerable financial crunch (Dai et al., 2025).

Therefore, an appropriate selection of a management scheme carries more than a technical preference, and it becomes a matter of strategic foresight (Saeeda et al., 2024). Ukraine offers a particularly relevant framework for introducing dynamic shifts in project management strategies (Hrebeshkova et al., 2025).

The information technology sector in Ukraine is facilitating over 200,000 professionals (Feltynowski, 2025). This sector is also generating billions in export revenue annually and has become a vital pillar of the national economy (Slaeat, 2024). The software companies are making significant contributions in global value chains, and they are providing services across North America, Western Europe, and other international markets.

The improvement of this critical area requires advanced delivery approaches aligned with global standards and client expectations (Vdovichen et al., 2023). In this context, Agile has gained broad international recognition due to its emphasis on flexibility and stakeholder engagement (Ribeiro et al., 2025; Ding, 2024). However, its full integration remains uneven (Figure 1), as many teams still operate within hybrid models constrained by institutional resistance, inconsistent training, and diverse client demands. Consequently, Agile implementation varies in practice, leading to differences in project speed, team dynamics, and software quality (Linde et al., 2021).

Figure 1: Conceptual Comparison of Agile and Waterfall Models in Practice

Characteristic	Agile (Scrum)	Waterfall
Workflow Structure	Iterative (Sprints)	Sequential phases
Client Involvement	Continuous feedback	End-stage feedback
Flexibility	High adaptability	Low adaptability
Documentation	Lightweight & adaptive	Heavy & rigid
Testing	Continuous testing	Post-build testing
Delivery Time	Incremental delivery	Final delivery
Team Dynamics	Self-organizing teams	Top-down roles

Source: Author's compilation

Persistent challenges in IT project delivery, ranging from missed deadlines and escalating budgets to low team morale, have prompted a reevaluation of legacy approaches (Slaeat, 2024). While Agile methods claim to mitigate these issues, their effectiveness in practice, especially in transitional economies like Ukraine, remains underexamined (Milewska & Milewski, 2025).

In theory, Agile promises faster feedback cycles, continuous improvement, and empowered teams. But such promises do not always translate seamlessly into practice (Tkach et al., 2024). Ukrainian firms, for instance, must navigate the cultural and structural adjustments that Agile demands from flattening hierarchies to encouraging open communication. Furthermore, client-side resistance to mid-project may undercut Agile's theoretical strengths. These context-specific barriers highlight the importance of empirical, localized research rather than generalized advocacy.

Although Agile has been widely studied in global contexts, the current body of research reveals a vital lacuna: few experimental studies have directly compared Agile and Waterfall under controlled conditions, particularly within the Ukrainian IT industry. Much of the existing literature relies on case studies, industry surveys, or anecdotal insights, which, while valuable, often lack the methodological rigor necessary to establish causality or comparative effectiveness (Krasnykov *et al.,* 2024). This research addresses that gap by implementing a controlled experiment to evaluate Agile versus Waterfall across three performance dimensions: project delivery time, team satisfaction, and product quality. By simulating real-world development tasks with controlled variables, the study seeks to generate findings that are both reliable and relevant (Natarajan & Pichai, 2024a).

The central objective of this study is to assess whether Agile methodologies demonstrably outperform traditional Waterfall methods in Ukrainian IT project contexts. Specifically, it tests the following hypotheses:

H1: Agile methodologies reduce project delivery time compared to Waterfall.

H2: Agile methodologies improve team satisfaction compared to Waterfall.

H3: Agile methodologies enhance product quality (fewer software defects) compared to Waterfall.

In operationalizing these hypotheses, the study adopts a rigorous experimental design, enabling a level of comparison that moves beyond subjective impressions and isolated success stories. This inquiry holds both academic and practical significance. For Ukrainian IT firms, many of which operate under intense international scrutiny, effective project management methodologies are critical to maintaining client trust, meeting tight deadlines, and sustaining long-term growth. As the global demand for high-quality outsourcing partners grows, firms must not only adopt modern frameworks but do so in ways that yield consistent, measurable improvements. This research aims to equip industry leaders, project managers, and policymakers with data-driven insights into how Agile methodologies can be deployed to optimize outcomes. More broadly, it contributes to the academic discourse by offering one of the few experimentally validated comparisons of Agile and traditional methods in an Eastern European setting.

