EVALUATING THE EFFECTIVENESS OF INCENTIVE SCHEMES IN ADAPTING TO CHANGES IN IT PROJECTS

by

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

WMT Work More Tomorrow

LC Linear Contract

IT Information Technology

AI Artificial Intelligence

GDPR General Data Protection Regulation

HIPAA Health Insurance Portability and Accountability Act

EU AI Act European Union Artificial Intelligence Act

GDP Gross Domestic Product

WBS Work Breakdown Structure

NDA Non-Disclosure Agreement

CHAPTER 1. INTRODUCTION

Information Technology (IT) is one of the most dynamic and rapidly growing industries. According to the study of IT Ukraine Association (2023), employment in IT industry is mainly project-based, so on-time and high-quality delivery is an essential factor for success. Thus, we have to identify what changes in project management practices can help enhance productivity and adaptability so that we could implement those changes and influence directly project success. Nowadays, adaptability as a characteristic of project management is no longer just a convince. It is a critical factor for company's ability to survive and grow in the competitive enviroment.

Over 30% of software development projects are delayed or exceed their budgets, and half of them result in less-than-satisfactory outcomes (Boston Consulting Group, 2024). These challenges are caused by various factors especially by frequent changes in project scope and requirements. Consequently, it is crucial for any project team to be able to adapt to given conditions so that it could successfully deliver the project. This need for flexibility inspired a focus for this reseach topic that is related to IT industry. The aim of the study is to provide practical, business-oriented recommendations on incentive schemes as a adaptability measure that can support responsiveness of the company to changes in the project demands. Thus, it can help to improve its market reputation and secure increased revenue from satisfied customers.

Modern IT environment is developing fastly and current study understands this trend. Effective project management has direct influence on the project success. It also contributes to organization's long-term strategic goals, fosters a culture of adaptability and responsiveness so that companies can better manage risk and mitigate the unexpected changes. Application of Agile and other adaptable methodologies continues to grow across the world. It is aligns with the goal of the study to provide practical guidance that can help to maintain sustainable performance and improve resilience in the face of ongoing changes.

This thesis examines the Work More Tomorrow (WMT) approach developed by Chinese researchers in 2022 as an incentive scheme that encourages employees to adapt faster to scope changes by promising future rewards based on daily progress. It enhances efficiency and meets project deadlines more consistently than traditional incentive schemes, for example Linear Contracts (LC). Thus, the primary research question of this study is to evaluate the effectiveness of incentive schemes, such as WMT and LC scheme, in improving team adaptability and productivity in handling scope changes in IT projects.

The WMT scheme addresses the issue of present bias in project management. It includes daily incentives for employees who achieve their daily workload targets and makes adjustments to the incentives at the end of the project. The research aims to simulate the WMT incentive scheme based on historical data from a Ukrainian IT project and to analyze its impact on team adaptability to changes and on-time delivery. Then, we will do the same flow for a benchmark incentive schem, a linear contract, and compare the results of both approaches.

The study topic is particularly relevant to the author's experience in Ukrainian IT software development company, where projects often face delays due to many unpredictable factors, such as changes in the requirements, technical issues or resource constraints. Access to actual data from historical project records within the task management system provides a unique opportunity to empirically test benefits of using the incentive scheme and their potential impact on project performance.

The findings of this research offer several practical benefits both for businesses and employees. First of all, the approach of incentive scheme provides motivation for employees to respond proactively to project changes. Moreover, this additional motivation to complete tasks more efficiently can improve overall project productivity and optimize resource allocation which all together contributes to better on-time delivery. This approach helps provide clients with more predictable and reliable estimates. As a result, it promotes their satisfaction and strengthens the business's competitive position in the market.

Finally, it is worth to mention that WMT is quite a novel direction for research in project management area, so there could be many opportunities for further studies. This study provides valuable insights how effective incentive schemes can be in adaptability to scope changes that is especially actual for IT sector. It also opens the potential for similar research in other industries where scope changes are common. The research findings expand the academic understanding of incentive-based adaptability in project management. They also offer practical advice how to increase team adaptability, improve resource allocation and enhance project delivery timelines.

CHAPTER 2. INDUSTRY OVERVIEW AND RELATED STUDIES

Computers, operating systems, email services, communication channels, wearable devices, games, business intelligence tools, online shopping platforms… The list goes on but what all these things have in common is that they are all IT products. The value of information technology sector is represented by the most valuable publicly traded companies: Microsoft, Apple, NVIDIA, Alphabet, and Amazon. The list of the top ten largest companies by market capitalization is presented in Table 1.

Table 1. Global ranking of the companies by market capitalization (September, 2024)

Rank	Name	Market Cap	Industry
1	Apple	$3.481 T	Technology (Consumer Electronics)
2	Microsoft	$3.100 T	Technology (Software & IT Service)
3	NVIDIA	$2.928 T	Technology (Semiconductors)
4	Alphabet (Google)	$2.021 T	Technology (Internet Services, Software)
5	Amazon	$1.873 T	E-commerce & Cloud Computing
6	Saudi Aramco	$1.802 T	Energy (Oil & Gas)
7	Meta Platforms	$1.318 T	Technology (Social Media, Advertising)
8	Berkshire Hathaway	$1.025 B	Diversified Financials & Insurance
9	TSMC	$890.44 B	Technology (Semiconductors)
10	Eli Lily	$864.42 B	Health Care (Pharmaceuticals)

Source: Companiesmarketcap.com

According to the Business Research Company report "Information Technology Global Market" (2024), the global IT market is valued at over $9 trillion in 2024. Therefore, it is expected to grow at annual rate of 8.3% until 2028. The most striking trend in IT industry is artificial intelligence (AI) and automation. More and more companies explors the potential of generative AI to push their efficiency and productivity. In addition to these trends, cloud computing also becomes popular and enables more scalable and flexible workload management. Delloitte has reported (2024) that the growth in the tech market is mainly driven by enterprise spending on software and IT services, especially AI, cloud computing, and cybersecurity technology. Regarding the geographical contributions, the most significant come from the North American, European, and Asian markets.

The outcome of the technology development is the increasing of cybercrimes. Consequently, such topics as data protection and ethical artificial intelligence usage become more and more important on the worldwide IT agenda. Governments have increased their focus on information security and how the technologies impact on businesses and their consumers. That is why they are introducing new regulations like GDPR, HIPAA, and EU AI Act.

