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RESEARCH OF MANAGEMENT MODELS FOR COMMERCIAL IT PROJECT DEVELOPMENT IN A REMOTE TEAM ENVIRONMENT

Abstract. *This article is dedicated to the analysis of management methods for commercial IT project development in remote working conditions. The primary objective is to identify the most effective approaches to project management in the absence of participants' physical presence, which is particularly relevant due to the growing popularity of remote work. Today, information technology is advancing rapidly, and commercial IT project development plays a crucial role in this field. Thanks to modern technology and globalization, an increasing number of teams are working remotely, creating both new opportunities and certain challenges. Among the main challenges for remote teams are ensuring effective communication, organizing task coordination, and maintaining participants' motivation. Additionally, it is important to adapt traditional methodologies, such as Agile and Scrum, to remote work conditions, as the lack of physical interaction may lead to misunderstandings, reduced productivity, and an increased risk of losing important information. The study compares traditional and new approaches to management. Among the recommendations is the implementation of communication platforms such as Slack or Zoom, which greatly facilitate information sharing and coordination. Furthermore, to foster team spirit and support productivity, it is recommended to hold regular online meetings, both formal and informal. Significant attention is also given to risk management and information security – remote access to corporate data requires additional protective measures, such as data encryption and multi-factor authentication. The study shows that, despite certain drawbacks, remote work, with the implementation of adaptive and flexible management approaches, can ensure a high level of productivity. In the final section of the article, recommendations are provided on implementing the methodologies that have proven most effective for remote IT teams. This approach will help companies remain competitive and successfully execute their projects, even under remote working conditions.*

Keywords: project management; remote teams; IT development; agile methodologies; productivity; communication platforms; task coordination; team motivation; data security; risk management

Introduction

In today's world, where technological progress is accelerating, the information technology (IT) industry has become a defining segment of the global economy. Commercial IT project development is a vital component of this sector, supporting the creation of effective and innovative products for various businesses.

Due to several factors, such as the COVID-19 pandemic, the need to reduce office space costs, and increasing globalization, remote work is becoming an increasingly popular and widespread trend. This trend not only establishes a new way of organizing work but also has a significant impact on businesses specializing in commercial IT project development.

Managers leading remote teams inevitably face unique challenges, requiring rapid adaptation and the implementation of more effective management methodologies. One of the primary difficulties is ensuring high-quality communication among remote employees. The lack of physical contact can result in decreased productivity, misunderstandings, and information loss. These issues can also negatively affect the overall motivation of the team and their ability to collaborate. An additional challenge is the difference in time zones among team members, which is common in remote groups. Apart from potential communication difficulties, task management and progress monitoring also become crucial concerns.

Given these changes in work conditions and the need to address the above issues, it is essential to explore various strategies and management models specifically for remote teams. Effectively meeting these challenges requires the development and implementation of new management models that promote effective collaboration and sustain high productivity in a remote work environment. Research on these matters is particularly relevant for IT companies aiming to optimize operations in remote work settings.

This study examines different models for managing commercial IT project development within remote teams, investigating the advantages and disadvantages of each model, and proposing recommendations for implementation. The objective is to identify an optimal approach that supports the successful and stable execution of IT projects in remote work conditions.

Analysis of Recent Research and Publications

The issue of effective management for remote teams in the IT field has been examined in numerous studies. For instance, Sayan Ghar [1] studied the impact of using various communication platforms (Slack, Zoom, Microsoft Teams) on the effectiveness of interaction and coordination within remote teams. This research found that the choice of communication tools significantly affects the speed of information exchange and the quality of decisions made. Mrs G. Sirisha, Vani Sarada, Dr John, B.V. Ramakrishna, Dineshwari Bisen, and Dr Bhadrappa Haralayya [2] explored task and project management methods in remote teams, examining different approaches, such as Agile, Scrum, and Kanban, and analyzing their effectiveness in the context of remote work. In their work, Ana Margarida Graça and Ana Margarida Passos [3] studied the role of leadership in remote teams, emphasizing the importance of communication skills, motivation, and delegation of authority for successful management of a remote team. Graça [4] further focused on the influence of trust and mutual understanding on the productivity of remote teams, asserting that building trust among team members is a key factor for success in remote work. Stanley Ugochukwu Emenike and Sadia Khan [5] examined quality control issues and the timely completion of tasks within remote teams, proposing various tools and methods for monitoring progress and identifying potential issues at early stages.