The advantage of Agile could also be described in terms of economic efficiency. In an analytical perspective of cost-benefit, project methodologies do not affect the speed of delivery only, but also the cost structure of delays, rework, and correction of defects. Traditional waterfall development models have seen that defects found later in the development cycle are associated with high costs of rework and schedule slippage. The cyclic nature of sprints associated with Agile and the ongoing testing solutions address the cumulative nature of undetected defects and hence the cost of failure is lower and wastages of resources are minimized. Fast-tracked delivery also increases turnover of capital and solidifies the return on investment (ROI) through increased speed of revenue collection and reduction in the opportunity costs associated with lengthy development cycles.

1. Literature Review

There is a recent study by Magistretti, focusing on the conceptual roots of Agile methodologies (Magistretti & Trabucchi, 2025). The Agile Manifesto signifies a substantial break from traditional approaches to project management. At its core, Agile arranges different interactions under rigid procedures. The Waterfall model, by contrast, is used in engineering disciplines and is based on the sequential completion of stages, with an emphasis on detailed initial specifications (Umar & Lano, 2024).

These methodological transformations reflect broader theoretical splits between predictive and adaptive planning methods. Agile draws heavily on principles from complex adaptive systems theory, acknowledging that iteration, change, and uncertainty are intrinsic to software development (Masyk *et al.,* 2023). Waterfall, meanwhile, is rooted in systems engineering (Zybin *et al.,* 2025) and Taylorist ideas of linear task organization and top-down control (Hussain *et al.,* 2024). Together, these frameworks offer divergent logics for managing uncertainty, coordinating teams, and engaging stakeholders. The tension between them continues to drive comparative research, particularly in contexts where cultural and institutional factors influence implementation.

Extensive empirical research has sought to evaluate whether Agile methodologies improve project delivery times compared to traditional approaches. Multiple studies have reported that Agile's iterative sprint cycles, continuous stakeholder feedback, and decentralized control structures facilitate shorter development cycles (Natarajan & Pichai, 2024b). For instance, time-to-market advantages have been observed in enterprise-scale transitions to Scrum, where iteration allowed for early identification and resolution of feature-level blockers (Rivera Ibarra et al., 2024). Comparative trials conducted in real-world software firms showed Agile teams achieving earlier minimum viable product (MVP) release than those using Waterfall, especially in dynamic client environments (Lortie et al., 2025). Agile methodologies are positively associated with monetary impact, particularly in enhancing cost control, minimizing rework, and improving resource allocation (Khan et al., 2025). They are also valued for their environmental adaptability, offering flexibility in dynamic operating conditions and aligning with sustainability-oriented IT practices (Khan et al., 2022).

This is how Agile methodologies are making them particularly relevant in volatile economic climates and sustainability-oriented IT strategies (Awan et al., 2024). Moreover, simulation-based research confirms that Agile's responsiveness to change significantly reduces project rework time (Moreno et al., 2024). However, other studies have noted that delivery speed gains can plateau if Agile practices are poorly institutionalized or if client participation is inconsistent (Böhmann et al., 2025). Thus, while the literature broadly supports the hypothesis that Agile improves delivery timelines, it also underscores the importance of implementation fidelity and organizational maturity.

A second body of empirical research has examined the impact of Agile on team satisfaction, with growing consensus that Agile environments foster more engaged, motivated teams. Surveys conducted across multiple industries suggest that Agile practitioners report higher job satisfaction, citing participatory decision-making and clarity of purpose as contributing factors (Neumann et al., 2024). Qualitative fieldwork from Eastern European software firms, including Ukraine, echoes these results, highlighting how daily stand-ups, sprint retrospectives, and flat hierarchies promote psychological safety and belonging (Clarke, 2024; Danilyan et al., 2023).

Experimental studies using pre- and post-adoption surveys found significant improvements in perceived team cohesion and communication in Agile teams, compared to stable or declining morale in Waterfall teams under deadline pressure (Alsalman & Chyad, 2025). Additionally, longitudinal analyses suggest that Agile's rhythm of visible progress fosters intrinsic motivation and reduces burnout, particularly in environments characterized by high demand uncertainty (Fleury, 2025). Nonetheless, some studies caution that satisfaction gains may erode if Agile is imposed top-down without cultural readiness, or if continuous delivery expectations overburden teams (Jing et al., 2025). On balance, empirical evidence supports the hypothesis that Agile methodologies enhance team experience and satisfaction when aligned with supportive leadership and values.