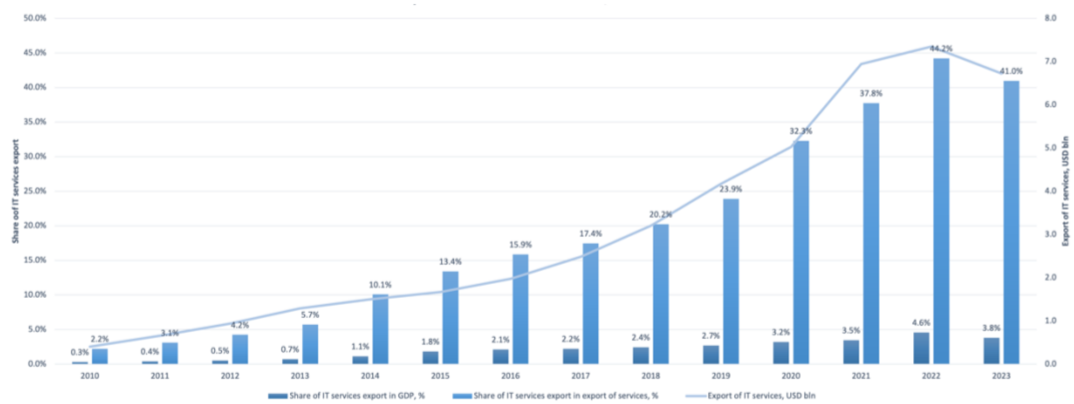
Furthermore, the demand for digital transformation is increasing across different industries, even among those that were traditionally non-technical: agriculture, construction, education and others. They leverage digital tools to achieve better operational efficiency, meet demands of modern consumers, improve their experience, and stay competitive on the market. The global update of IT solutions is even boosted more by appearance of digital colloboration tools. As a result, remote or hybrid ways to learning and work have already become common approaches in modern world.

Many countries, including Ukraine, support the development of the domestic IT industry, as it is often quite significant in the economic performance. According to the report "Digital Tiger. The Power of Ukrainian IT" (2023) by IT Ukraine Association, Ukraine is one of key players in the global IT landscape since more than 2,000 companies operate there and over 346,000 professionals are employed.

In the context of the Ukrainian IT sector, there is an upward trend, and it contributed around 4% to the country's GDP in 2023. Over the past decade, the share of computer service exports in services exports has increased by 35.3% – from 5.7% in 2013 to 41% in

2023, worth $6.7 billion. The dynamics of changes in the export IT services in Ukraine are represented in Figure 1.

Figure 1. Export of IT services in Ukraine, 2010-2023



Source: National Bank of Ukraine, International Monetary Fund

Additionally, the Ukrainian IT sector is highly supported by the government, which directs efforts to the country's digital transformation and is led by the Ministry of Digital Transformation. The progress of Ukraine in digitalization is recognized internationally. The most known initiatives are the Diia application that provides digital documents and services and platforms like Diia.City and Diia.Business that offer legal and tax environment for IT companies.

The Ukrainian IT sector is characterised by resilience and adaptability despite of decline in IT service exports due to the ongoing war with russia (Kyiv Consulting, 2023). It is supported with government efforts in implementation of state policies on digitalization, improvement of electronic services and internet access. The goals annouced by the Ministry of Digital Transformation (2024) are to make 100% of public services available online, provide high-speed internet access to 95% of transport infrastructure and social facilities and increase IT sector's contribution to GDP to 10%.

One of the crucial factors to achieve these objectives is robust project management since it can help execute such complex initiatives effectively. Projects in the IT sector typically follow two primary methodologies: Agile and Waterfall (Asana, 2024). The latter approach is linear and sequential where each phase must be completed before moving on to the next one. It is usually used on projects with clearly defined requirements and strict timelines but lacks flexibility for changes once underway. In contrast, Agile is iterative and incremental throughout project lifecycle. In HYS Enterprise research "Top 5 Best Project Management Methodologies for the IT Industry" (2023), it is recognized as the most widely adopted project management methodology in IT that is confirmed by the fact that 52% of surveyed project managers choose agile frameworks.

Overall, a choice of methodology for the project depends on different factors such as project size, team structure, budget, adaptability to change, need for documentation. Agile is typically chosen for projects where requirements are very likely to change while Waterfall is more effective for large and well-defined projects.

The reason of project delays are often linked to Parkinson's Law (Parkinson, 1995). Therefore, it is important to understand the effectiveness of different project management methodologies to address issues in project delivery. Parkinson's Law says that work expands to fill the time available which leads to procrastination and conscious delays to avoid more challenging deadlines in the future. Economists introduced performance incentive schemes to solve Parkinson's Law in project management, but project delays still happen.

This thesis on evaluation the effectiveness of incentive schemes in adapting to changes in IT projects is based on the study "Work More Tomorrow: Resolving Present Bias in Project Management" by Yun Shi, Nicholas G. Hall, and Xiangyu Cui (2022). Authors introduced WMT incentive scheme to handle the problem of late delivery for construction projects. It is designed to manage the problem of present bias — a tendency when people focus more on immediate tasks rather than future goals.

The scientists argue that Parkinson's Law and other traditional explanations for project delays do not fully capture underlying causes. As an alternative they identify that time-inconsistent behaviour, such as present bias, can significantly contribute to delays. The writers propose a new incentive scheme that could directly addresses present bias in projects – Work More Tomorrow (WMT). The study by Shi et al. (2022) is one of the first that suggests an approach in the form of a multiple period project model where delays in early tasks may impact entire project work. It is also worth to mention that the authors of this study assume complete information where the project manager continuously observe task progress.

The Work More Tomorrow incentive scheme has several studies in its basis. The concept of present bias was explained for the first time by the quasi-hyperbolic utility discounting model from Phelps and Pollak (1968). They modified traditional exponential discounting approach and introduced a model with parameters that captures tendency to overvalue immediate rewards. They used two parameters to describe how people discount future benefits in favor of immediate satisfaction: present bias parameter (β) and discount factor (δ). If $\beta = 1$, means that preferences are time-consistent, so the project delay could be explained with Parkinson's Law. However, a case of $\beta < 1$ indicates that present bias is stronger.

It must be pointed out that although delays in project delivery are often can be because of technical issues, when they are caused by present bias than it is more because of natural tendency to procrastinate and prioritize immediate tasks rather than technical challenges. This leads to the accumulation of unfinished work. In such scenarious it is especially important to implement strategies like WMT which encourage consistent effort and could help reduce delays, particularly in IT projects where meeting deadlines is critical.

The WMT scheme was also inspired by Thaler and Benartzi's (2004) "Save More Tomorrow" plan which encourages consumers to save thereby mitigate present bias issue that reduces saving rates. The WMT concept draws on an analogy between cost of savings experienced by an employee and the effort required by a project worker to complete a task.

The study by Shi et al. (2022) also considers traditional incentive scheme on the example of linear contracts where there is a bonus for early completion of task and a penalty for late completion. The researchers provide both theoretical and computational framework for WMT and LC incentive schemes. They developed a model for multiple periods that incorporates for time-inconsistent preferences. The authors show that WMT scheme significantly improves on-time delivery and reduces expected tardiness compared to traditional incentive schemes, especially in larger and more complex projects. The results confirm that WMT approach has potential to improve on-time project delivery by 30-40% on average compared to traditional incentive systems like linear contracts. Besides it, WMT scheme could achieve these outcomes at a lower cost that means a more efficient solution for project management to cope with time-inconsistent behaviour within project teams.