Mikko Korkala and Pekka Abrahamsson [6] examined the experience of a successful global software development team that utilizes the Agile approach, identifying key success factors such as clear communication, the use of appropriate tools, and process flexibility. Janine Viol Hacker, Michael Johnson, Carol Saunders, and Amanda L. Thayer [7] studied the concept of trust in virtual teams at various levels: individual, team, and organizational. They proposed a model for trust development and provided recommendations for enhancing it. Charles Nwoko and Khashayar Yazdani [8] explored the concept of self-leadership in the context of remote work, proposing a model that includes components such as self-observation, self-management, and self-development.

Arvind Malhotra, Ann Majchrzak, and Benson Rosen [9], along with Ilze Zigurs, Deepak Khazanchi, and Azamat Mametjanov [10], proposed practical guides for managing virtual teams and projects within remote teams. They examined various aspects, including team building, communication, conflict management, performance evaluation, planning, risk management, and quality control.

Katherine M. Chudoba, Eleanor H. Wynn, Mei Lu, and Mary Beth Watson-Manheim [11] proposed a tool for measuring the virtuality of teams, identifying four dimensions of virtuality: geographical dispersion, electronic communication, task independence, and cultural diversity. Martha L. Maznevski and Katherine M. Chudoba [12] studied the dynamics and effectiveness of global virtual teams, identifying key factors influencing the success of such teams, including leadership, communication, trust, and cultural integration. Jessica Lipnack and Jeffrey Stamps [13] examined various aspects of virtual teams, such as their advantages and disadvantages, types of virtual teams, technologies for virtual collaboration, and virtual team management. Cascio W. F. and Shurygailo S. [14] explored the concept of e-leadership within the context of virtual teams, identifying essential skills and competencies required for effective leadership in a virtual environment.

Guido Hertel, Susanne Geister, and Udo Konradt [15] summarized the findings of empirical studies on managing virtual teams, identifying key issues and challenges, and providing recommendations for managers. Susan G. Cohen and Cristina B. Gibson [16] identified key conditions for the effectiveness of virtual teams, including a shared goal, clear roles and responsibilities, effective communication, and mutual trust.

In papers [17 – 21], the authors analyzed the application of game theory in the management of project teams and stakeholders, as well as considered the management of teams in IT organizations.

Despite the considerable amount of research, questions remain regarding the adaptation of project management methodologies to remote work and the impact of different management models on commercial IT project development in remote environments.

The aim of the study is to identify an optimal management approach that ensures the successful and stable execution of IT projects in remote work environments.

Research tasks:

– Examine and analyze various management models for commercial IT project development within remote teams.

– Investigate the advantages and disadvantages of each model.

– Develop recommendations for selecting and implementing an optimal management model, considering the specifics of remote work and the characteristics of individual IT projects.

– Evaluate the effectiveness of the proposed model in practice.

Article Purpose and Objectives

According to the results of the literature and information source analysis, numerous approaches to IT project management in remote work environments have been identified. Many researchers have focused on factors that influence project success, particularly communication processes, team trust, and resource management. However, the integration of different management models and their adaptation to the specific conditions of remote work remain underexplored. Therefore, the purpose of further research is to identify an optimal management approach that ensures the successful and stable execution of IT projects in remote work settings.

The methods for further research will include a comparative analysis of existing IT project management models, case studies of specific project implementations in remote teams, as well as the experimental implementation and evaluation of the effectiveness of the developed management model. The results of these studies will be presented in the main body of the work, where a detailed analysis of the effectiveness of the proposed approaches will be carried out and recommendations for their implementation will be provided.