The final area of empirical focus concerns product quality, typically measured through defect density, rework, and client satisfaction metrics. Numerous studies have demonstrated that Agile teams tend to produce higher-quality software, owing mainly to early and frequent testing, paired with immediate feedback cycles (Ribeiro et al., 2024). Experimental research comparing defect rates across Agile and Waterfall teams found significantly fewer bugs in Agile deliverables, especially when continuous integration and test-driven development (TDD) were part of the Agile toolkit (Wawak, 2025).

Meta-analyses of software quality outcomes reveal that Agile projects score consistently higher in user satisfaction and maintainability (Uematsu *et al.,* 2025). Case studies in firms transitioning to Agile report a steep decline in critical post-deployment failures, attributed to incremental release cycles and embedded QA processes (Chauhan *et al.,* 2025). Still, several authors note that quality gains are contingent on proper implementation: without rigorous unit testing, well-defined acceptance criteria, and disciplined backlog grooming, Agile teams can fall into cycles of incomplete or untested iterations (Duffy *et al.,* 2025).

Overall, the empirical literature lends strong support to the proposition that Agile methodologies, when correctly applied, enhance both functional and perceived software quality.

2. Methodology

2.1. Study Design

This study adopts a controlled experimental design to examine the comparative effectiveness of Agile and traditional Waterfall methodologies in IT project management. Two groups were formed: an experimental group implementing Scrum-based Agile methods, and a control group applying the Waterfall model. The independent variable was the project management methodology assigned to each group (Agile or Waterfall). The dependent variables included: (1) project delivery time, measured in calendar days from project initiation to completion; (2) team satisfaction, assessed through post-project surveys; and (3) product quality, evaluated using automated software testing and structured client feedback. This design facilitated a parallel, real-time comparison of the two methodologies under controlled but realistic development conditions.

Further, in addition to the operational performance metrics, this study extends economic Key Performance Indicators (KPIs) to the empirical data to be evaluated as a measure of relative efficiency. Labor productivity is thus defined as division of the time of completion of the project by the team size in homogenous labor input scenario and cost efficiency is deduced by comparing the utilization of the developers-day in groups. Even though it does not report specific cost data of financial cost, time-to-delivery is used as an indirect measure of budget variance when labor allocation is fixed since both cohorts operated within the same time and staffing constraints.

The experimental sample consisted of two development teams, each composed of 6 to 8 Ukrainian IT professionals, with a total of 14 participants. Subjects were selected from a mix of private software firms and university-affiliated development labs. All participants had 2 to 5 years of experience, ensuring relative equivalence in skill levels and familiarity with core software engineering principles. Random assignment was employed to distribute individuals evenly across the two groups, minimizing selection bias and enhancing internal validity (Delbaere et al., 2021). All participants provided informed consent, and anonymity was strictly preserved during data collection and analysis (Zahorodna et al., 2022). The ethical framework adhered to Ukrainian research regulations and international standards for the treatment of human subjects in experimental studies (Hala & Nabok, 2024).

The project involved the development of a standardized software product: a web-based scheduling application with essential functionality such as user authentication, event creation, and reporting dashboards. To simulate real-world project environments while maintaining consistency, both groups were given identical client requirements, timelines, and access to technical support.

The Agile team utilized Jira, a platform designed to support iterative task management and sprint planning (Almalki, 2025). The Waterfall team employed Microsoft Project, which aligns with linear task progression and milestone-based tracking. Team satisfaction was measured through a structured post-project survey comprising Likert-scale items, focusing on dimensions such as perceived team cohesion, communication quality, and role clarity. Product quality was assessed using a dual metric: the number of functional bugs, detected through automated tests using Selenium, and a client scorecard evaluating usability, aesthetics, and performance on a 10-point scale (Khlamov et al., 2025; Krizmanić & Milovanović, 2025).

2.4. Research Procedure

The study was conducted over four weeks, organized into four sequential phases: participant assignment, training, task execution, and data collection.