From practical point of view, the paper by Shi et al. (2022) suggests that adopting of WMT scheme can also lead to better project management outcomes due to alignment of worker incentives with project deadlines. It highlights the importance to recognise such factor as present bias by project managers and organizations. Introduction of incentive schemes is one of possible ways to improve worker productivity and project outcomes despite scope changes and technical issues.

Based on the above-mentioned paper, the current one aims to offer empirical evidence on the effectiveness of incentive schemes to improve adaptability to project changes for IT industry. The research will assess whether WMT and LC schemes can mitigate project delays and improve project outcomes by analyzing historical project records. There is a gap in existing researches related to application of WMT approach in real-world settings where where frequent project adjustments challenge team responsiveness. The goal of the thesis is to demonstrate the potential of incetive schemes to improve project management practices by stimulating adaptability to scope changes. this research can declare future implementations and potential for adaptations of incentive systems in the IT industry and beyond. Therefore, the findings may also inform future adaptations of incentive systems across other industries in addition to IT one where responsiveness to change is essential.

CHAPTER 3. METHODOLOGY

The research aims to test two key hypotheses to answer the stated research question. The first one is that WMT scheme will reduce the average completion time of tasks in IT projects comparing to LC scheme even when some scope changes occur. The idea is that offering daily rewards for efficiency today should encourage employees to finish tasks faster than they would do under a traditional incentive system which usually rewards them as soon as a task is done.

The second hypothesis is logically built upon first one. It suggests that WMT scheme could increase the percentage of tasks completed on or before their deadlines. It aligns with key target of project management and Agile methodology where changes are often present, but timeline should be maintained anyway. By examining these two hypotheses, the study seeks to determine the effectiveness of the WMT scheme in improving project management outcomes in the IT sector despite facing the scope changes.

We can conditionally divide the methodology of this study into two directions – theoretical foundation and implementation. From the theoretical side, the research is mainly based on the above-described related study by Shi et al. (2022). The method is adapted to evaluate the WMT approach within the context of IT project management. The characteristic feature of an IT project, especially in the case of using Agile approach, is a change in the scope of tasks. It often is one of the most common reasons of the project delay. Therefore, to bring the WMT approach closer to the reality of the IT world, the scope changes factor will be considered during execution. From the implementation side, this research will employ a simulation-based approach to replicate the application of WMT and LC on historical project data.

It is essential to understand the basic concepts and assumptions on which the WMT approach is built. The authors of this scheme state that task owners know that there is present bias in their behavior. However, they often do not recognize its impact on their future decisions. As a result, it leads to time-inconsistent behavior, where task owners postpone tasks because they believe they will make a greater effort in the future, which rarely comes true in practice.

First of all, we have to align the WMT theoretical approach with the IT projects specifics. The project simulation is based on a sprint structure that is commonly used in Agile projects. The sprint typically lasts 2 weeks and has 10 workdays consequenty. The core of the WMT scheme is giving daily incentives for task owners based on whether they achieved daily workload targets or not. Thus, we have to set total, sprint and daily workload targets for the task owners. The total workload (W_s) represents the total work required to complete a task. In our case, it's the total amount of estimated hours required to complete all tasks within the project. It is a positive integer that can be distributed across multiple periods. In terms of IT project, the daily target is calculated by dividing the total workload per sprint by the number of days in the sprint (D). In other words, the task owner should complete a fraction of the total workload $\frac{S_1}{D}$ daily to ensure the task is completed on time.

If the task progress is satisfactory up to period t, $S_t \leq \frac{S_1(D-t+1)}{D}$, then the task owner will continue with the regular workload for that period, achieving the target $\min\{S_t - \frac{S_1}{D}, 0\}$. If the task progress is behind schedule, $S_t > \frac{S_1(D-t+1)}{D}$, then the task owner must complete both the regular and delayed workloads $[S_t - \frac{S_1(D-t+1)}{D}]$ to achieve the target $\frac{S_1(D-t)}{D}$. This mechanism ensures that any backlog is accounted for in subsequent periods to motivate the task owner to catch up on delayed work.

As it was already mentioned, the present bias is a key factor that influences productity becase workers tend to delay their effort until later in the sprint. This behavioral tendency is covered by introduction of the present bias coefficint (β) and time discount factor (δ) to capture the time devaluation. Moreover, the task owners decide how much effort to apply each period (e_t). It is a positive integer and can vary from period to period since it depends on the choices of the task owner and the remaining workload. Knowing this, we can model the effort on each day of the sprint as in the equation (1):

$$e_t = \beta \cdot \frac{S_t}{S-t+1} \cdot \delta^{S-t} \tag{1}$$

where S_t is the remaining workload for the sprint at time t.

As task owners choose their effort levels (e_t) each period, a random amount of completed work $Q_t e_t$ is generated in period t due to uncertain productivity (Q_t). It is a positive discrete random variable during each period. Consequently, it makes task completion unpredictable. The task starts with a total workload and is completed once all work is done. At the beginning of each period (t), the amount of unfinished work is denoted as S_t, where $S_t = W$ and $S_t = 0$ when the task is completed.

Knowing this, we can describe the dynamics of task completion as in the equation (2):

$$S_{t+1} = \max\{S_t - Q_t e_t, 0\}, t = 1, \dots \tag{2}$$

This equation shows how the remaining workload decreases as effort is applied and should be updated each day. The unfinished work (S_t) is also important to determine the task completion time (τ) – the first period in which $S_{t+1} = 0$.

To study how incentive schemes handle scope changes, we introduce them as additional workload in the middle of the sprint (ΔW_{change}) . For research purpose, it will add from 2% to 20% more to the total workload. As a result, the new total workload for the sprint is defined as in the equation (3):

$$W_{new} = W_{initial} + W_{change} \tag{3}$$

The scope change also influences the daily target of the task owner that should be recalculated for the remaining days in the sprint as in the equation (4):

$$New\ Daily\ Targer = \frac{W_{new} - Work\ Completed\ Before\ Change}{S-t} \quad (4)$$

Under the WMT scheme the task owner can receive a bonus or penalty at each period based on whether they meet the progress target. The aim of incentive is to adapt the task owner to the new workload. The incentive for each period t is calculated as follows in the equation (5):

$$I_t = b \cdot (New\ Daily\ Target - \ S_{t+1}) + p \cdot 1(S_{t+1} \leq New\ Daily\ Target) \quad (5)$$

where $b > 0$ and $p > 0$ represent the bonus and penalty per unit of workload and S_{t+1}^{target} is the target workload at the end of period t. The cumulative incentive until period t is then follows the equation (6):

$$NI_{t+1} = NI_t + \delta^{S-t} \cdot I_t \quad (6)$$

At the project's end, if the cumulative incentive is negative, indicating a net penalty, the penalty is eliminated for on-time completion. In contrast, the bonus is lost if the project is delayed and the cumulative incentive is positive, indicating a net bonus. This final adjustment ensures that the task owner remains motivated and aligned with project deadlines.