Preliminary conclusions from the analysis indicate a significant gap between theoretical approaches and the practical needs of remote teams. Many management models fail to consider the specifics of remote work, resulting in insufficient effectiveness in their application. The unresolved aspects of the problem include the need to develop flexible models that account for both the technical aspects of management and social factors, such as trust and communication within teams.

The aim of this research is to develop and implement an optimal management model for commercial IT project development that ensures successful project execution in remote work environments, taking into account the specifics of team dynamics and the unique characteristics of various IT projects.

The primary tasks of the research to achieve the set aim include examining and analyzing various management models for commercial IT project development within remote teams, investigating the advantages and disadvantages of each model, developing recommendations for selecting and implementing an optimal management model that considers the specifics of remote work and the characteristics of individual IT projects, and evaluating the effectiveness of the proposed model in practice.

Challenges in Remote Teams During IT Project Development

Working on software development projects in remote teams is becoming an increasingly common practice in the IT industry. However, this work format is not without its challenges, which can significantly impact the success of a project. This section is dedicated to a detailed analysis of these issues to facilitate their resolution and enhance the efficiency of remote teams.

One of the primary challenges of remote work is the complexity of communication processes. The lack of direct contact between team members can lead to misunderstandings, delays in information exchange, and reduced collaboration effectiveness. Additionally, time zone differences can complicate synchronous communication and require extra effort for team coordination.

Remote teams also face difficulties in task coordination and performance monitoring. Managers may find it more challenging to track the progress of each team member’s work, ensure timely task completion, and identify potential issues at early stages. This can result in project delays and a reduction in the quality of the final product.

Remote work can negatively affect employee motivation and engagement. The lack of personal contact

with colleagues and managers can lead to feelings of isolation and a decrease in interest in the work. Additionally, remote employees may encounter difficulties in maintaining a balance between work and personal life, which can also impact their productivity.

Technical issues, such as unstable internet connections, software malfunctions, and insufficiently powerful equipment, can significantly complicate the work of remote teams. These problems can lead to wasted time, reduced productivity, and increased risks of project deadline failures.

Remote work also involves heightened security risks. Remote employees may use personal devices and networks to access corporate data, which can result in the leakage of confidential information. Moreover, remote work complicates the enforcement of security policies and the detection of potential threats.

In remote teams composed of people from different countries and cultures, cultural differences can pose challenges. Diverse communication approaches, work styles, and values can lead to misunderstandings and conflicts, which may negatively affect team effectiveness.

Working on software development projects in remote teams is becoming increasingly popular in the IT industry. However, this work format is accompanied by numerous challenges that can seriously impact project success. The main issues faced by remote teams include communication difficulties, coordination and control problems, motivation and engagement challenges, technical issues, security risks, and cultural differences.

The lack of direct contact and time zone differences complicate communication processes, which can lead to misunderstandings and delays in team work. This, in turn, makes it difficult to track progress and coordinate tasks, and can also undermine employee motivation due to feelings of isolation and difficulties with work-life balance. Technical issues, such as unstable internet or software malfunctions, add further challenges to the workflow of remote teams.

The overall goal of analyzing these issues is to resolve them and improve the efficiency of remote teams. Achieving this goal requires developing communication strategies, ensuring effective control and coordination of work, and creating a supportive environment for employee motivation and engagement.

Management Methods for Commercial IT Project Development in Remote Teams

Successful management of IT projects with a remote team requires adapting traditional methodologies and tools to the specific nature of this work format. It is essential to consider the unique aspects of communication, coordination, motivation, and control in remote teams, as well as to leverage modern technologies and approaches that facilitate effective collaboration.

Effective communication is critically important for the success of any project, and especially for remote teams. Using various communication tools such as Slack, Zoom, Microsoft Teams, and others enables continuous information exchange and swift issue resolution. Regular online meetings, both synchronous and asynchronous, help maintain team connections, discuss the project's current status, and plan future steps.

Creating a virtual space for informal communication, experience sharing, and team-building is also a key aspect. This could be a dedicated chat or channel in a messenger, virtual coffee breaks, or other formats of online interaction.