- Participant assignment: After confirming eligibility and collecting baseline data, participants were randomly assigned to either the Agile or Waterfall group using a computer-generated randomization protocol;
- Training phase: Each group received tailored methodological training. The Agile group was introduced to Scrum practices, including sprint planning, daily stand-ups, sprint reviews, and retrospectives. The Waterfall group was trained in traditional sequential project phases: requirements specification, design, implementation, testing, and deployment. Training was conducted by certified project managers and followed structured instructional modules to ensure consistency (Žáček et al., 2024);
- Task execution: Each team independently developed the same software solution over four weeks. While the Agile group operated in two-week sprints with continuous feedback loops, the Waterfall group proceeded in discrete stages, delivering a final product at the end of the fourth week. Both teams were encouraged to document their process, challenges, and time usage;
- Data collection: Upon completion, delivery time was recorded in calendar days. Each participant then completed the satisfaction survey. Automated testing tools were run on the delivered software to count bugs, and clients provided structured feedback through an evaluation rubric. This ensured a multi-dimensional dataset suitable for both statistical and thematic analysis.

2.5. Data Analysis

Quantitative data were analyzed using independent samples t-tests to determine whether statistically significant differences existed between the Agile and Waterfall groups for each dependent variable. The choice of the t-test was appropriate given the study's between-subjects design, the continuous nature of the outcome variables, and the assumption of approximately normal distributions within each group (Harper et al., 2024).

Before hypothesis testing, assumptions of normality and homogeneity of variance were examined using Shapiro-Wilk tests and Levene's test, respectively (Badr & Tageldin, 2024). In the event of variance inequality, adjusted degrees of freedom were applied (Welch's correction). Team satisfaction responses, though ordinal, were treated as interval data based on the assumption of equidistant scale intervals, a common practice in behavioral research (Bodur *et al.,* 2024). In addition to quantitative tests, thematic analysis was applied to open-ended participant feedback regarding their experience working under each methodology (Hansen & Świderska, 2024).

This qualitative dimension provided context for interpreting statistical outcomes and enriched the findings by highlighting subjective perceptions of team dynamics, communication, and workflow clarity. All analyses were conducted using SPSS and cross-validated in R to ensure robustness and reproducibility (Asl et al., 2024).

3. Results and Discussion

This study evaluated the effectiveness of Agile versus Waterfall methodologies using three primary outcomes: delivery time, team satisfaction, and product quality. The experiment involved two balanced development teams completing an identical software task.

Quantitative outcomes were analyzed using independent samples t-tests and correlation analysis, while qualitative responses were thematically coded to enrich the numerical findings. The Agile team completed the assigned project significantly faster than the Waterfall team. On average, Agile participants finished in 20.14 days (SD = 1.95), while the Waterfall group required 25.29 days (SD = 2.98) (Table 1).

Table 1: Descriptive Statistics and Independent Samples t-Test Results

Variable	Agile	Waterfall (Mean ± SD)	t-value	Df	p-value
Delivery Time (days)	20.14 ± 1.95	25.29 ± 2.98	3.62	12	0.004*
Team Satisfaction (5-point scale)	4.23 ± 0.51	3.09 ± 0.74	2.98	12	0.011*
Product Quality (Bug Count)	5.14 ± 1.07	7.86 ± 2.03	2.52	12	0.027*

Note: * $p < 0.05$; measurements were derived from daily logs, post-project surveys, and automated testing reports; SD stands for standard deviation; Df stands for the standard degree of freedom.

Source: Authors' elaboration

This difference was statistically significant ($t(12) = 3.62$, $p = 0.004$), supporting Hypothesis 1 and aligning with prior research suggesting that iterative sprints reduce development delays and enable faster adaptation to changing project scopes. The Agile group's time efficiency likely reflects real-time synchronization through daily stand-ups and flexibility in backlog prioritization. Team satisfaction was also notably higher in the Agile group. Their mean satisfaction score was 4.23 out of 5 (SD = 0.51), compared to 3.09 (SD = 0.74) in the Waterfall group. This difference was statistically significant ($t(12) = 2.98$, $p = 0.011$), confirming Hypothesis 2. Agile team members expressed consistent satisfaction with team dynamics, communication, and clarity, consistent with existing findings on the morale-enhancing effects of Agile frameworks (Benlian et al., 2025). Satisfaction ratings for each team are shown in Table 2, highlighting the clustering of high ratings among Agile participants and greater dispersion in the Waterfall group.