The authors compare the effectiveness of the WMT with the benchmark traditional incentive approach – the Linear Contract (LC) scheme – to evalute own suggested approach better. The latter offers a simpler structure that provides a bonus for early completion and a penalty for late completion. The formula for the LC scheme is described in the equation (7):

$$I_t = B \cdot 1(\tau < \ S) - P \cdot 1(\tau \geq S) \quad (7)$$

where $B > 0$ and $P > 0$ are the bonus and the penalty per period.

There is also explanation of difference between the WMT and LC schemes in the study by Shi et al. (2022). The WMT scheme is built on continuous adjustment principle which should directly target present bias by penalizing delays daily and as a consequence should encourage consistent progress of workers. Although the LC scheme is effective in simpler scenarios, it does not directly address the day-to-day decisions that could lead to procrastination as in case of WMT. Thus, it may not be as effective in environments where present bias significantly impacts task completion.

As prerequisites, we will include such key parameters to the simulation as the present bias coefficient (β), which measures the extent of the bias, the time discount factor (δ), the effort levels (e_t), and the productivity variable (Q_t), which adds randomness to the task progress. Based on the empirical studies summarized by Shi et al. (2022), $\beta = 0.65$ on average, with a range [0.40, 0.89], where lower values indicate stronger present bias. Similarly, the mean of the discount factor is $\delta = 0.995$ for a weekly period, showing that future utility is slightly undervalued compared to immediate utility. The task owner's effort levels are integer values that represent the amount of effort in each period. The productivity in each period is a discrete random variable. It reflects the uncertainty in how much work is completed given the task owner's effort.

Then, we can proceed to the simulation process and begin it by setting initial parameters, such as total project duration, sprint duration and the total workload which is based on the estimated hours for the task in the sprint. Then, we have to generate multiple realizations of the productivity variable across the timeline. For each day, we should calculate the effort level based on the WMT or LC incentive structure and update the remaining workload. Afterwards, in the middle of each sprint, we will introduce the scope change as additional hours to the workload and recalculate the daily target, so that the task owners could adjust their effort levels to meet the new target. We will record the target metrics at the end of each sprint to assess the impact of present bias on project delivery and handling of scope changes.

One of the key metrics is completion rate which is the percentage of the total workload completed by the end of the period. We will also introduce own metrics, different from the core study. They will help to analyze the influence of the WMT scheme on task completion times and commitment to deadlines. The adaptation speed that measures how quickly task owners return to normal productivity after the scope change. It is also important to measure the deviation from the daily workload target after the scope change.

Using the calculated metrics, we can assess the effectiveness of WMT scheme and compare it with LC scheme. The overall performance of WMT and LC schemes is evaluated across all simulation runs. This includes comparison of adaptation speed, completion rate, and deviation metrics for both schemes. The differences between approaches will be tested on statistical significance by assessing the normality of the metric distribution using the Shapiro-Wilk tests, and afterwards using t-test for normally distributed data and Wilcoxon test otherwise.

To sum up, the described approach ensures that the research not only tests the theoretical framework of the WMT scheme but also evaluates its practical applicability in real-world IT project scenarios. The dynamic project environment is captured by introduction of the scope changes in the middle of the project sprint. The goal is to receive the insights into how WMT can improve adaptation speed, completion rates, and overall project management outcomes. This evaluation contributes to both theoretical understanding and practical implications for Agile project management.

CHAPTER 4. DATA

Data is one of the most essential components of research that enables its implementation. The dataset used in this research is obtained from the Ukrainian IT company. It is the work breakdown structure (WBS) of the healthcare project that lasted almost a year and involved a team of 5-7 members. WBS represents the decomposition of historical task records. It is a commonly used project management technique that outlines project scope by tasks, defines responsible team members for each task and helps to track task progress easier. Since WBS divides the work into tasks, these tasks can be used for more accurate time and cost estimation and then aggregated to the project level to obtain an overall time and cost estimate.

Descriptive analysis is a fundamental tool for data examination. The given dataset includes 427 task records in total. It contains numerical values (for example, duration, hours, percentage of completion), variables in date format (such as start and due dates), and categorical data (for instance, task title and task owner). Each task is associated with a specific module or feature. Such view provides us with a structured view of the project's components and its progress. The data contains eleven attributes for each record that could be grouped by the relevance:

- Task characteristics: Task ID, Task Title, Task Owner, Start Date, Due Date, Duration
- Estimation Hours: Pessimistic, Optimistic
- Logged Hours (actual time spent on the task)
- Difference between Optimistic and Logged Hours
- Percentage of Task Complete

The presence of variables, such as task details, timelines, estimates, and actual time spent enables the application of the WMT approach because it requires daily based rewards, which could be implemented using the simulation-based approach.

From the data descriptive statistics, we observe that although the number of tasks is equal to 427, there are a lot of empty values for other variables since there are only 298 records with specified task owner, and 251 record with start-due date. The analysis also showed that actual logged hours have significant variability, having 552 hours on average with a standard deviation of 3913.4 hours. Similar high variability is also observed for the difference between optimistic estimates and logged hours, with a mean of 125.2 hours and a standard deviation of 3022.7 hours. A more detailed output of descriptive statistics, for categorical variables and for numerical variables, is in the Appendix A and B appropriately.

Both the descriptive statistics and the task frequency by the completion rate confirms that most tasks are reported as 100% complete, with an average completion rate of 95.3%. However, there are 14 tasks with zero and 9 tasks with below 10%-70% completion rate that requires further data analysis to check if they have any other attributes specified except the task id and title. The list of task completion rate by frequency is presented in Appendix C.

It is important to looked at the task completion rate in terms of the task owner since it can give valuable insights into the team members performance. It is worth mentioning that the task owner variable in the originally exported dataset contained sensitive personal information, particularly first and last name. Therefore, the data was anonymized to comply with the NDA agreement. Specifically, each name was replaced with a value corresponding to the responsibility area of the team member in the project. For example, if a person worked on the client-side, developing the user interface, their name was replaced with the abbreviation "FE" for front-end developer. Accordingly, "BE" stands for back-end developer, "QA" refers to quality assurance or the person responsible for system testing.