For effective task management in remote teams, methodologies such as Agile, Scrum, and Kanban can be employed. These approaches allow the project to be divided into small iterations, clearly assign tasks to each team member, and track progress on task completion.

Using specialized project management systems like Trello, Jira, Asana, and others helps visualize the workflow, allocate tasks, set deadlines, and monitor task execution. Additionally, these systems allow the automation of certain routine tasks, freeing up the manager's time for more strategic matters.

Maintaining a high level of motivation and engagement in remote teams is an essential task for managers. Regular feedback, recognition of achievements, and the creation of professional development opportunities help sustain employees' interest in their work.

It is also crucial to foster an atmosphere of trust and mutual support within the team. This can be achieved through regular online meetings, joint activities, and informal communication.

To assess the effectiveness of a remote team, various metrics should be used, such as the number of completed tasks, code quality, and response times to client requests. Additionally, tracking employee satisfaction and engagement levels in the project is important.

The use of modern analytics and reporting tools allows for the automation of data collection and analysis, helping managers make informed decisions and respond promptly to changes in the project.

Ensuring security is a critical aspect of managing remote teams. Using secure communication channels, data encryption, and multi-factor authentication helps protect confidential information from unauthorized access.

It is also important to develop and implement security policies governing the use of personal devices and networks for work, as well as procedures to follow in the event of a cyber incident.

Managing remote teams that consist of people from different countries and cultures requires consideration of cultural differences. Understanding and respecting

diverse communication approaches, work styles, and values is essential.

Conducting cultural training sessions and creating an inclusive environment where each team member feels heard and valued helps prevent misunderstandings and conflicts and promotes effective collaboration.

Given the specifics of remote work, it is important to focus particularly on risk management. Potential risks, such as communication issues, task delays, and technical failures, must be identified, and action plans should be developed to minimize them.

Regular project progress monitoring, risk analysis, and timely adjustments help avoid serious issues and ensure the successful completion of the project.

In today's dynamic environment, it is essential to be prepared for change and capable of adapting quickly. Flexible development methodologies, such as Agile, enable rapid responses to changes in client requirements, new technologies, and other factors that may impact the project.

It is also important to foster an atmosphere of openness to change and a willingness to learn within the team. This helps the team adapt swiftly to new conditions and complete the project successfully, even in the face of unforeseen circumstances.

Applying the aforementioned management methods will help mitigate remote work challenges and ensure the successful implementation of IT projects. It is essential to understand that each project is unique, so the selection of specific tools and approaches should be tailored to the characteristics of the particular team and project.

Analysis of the Impact of Proposed Methods on Project Implementation

This section examines how the developed and implemented management models can influence key aspects of IT project implementation. Specifically, it focuses on evaluating the effectiveness of the new methods in terms of meeting planned timelines and budget. Managing remote teams often presents specific challenges, such as ensuring effective communication, maintaining motivation, and overseeing task completion. The implementation of the proposed models is intended not only to address these issues but also to optimize processes that directly impact project timelines and budget.

This section will provide a detailed analysis of the results of implementing the proposed methods, particularly their impact on team productivity, task completion speed, and overall project costs. This allows for conclusions to be drawn regarding the economic feasibility and practical effectiveness of the new approaches in managing remote IT teams.

Earlier, we proposed various methods to enhance project management in remote team environments. Each of these methods is given a code for ease of analysis:

– Using modern communication tools (Slack, Zoom, Microsoft Teams) instead of slower, analogue tools like email *(m1)*.

– Creating and using a single centralized virtual space to update information on technical requirements, news, bugs, and any other project-related information *(m2)*.

– Employing modern project management methodologies, such as Agile, Scrum, and Kanban *(m3)*.

– Utilizing task management and tracking systems, such as Trello, Jira, and Asana *(m4)*.

– Introducing regular feedback within the team and creating pathways for professional and career development *(m5)*.

– Conducting regular online meetings, both formal and informal, to improve communication and interaction within the team *(m6)*.