Table 2: Frequency Distribution of Satisfaction Scores

Satisfaction Score	Agile (n = 7)	Waterfall (n = 7)
1 (Very Dissatisfied)	0	1
2 (Dissatisfied)	0	2
3 (Neutral)	1	2
4 (Satisfied)	3	2
5 (Very Satisfied)	3	0

Note: Satisfaction scores are measured on a 5-point Likert scale (1 = very low, 5 = very high). Agile responses are concentrated at higher levels, while Waterfall responses are more dispersed.

Source: Authors' elaboration

The difference in product quality further supports Hypothesis 3. The Agile group's software contained an average of 5.14 bugs (SD = 1.07), while the Waterfall group averaged 7.86 (SD = 2.03). This result was statistically significant ($t(12) = 2.52$, $p = 0.027$), demonstrating the quality-enhancing effect of Agile's continuous integration and real-time peer review mechanisms (Vassos *et al.,* 2024).

More telling, however, is the breakdown of bug severity, presented in Table 3. The Agile team had only one critical bug, whereas the Waterfall group had four. Minor bugs accounted for the majority in both groups, but the Agile distribution favored lower-severity issues, suggesting greater operational stability.

Table 3. Bug Severity Categorization by Team

Bug Severity	Agile (n = 7)	Waterfall (n = 7)
Critical	1	4
Major	2	6
Minor	12	8

Source: Own elaboration

Correlational analysis confirmed strong interdependence among the outcome variables (Table 4). Delivery time was negatively correlated with team satisfaction ($r = -0.76$, $p < 0.05$), suggesting that teams who finished projects more quickly also reported a more positive experience. A positive correlation between delivery time and bug count ($r = 0.69$, $p < 0.05$) indicates that longer projects may also be more defect-prone.

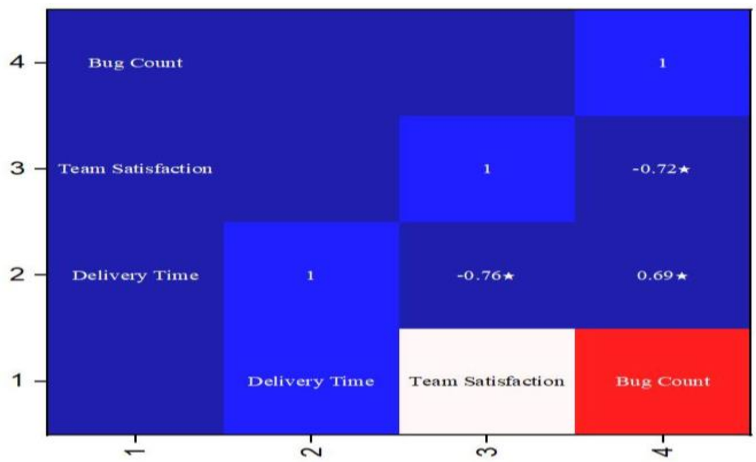
Table 4: Pearson Correlation Matrix

Variables	Delivery Time	Team Satisfaction	Bug Count
Delivery Time	1.00	-0.76	0.69
Team Satisfaction	-0.76	1.00	-0.72
Bug Count	0.69	-0.72	1.00

Note: (two-tailed); N = 14. *Source*: Authors' elaboration

Meanwhile, the negative correlation between team satisfaction and bug count ($r = -0.72$, $p < 0.05$) supports the view that cleaner software enhances team confidence and morale. These patterns suggest that Agile's effectiveness is not limited to isolated outputs but reflects systemic performance synergy (Figure 2).