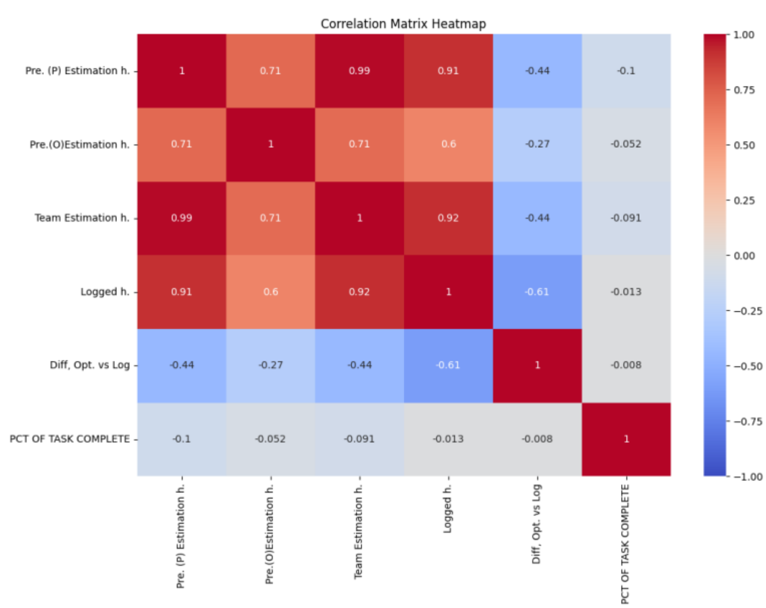
From the Table 2, which represents the logged hours and average task completion rate for each task owner, several insights can be drawn. The highest workload is observed on the backend part, with a total of 36,575 logged hours and an average task completion rate of 99.12%. It indicates that the development of the system logic is a significant part of the project. In comparison, the frontend team spent slightly less than half as much time – 16,824 hours in total and average task completion rate of 99.55%. Finally, although the QA team has the lowest completion rate of 95.96%, it shows almost 3 thousand logged hours, suggesting that QA tasks are more complex and time-consuming.

Table 2. Workload and task completion efficiency across task owners

Task Owner	Total Logged Hours	Average Task Completion (%)
BE	36,575	99.12
FE	16,824	99.55
QA	2,849	95.96

The correlation matrix reveals the relationships between the numerical variables in the dataset. According to Figure 2, there is a strong positive correlation between pessimistic estimated hours, and logged hours. At the same time, the correlation between optimistic estimated hours and logged hours is much lower, 0.91 and 0.6 respectively. It could show that the actual time spent for the task is closed to pessimistic estimate rather than optimistic, that is realistic in general.

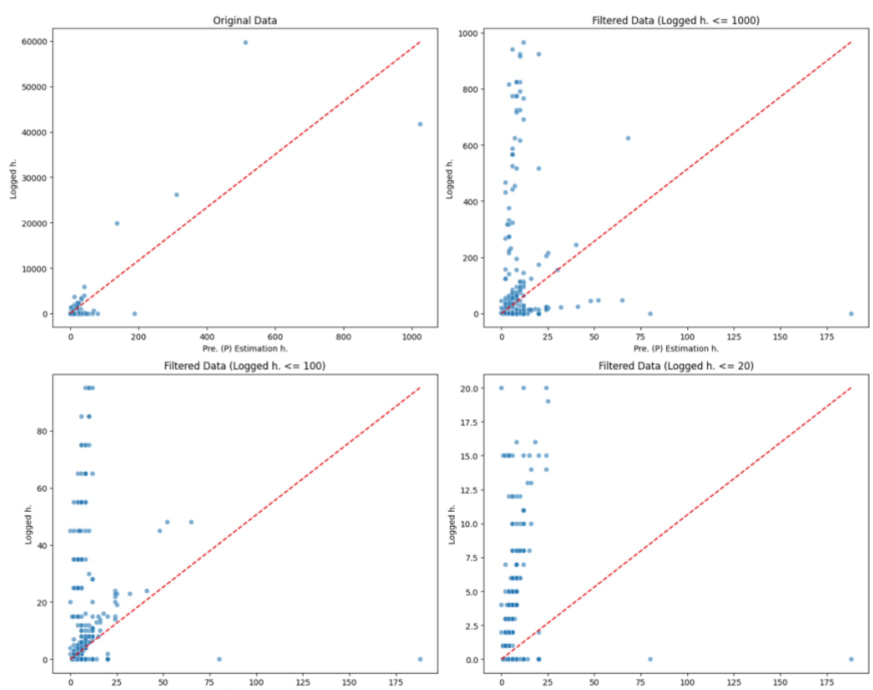
Figure 2. Correlation matrix



In addition, there is a strong negative correlation between the logged hours and the difference between optimal and logged hours, suggesting that higher logged hours often result in greater deviations from the optimal estimates. This confirms the stated conclusions. Interestingly that the task completion percentage has weak correlations with all other variables. It could indicate that task completion rates remain relatively stable regardless of variations in estimation and logged hours.

The target variables for further research are estimated and logged hours. Therefore, the scatter plot was used to discover their distribution and relationship. Since the correlation analysis showed that the logged hours are usually closer to the pessimistic estimates, the latter is used as a variable for scatter plots. The original data showed several outliers, so Figure 3 below shows subplots filtered by logged hours to reduce the clustering of observations. As a result, we see a nonlinear relationship between the variables. Moreover, there is a need for deeper data preprocessing and preparation before the simulation because of the revealed extreme values.

Figure 3. Comparison of pessimistic estimated and logged hours



As we can see the dataset is quite unbalanced and requires further data preprocessing since it is a critical foundation for the further simulation. That is why the initial dataset was reviewed and cleaned to get the good basis for the study. As a result, all the irrelevant columns were removed as well as the records with at least one empty value. The final dataset contains 112 records where each one represents a specific task completed during the project. It still includes numerical and categorical variables. However, the date-related ones were removed to simplify the future work. At the same time, the timeline was not broken due to having duration variable in the initial dataset.

For this research the following key variables were kept and considered: WBS number, Task Title, Task Owner, and Duration (in days), Estimated Hours and Logged Hours, and Difference between the Estimated and Logged Hours. We consider these variables are essential in applying the Work More Tomorrow and Linear Contract schemes during the simulation of scope changes and worker behavior in project settings. The Figure 4 shows the sample of the final dataset records.

Figure 4. Example of the preprocessed dataset

WBS NUMBER	TASK TITLE	TASK OWNER	DURATION	Estimated h.	Logged h.	Diff, Est vs Log
1.1	Design DB	BE	1	4	4	0
1.2	Access rights	BE	1	4	11	-7
1.3	Access rights	FE	14	12	12.25	-0.25
1.4	Architecture doc	BE	3	8	13.25	-5.25
1.5	Create project	FE	5	24	18.5	5.5
1.6	Create project (back)	BE	1	6	6	0
1.7	General typography	FE	5	24	24.75	-0.75

The descriptive analysis of dataset, shown in Table 3, also displays that estimated hours have significant variability with 8.12 hours on average and a standard deviation of 7.1 hours. Similar high variability is also observed for the actually logged hours, with a mean of 7.41 hours and a standard deviation of 5.92 hours. It indicates that tasks generally took slightly less time than estimated. Finally, the valuable insight was revealed for difference between estimated and logged hours. Some tasks were completed more efficiently than anticipated while others required significantly more time with deviations range from -7 hours (it means tasks were completed faster) up to 20 hours (implying that tasks took longer than estimated).