– Mandatory reporting on completed tasks within the team and introducing metrics to evaluate the performance of each employee, along with automating the process of data collection and project analysis *(m7)*.

– Developing and implementing security policies to protect project-related confidential information and creating protocols for action in case of cyber incidents *(m8)*.

– Conducting training to prevent misunderstandings and conflicts within the team and to enhance team interaction *(m9)*.

– Implementing a risk management system and protocols to mitigate their impact on the project, along with regular project progress monitoring to minimize force majeure situations such as communication issues, task delays, and technical failures *(m10)*.

– Establishing continuous communication between the client and the project team, introducing guidelines for client-initiated project changes at various phases, and conducting team training to coordinate actions when the client makes changes to the project *(m11)*.

To analyze the impact of the proposed methods for improving project management in remote teams, we propose comparing two teams:

– Team A *(A)* – does not use methods *(m1-m11)* in project management or uses them ineffectively *(E<50%)*. The effectiveness of the methods *(m1-m11)* will be represented by the letter *E*.

– Team B *(B)* – uses methods *(m1-m11)* effectively *(E>50%)* in project management.

In order to assess the impact of the proposed methods on the effectiveness of teams A and B during the project implementation, we compare the effectiveness of both teams in Table, where BMA is the use of the method by team A (yes/no), EMA is the effectiveness of the method by team A *(E, %)*, BMB is the use of the method by team B (yes/no), EMB is the effectiveness of the method by team B *(E, %)*.

Table – ***Comparative analysis of teams A and B***

Method	BMA	EMA	BMB	EMB
m1	yes	30%	yes	90%
m2	yes	25%	yes	90%
m3	no	0	yes	75%
m4	yes	25%	yes	80%
m5	no	0	yes	70%
m6	yes	10%	yes	65%
m7	no	0	yes	60%
m8	no	0	yes	70%
m9	yes	10%	yes	80%
m10	no	0	yes	55%
m11	no	0	yes	75%

To compare the effectiveness of Teams A and B, the overall efficiency for each team can be determined as the average effectiveness of using all methods. The formula for calculating the overall efficiency $(E_{general})$ of a team can be represented as follows:

$$E_{general} = \frac{\sum_{i=1}^{n} E_i}{n}, \quad (1)$$

where E_i – is the effectiveness of using method m_i and n– is the total number of methods (in our case, $(n = 11)$).

For Team A:

$$E_{general,\ A} = \frac{E_{mi} + E_{mi+1} + \cdots}{n}. \quad (2)$$

For Team B:

$$E_{general,\ B} = \frac{E_{mi} + E_{mi+1} + \cdots}{n}. \quad (3)$$

Now, using the values from the table, we can calculate the overall effectiveness for each team.

For Team A:

$$E_{general,\ A} = \frac{100}{11} \approx 9.09\%. \quad (4)$$

For Team B:

$$E_{general,\ B} = \frac{810}{11} \approx 73.60\%. \quad (5)$$

Thus, the overall effectiveness of Team B is significantly higher than that of Team A.

After calculating the overall effectiveness for both teams, we can compare them to determine how much more effective Team B is than Team A. This can be done by finding the percentage difference between the efficiencies of the two teams:

$$E_{increase} = \frac{E_{general,\ B} - E_{general,\ A}}{E_{general,\ A}} \times 100\%. \quad (6)$$

For our data:

$$E_{increase} = \frac{73.60 - 9.09}{9.09} \times 100\% \approx 709.68\%. \quad (7)$$

Therefore, Team B is approximately 709.68% more effective than Team A, according to the data presented in the table.

The data analysis shows that Team B significantly outperforms Team A in terms of overall effectiveness in using the proposed project management methods. The overall effectiveness of Team B is approximately 81.36%, whereas Team A's overall effectiveness is only 9.09%. This indicates that Team B is effectively using methods aimed at improving communication, task management, and the overall organization of work.