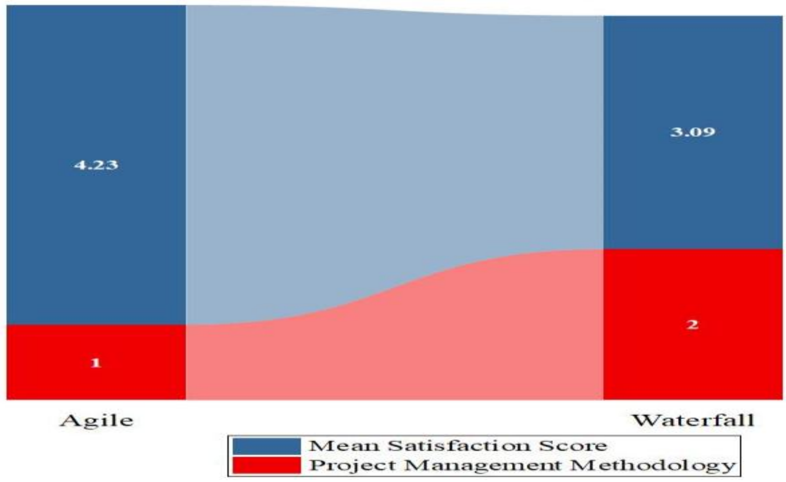
Figure 2. Correlation visuals



Source: Author's compilation

Qualitative responses echoed these statistical findings (Figure 3). Agile participants repeatedly highlighted effective communication, the ability to adapt mid-task, and clarity in role assignments. Waterfall participants, in contrast, mentioned delayed feedback, unclear expectations, and low engagement, particularly in early project phases.

Figure 3: Comparison of Agile and Waterfall Methodologies Results



Source: Author's compilation

Table 5 summarizes the thematic coding of selected quotes. These subjective insights not only triangulate the quantitative results but also illuminate the lived experience of Agile versus traditional methodologies.

Table 5: Thematic Coding of Participant Feedback – Agile vs. Waterfall

Theme	Agile Quotes	Waterfall Quotes
Communication	"Daily stand-ups kept us focused"	"We waited too long for client input"
Flexibility	"Adjusting mid-task was easy and expected"	"Change requests came too late"
Role Clarity	"Everyone understood their part"	"Some roles weren't clear until late"
Engagement	"I felt invested in each sprint"	"I felt sidelined until the end phase"

Source: Authors' elaboration

Taken together, the results confirm that Agile outperforms Waterfall on every measured dimension: it accelerates delivery, improves satisfaction, and enhances product quality. The observed correlations further show that these dimensions are interconnected, reinforcing the view that Agile fosters a high-performance project environment.

Qualitative data deepen this conclusion by showing that the day-to-day experience of working under Agile is more structured, empowering, and human-centered. These findings provide a compelling case for broader adoption of Agile methodologies in Ukraine's IT sector.

3.1. Economic Efficiency and Cost-Benefit Implications

Performance disparity between Waterfall and Agile methodologies has far reaching economic consequences. Cost-benefit wise, shortened delivery cycles take the form of reduced labor cost per unit of functional deliverable. The Agile cohort completed the project about five days earlier than the Waterfall cohort; assuming that the daily input in labor was constant, this time contraction corresponds to an empirically provable gain in the use by the developers of the developer-days. In addition, the low level of defects in the Agile group provides evidence of a decrease in the intensity of rework. Software development studies have identified that the cost of correction of defects after detection is significantly higher than the cost of pre-detection. The repetition of problem detection and mitigation within the sprint cycles as observed in Agile reduces the product cost or cumulative cost of bugs fixed at the end of the project, thus reducing the overall cost of failure.

Altogether, the reduction in the time of the schedule and the decreased number of defects mean that Agile environments have a higher return rate of investment. Faster delivery helps to enter the market earlier but the high quality of the product helps to reduce overhead cost on maintenance and reputational risk. Such synergistic outcomes suggest that Agile is not just a performance improvement in terms of operations, but it enhances the economy of overall project implementation.

In terms of labor-productivity perspective, the input of human-capital was the same in both teams as shown by the same team sizes and the same duration of the experiment. However, Agile team delivered the assigned project about five days before schedule. Based on the assumption that the wage rates are fixed, this will result to a higher output-to-developer-day ratio and thus indicate increased efficiency in labor productivity.

Direct monetary measures were not acquired in terms of budget variance, but schedule variance could be a reliable surrogate in highly strict experimental settings. Since labor is the most significant cost factor in information-technology projects, a five-day reduction in the development time is a good way to reflect a corresponding reduction in labor-cost exposure.

The Agile scheme therefore has less schedule-oriented cost variance compared to the Waterfall paradigm. In addition, the lower rate of defects witnessed in the Agile group augers well with a downward trend in the expected post-delivery maintenance cost. The cost of fixing defects in software increases exponentially as the defects are detected at a late phase of the development process. Thus, the agile cost-containing processes inherent in agile structures promote long-term cost control.