Table 3. Descriptive statistics of final processed dataset

	WBS Number	**Duration**	**Estimated h.**	**Logged h.**	**Diff Est vs Log**
count	112	112	112	112	112
mean	5.49	3.36	8.12	7.41	0.71
std	2.36	3.93	7.09	5.92	2.79
min	1.1	1	2	0	-7
25%	4.12	1	4	3.94	0
50%	5.17	2	5	5	0
75%	7.23	4	8.5	8.93	0.87
max	9.9	22	47	32	20

Each task record in the final preprocessed dataset is assigned to one of the three main roles in the typical IT project. It is either backend developer (BE) or frontend developer (FE) or quality assurance (QA). Moreover, the number of tasks is more or less equally distributed among the roles: 39, 37, and 36 accordingly. Having the task owner variable enable us to understand better how workloads and task completion rates differ across the team as well as how the WMT and LC schemes affect their performance.

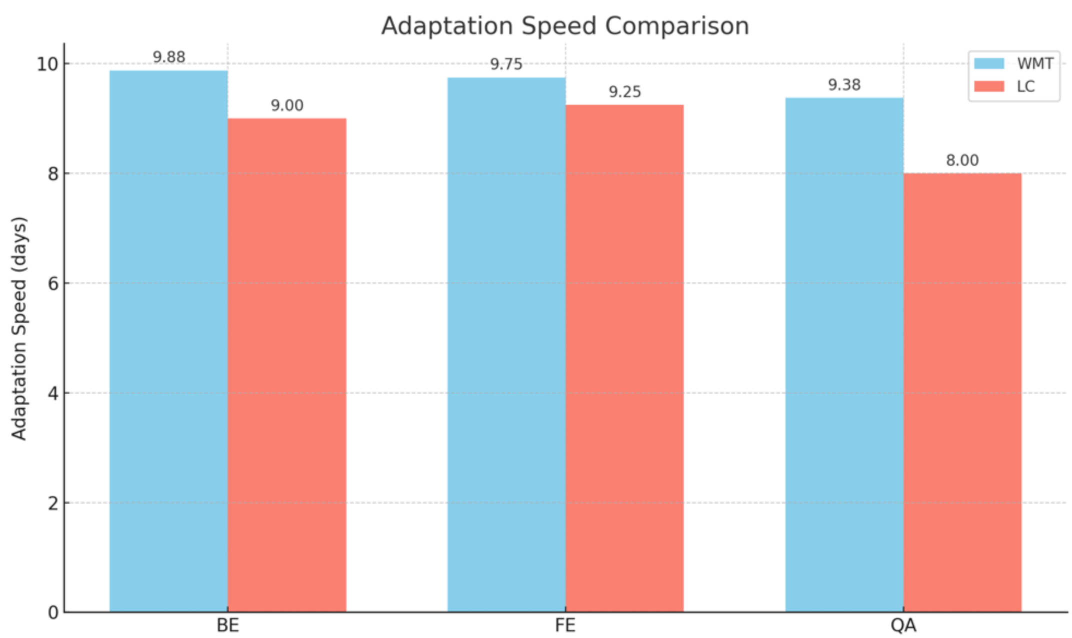
CHAPTER 5. RESULTS

5.1. Project Simulation

The analysis begins with the evaluation of each task owner's performance under WMT and LC approaches. We calculate the defined key metrics (adaptation speed, completion rate, and deviation from targets) across multiple sprints for each incentive scheme and task owner separately.

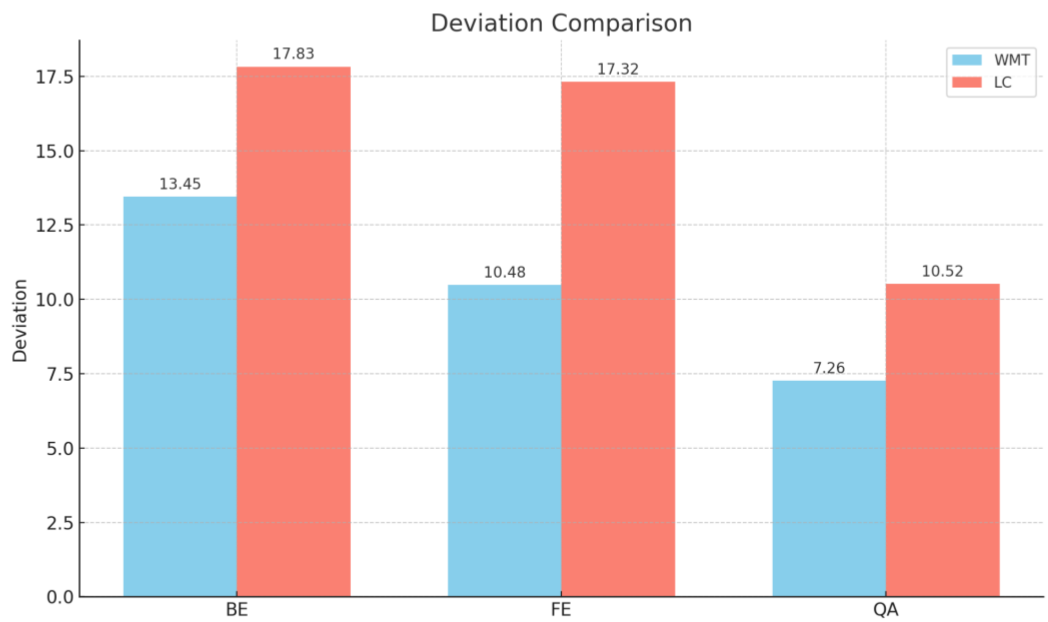
According to the simulation results, we observe differences in adaptation of each scheme to scope changes. Figure 5 shows that for most task owners under WMT adapts to changes slower than LC. For example, BE have an average adaptation time of 9.88 days under WMT, and 9 days under LC. Similar results are observed for FE and QA roles.

Figure 5. Adaptation speed simulation results at the individual task owner level



However, according to Figure 6, we observe better performance of the WMT approach in terms of the deviation from targets metric. It outperformed traditional incentive scheme across all task owners. Such reduction in deviation might suggest that daily incentives help developers stay on track more effectively and maintain steady progress throughout the sprints.