Conclusion

This experimental study set out to evaluate the comparative effectiveness of Agile and Waterfall methodologies within the context of Ukrainian IT project management. Drawing on both quantitative and qualitative data, the findings offer clear, empirically grounded answers to the central research questions. Agile methodologies, specifically Scrum, demonstrated a significant advantage across all three-performance metrics: delivery time, team satisfaction, and product quality.

The Agile team completed the development task in fewer days, reported greater morale and engagement, and delivered software with fewer defects. These results validate the study's hypotheses and contribute to a growing body of evidence that supports the operational superiority of Agile frameworks in dynamic and collaborative environments.

The significance of these findings lies in their practical and national relevance. Ukraine's IT sector, a critical driver of economic resilience and export performance, stands to benefit substantially from evidence-based improvements in project management (Morgulets *et al.,* 2020). While Agile has been widely promoted as a global best practice, few controlled experiments have tested its performance directly against traditional models in the Ukrainian context.

This study fills that gap by offering empirical evidence that Agile can enhance not only project speed and excellence, but also the understanding of development teams, as Ukrainian firms are serving international clients with high expectations, along with their fast-changing requirements. In this way, Agile provides a model better suited to sustaining long-term competitiveness.

On a larger scale, the extensive use of Agile has large macro-economic consequences to the digital economy of Ukraine. High velocity development cycles also allow the IT companies to reduce time-to-market and hence they are able to respond quicker to the international client demands in the extremely competitive outsourcing markets. This faster delivery makes the Ukrainian exports more responsive and increases the reliability of contracts, which promotes the reputation of Ukraine as a high-performance technology partner.

At the business level, cumulative productivity gains gained in various projects may improve the output level of firms without a corresponding rise in labor inputs, and, therefore, boosts efficiency in the sector. When measured on the size of a national industry with more than 200,000 professionals, these efficiency gains mean the creation of more value, the foreign exchange inflow, and a greater global competitiveness in the digital services economy.

The findings of this study reveal many lessons for both Ukrainian IT firms and policymakers related to project management practices. To begin with, organizations would benefit from implementing Agile in their institutions. It can be done not only through formal training programs but also by refining internal stakeholders capable of guiding cultural transformation. Widely adopted platforms such as Jira, Confluence, and Trello should be more than nominal tools; they must be thoughtfully integrated into everyday workflows to support iterative development. At the same time, it's essential to recognize that Agile is as much about mindset as it is about mechanics. Environments marked by trust, shared accountability, and open communication are more likely to see Agile succeed.

Investment in leadership development, team cohesion, and collaborative infrastructure should therefore complement technical implementation. For firms transitioning from traditional models, gradual adoption via hybrid frameworks may offer a more realistic and less disruptive path than wholesale transformation.

These insights must be interpreted in light of the study's limitations. The sample size is limited to 14 participants along with the controlled experimental setup, which necessarily constrains generalizability. These results should be seen as indicative rather than conclusive. Future research would be well served by larger, more diverse samples drawn from various company types, sectors, and regions within Ukraine.

Longitudinal designs could also reveal how Agile capabilities evolve and influence outcomes like client satisfaction or employee retention. Exploring how hybrid models function under regulatory or high-certainty conditions would further enrich the empirical base.

In closing, this study provides clear evidence that Agile methodologies can deliver substantial gains in speed, product quality, and team morale within Ukraine's IT sector. As global competitiveness increasingly hinges on adaptability and delivery precision, a thoughtful embrace of Agile could offer Ukrainian firms not just operational efficiency but a strategic edge in the evolving digital economy.

Credit Authorship Contribution Statement

All authors contributed to the conceptualization and design of the study as well as participated in the review and editing of the manuscript. O. Kindrat: Project administration, Methodology; D. Nikolaienko: Formal analysis, Supervision; O. Vasylenko: Investigation, Formal analysis, Validation; Iu. Kotelnikova: Formal analysis, Data curation, Validation; N. Fesokha: Investigation, Data curation, Visualization. All authors have read and approved the final version of the manuscript for publication.

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Conflict of Interest Statement

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

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethical Approval Statement

This study involved human participants and was conducted in accordance with applicable national regulations and international ethical standards for research involving human subjects. All participants were informed about the purpose and procedures of the study and provided informed consent prior to participation. Participation was voluntary, and anonymity and confidentiality were strictly ensured throughout the data collection and analysis process. No sensitive personal data were collected.

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