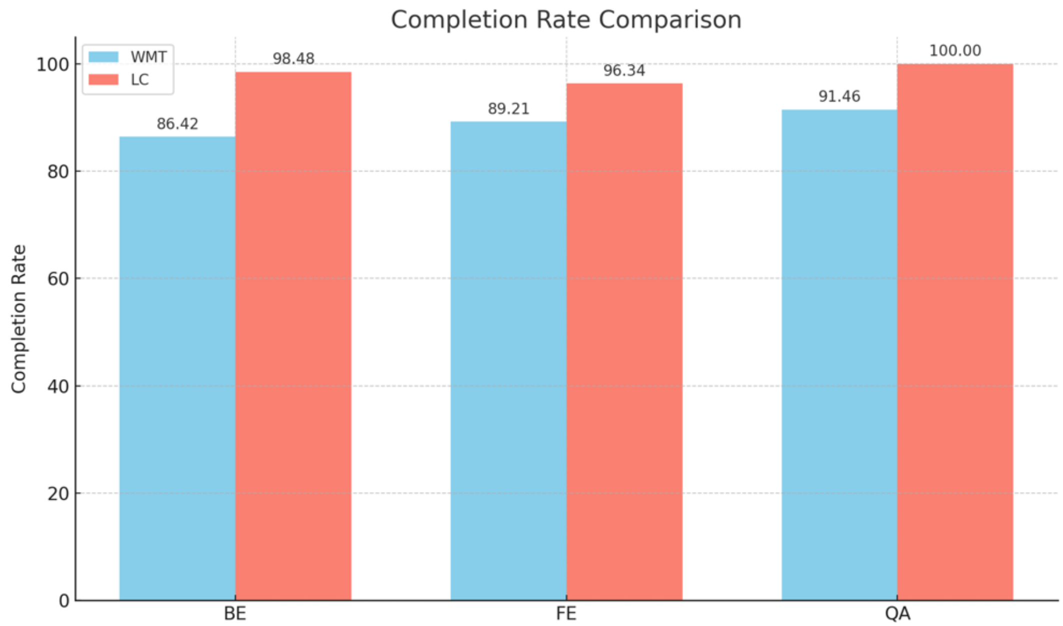
Figure 6. Deviation simulation results at the individual task owner level



The only case when LC scheme showed better results is the task completion rate, slightly exceeding WMT at the task owner level. It is observed in Figure 7. The latter shows completion rate around 90% for all the roles while LC is about 98%. We can conclude that while the task-based approach provides stronger motivation for task completion, the daily-based one may offer more flexibility in handling scope changes without sacrificing significant amount of work.

In addition to the analysis at the individual task owner level, we have also conducted it at the team-level to observe the overall effects of each scheme on project outcomes. Generally, it consists of two parts: the single simulation for all sprints, and multiple runs of it. The first part evaluates the average performance of the analyzed schemes in terms of key metrics while the second one ensures the validity of findings across multiple simulations.

Figure 7. Completion rate simulation results at the individual task owner level



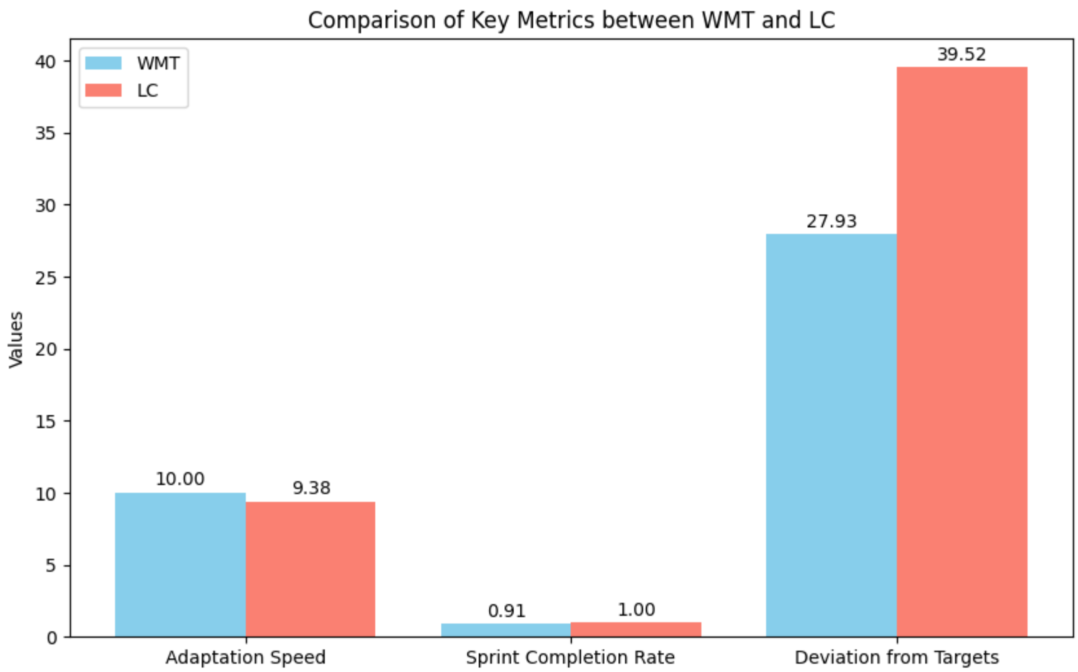
According to the final dataset and 2-week sprint duration, we have 8.5 sprints for the given project. The single simulation for all sprints showed pretty similar results to the task owner level in terms of conlusions. Figure 8 shows that the WMT still has slower adaptation to scope changes. However, its gap with the LC scheme is small, with LC being only 1 day faster, taking on average 9 days to adapt.

As observed at the task owner level, the LC scheme achieved a higher completion rate in most runs. This may be explained by its focus on end-of-sprint rewards, which pushes teams to complete all tasks, even if their progress throughout the sprint is not constant. Although WMT approach promotes more flexibility in handling scope changes, it might slightly reduce urgency to complete every task as its focus is on consistent progress rather than final sprint outcome.

Finally, the deviation from targets metric shows the advantage of WMT scheme because of the smaller deviations compared to LC. This suggests that WMT is better at maintaining consistent every day progress, as its daily rewards motivate teams to hit short-term goals.

By contrast, in case of LC, the end-of-sprint incentives migt cause more variability since teams often make more efforts toward the end of the sprint, leading to inconsistencies at the begining of the period.

Figure 8. Key metrics results for a single simulation run



5.2. Results Significance

The second part of the simulation, multiple runs for each scheme, is done to validate the findings above. We have repeated the process 30 times. These multiple runs allowed us to check the statistical significance of the results by examining the distribution of the metrics. To begin with, we assessed the normality of the metrics using the Shapiro-Wilk test. The results showed that only deviation from targets followed a normal distribution for both WMT and LC.

Based on the normality test results, we applied the appropriate statistical significance tests. We user t-test for the deviation from targets metric since both WMT and LC metrics followed a normal distribution. It showed a significant difference between the two schemes, with a p-value less than 0.05. As a result, the WMT significantly outperforms LC in reducing deviations from targets, meaning that WMT teams were much more consistent in meeting their daily workload goals.

For adaptation speed and completion rate, we applied Wilcoxon test since these metrics were not normally distributed. These results also are statistically significant. The LC outperformed WMT in terms of how quickly teams adapted to scope changes in the middle of the sprint. It shows that LC's structure of incentives might encourage quicker adjustments toward the end of the sprint while WMT's daily incentives still promote steady, ongoing changes. The completion rate results showed statistical significance, indicating that the end-of-sprint incentives provide stronger motivation for teams to complete all tasks by its end.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

The goal of research is to evaluate two incentive schemes, Work More Tomorrow and Linear Contract, in how they much effective they are in managing adaptability to scope changes of IT projects. The impact of each scheme is measured with several key metrics: adaptation speed, completion rate, and deviation from targets. The WMT scheme showed better results in faster adaptation to scope changes and more consistent daily progress. Since it gives daily incentives they might encourage team members better to maintain steady work pace descipe of changes in the project needs.

On the other hand, LC scheme showed its advantages in overall higher completion rates. Since it focuses on incentives at the end of each sprint, such scheme motivates team memebers to finish the tasks anyway regardless of the not equal distribution of efforts throughout the sprint. The analysis of completion rate metric proves that end-oriented structure of incentive scheme may better benefir projects where the final output or deadline is prior over daily progress consistency. Overall, the results proves that WMT promotes higher adaptability to changes in the project scope while LC performs better in the context of higher project completion rates.

The results of this research are especially valuable for project management practices in such dynamic industry like IT. Introduction of incentive schemes into the project with aim to promote higher adaptability of task owners in such fast-changing environments can improve team efficiency and lead to better project outcomes. Moreover, the characteristics of incentive schemes aligns with project needs from business perspective since they optimize both team performance and resource allocation.

The WMT scheme is better for IT projects that use Agile methodology where responsivness to changes has high priority. The daily rewards of WMT provide fast mechanism to keep project team aligned with changing goals. It allows for immediate workers feedback and motivation that is helpful to be aware of overall project progress and mitigate the impact of scope changes. It may be also beneficial for organizations from culture point of view since it promotes an approach of continuous improvement and adaptability.

For projects where completion is a key objective, especially those that follow Waterfall methodology, it is recommended to introduce LC scheme or a blended approach. Because of LC's focus on end-of-sprint incentives, project managers can be sure that all tasks will be completed by the deadline. If we are talking about blended approach that combines both WMT and LC, then project team benefits from daily incentives, but also has a clear goal at the end. Such hybrid models could be effective in environments where adaptability is needed, but meeting specific deliverable deadlines still has high priority. As a result, it lets organizations to balance the benefits of daily progress and kepp the drive for overall task completion, optimizing team performance.

Hybrid incentive scheme that combines WMT and LC can support adaptability to scope changes more effectively, but still make task owners account for project completion goals. Project team can receive daily rewards when its members meet workload targets. The milestone bonuses as characteristic of LC scheme can encourage focus on key stages and final deadlines. Such blended model could be highly effective for Agile projects that demand adaptability and timely task completion.

We consider that implementation of incentive schemes should require thoughtful analysis before practical usage to avoid unintended consequences. For instance, daily incentives in WMT scheme can keep teams on track when requirements are changing. However, they can also lead to increase in pressure on team members if the workload management is not balance. Companies can introduce occasional buffer days when workers can refine their focus before moving forward as a possible way to mitigate stress.

Similarly, LC emphasises on completion incentives that may lead to hustled work toward the end of the sprint if team members perceive it as their last chance to meet goals. Project manager can implement mini-rewards throughout the sprint to keep the progress and do not lose focusing from the end goal. Anyways, suggested strategies can help maintain a healthy work environment and leverage benefits from each incentive model.

Different individuals in a team, regardless of their role in the project, may repond better to certain rewards. It would open possibility for future research to explore the importance of personalization as part of incentive schemes. As a consequence, match between incentives and individual preferences can optimize even better team adaptability and productivity. For instance, task owners who usually show high performance might be more motivated by completion bonuses while team members who prefer structure may prefer daily rewards.

The current study has several areas for improvement. First of all, it uses simulation approach to analyze the effectiveness of WMT and LC schemes to handle scope changes in IT projects. However, such methodology cannot fully replicate the real-world conditions that projects usually face. Additionally, this research offers insights relevant to Ukrainian IT industry since it is based on historical project data, but at the same time it limits generalizability to other industries with other project management demands.

Therefore, the study does not account for the long-term effects because it looks on immediate outcomes like adaptation speed and completion rates. Such narrow focus on two incentive schemes and immediate project metrics still provides space for future research. Knowing these limitations, we have to underscore the need for more extensive studies to understand better how incentives can influence project adaptability and team performance across various settings.

This study provides foundation for future research in the area of incentive schemes for project management. First of all, the provided analysis can be replicated across different industries to find whether WMT and LC adaptability benefits extend beyond IT. Further studies could also examine the impact of incentive schemes on team morale, stress level, and long-term productivity. This will provide better picture of its implications in project management settings.

Another direction for discovery can be modeling of blended incentive schemes as it was already mentioned above. In addition, the research can be expanded with variations of WMT and LC in Waterfall and other project methodologies. This direction can reveal new insights into more optimal incentive schemes depending on the project methodology. All in all, current research provides a solid foundation for further exploration of incentive schemes as an approach to increase adaptability of project management practices across IT and other industries.

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APPENDIX

APPENDIX A. Description statistics: categorical variables

	Task ID	Task Title	Task Owner
count	427	427	298
unique	404	270	24
freq	2	49	52

APPENDIX B. Description statistics: numerical variables

	Start Date	Due Date	Pes. Estim., h	Opt. Estim., h	Log-ged, h	Diff, Opt. vs Logged, h	Percentage of Task Complete
count	251	251	418	418	421	419	420
mean	27/11/2022	29/11/2022	13.52	11.54	551.98	125.17	95.27
min	11/02/2022	11/03/2022	0	0	0	-8581	0
25%	10/11/2022	11/11/2022	4	2	2	0	100
50%	02/12/2022	05/12/2022	6	4	7	2	100
75%	19/12/2022	21/12/2022	10	8	65	10	100
max	30/12/2022	17/01/2023	1023	754	59781	60547	100
std	-	-	58.87	50.74	3913.42	3022.71	18.46

APPENDIX C. Task completion rate by frequency

Task Completion Rate	Frequency	Task Completion Rate	Frequency
0%	14	80%	14
10%	1	90%	8
50%	1	100%	373
70%	7		