Team B demonstrates a high level of integration of modern tools and project management approaches, such as the use of contemporary communication tools *(m1)*, a centralized virtual space for updating information *(m2)*, and modern project management methodologies *(m3)*. They also actively use technological systems for task management *(m4)*, ensure regular feedback *(m5)*, conduct regular online meetings *(m6)*, maintain reporting *(m7)*, implement security policies *(m8)*, conduct training to enhance team interaction *(m9)*, manage risks *(m10)*, and maintain continuous communication with the client *(m11)*.

In contrast, Team A either does not use these methods or uses them ineffectively. This significantly impacts their overall productivity and ability to achieve project goals. The difference in effectiveness between the two teams highlights the importance of implementing modern project management methods and approaches, especially in remote work settings.

For a more representative display of the effectiveness of methods m1-m11, see Figure below.

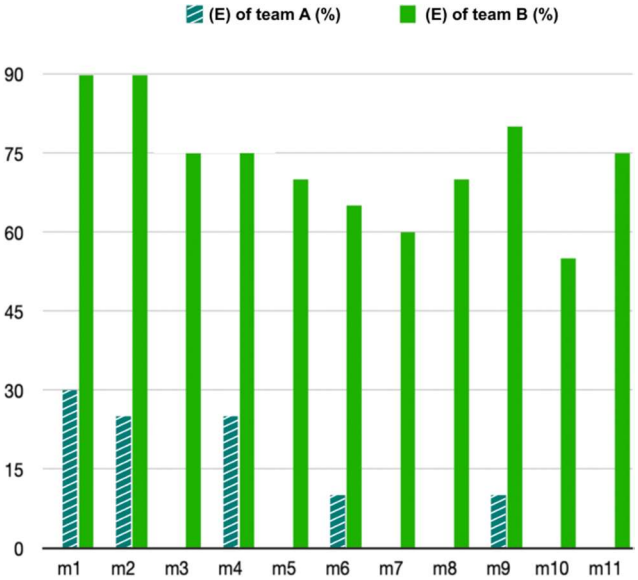

Figure – Efficiency (E) of using methods m1-m11 by teams A and B

Thus, increasing the effectiveness of Team A to the level of Team B could significantly boost their productivity, shorten project implementation timelines, and reduce costs. This underscores the need for adapting and implementing modern project management methods across all remote teams to ensure their competitiveness and success.

Conclusions

Managing remote IT teams is a complex task that requires a deep understanding of technical, social, and organizational aspects. The analysis of various project management models in remote work settings highlighted the diversity of approaches, along with their advantages and disadvantages. The results of our study indicate the importance of developing flexible and adaptive management methods that can function effectively amidst constant change and uncertainty.

The practical application of these findings can significantly improve the performance of remote teams, enhancing their productivity and enabling them to achieve project goals. Interdisciplinary research is proving to be highly promising, as collaboration with experts from various fields allows for the discovery of new ideas and approaches to solving complex problems.

It is essential to continue research in this area, develop new management methods and models, and implement them in practice to continually improve the work of remote IT teams. Understanding the main challenges and issues faced by remote teams will enable a more effective response and the development of strategies to overcome them.

Final conclusions regarding optimal approaches to managing remote IT teams require further research and experimentation to achieve the best possible outcomes.

Further Research Directions. For further research development, several key directions are worth considering. First, expanding the study of mathematical models could be beneficial, analyzing other approaches and identifying the most effective ones. Additionally, creating new models that better reflect the specifics of IT project management in remote work conditions would add value.

Developing new research methods, such as algorithms and software for efficient data analysis and optimal decision-making, could deepen insights. These methods may also address other challenges in this field.

The practical application of research findings holds potential for improving real IT project management practices. Developing and testing a prototype or software product based on these results could greatly ease the work of remote teams and boost productivity.

Research could further explore other issues remote teams face, analyzing various factors' impact on outcomes. Comparative analysis with other research could reveal new perspectives for solving these problems.

Lastly, interdisciplinary research could be especially useful. Collaboration with experts in other fields can bring fresh approaches and ideas to tackle complex issues in remote IT team management, opening pathways for further advancements in project management in remote environments.

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ДОСЛІДЖЕННЯ МОДЕЛЕЙ УПРАВЛІННЯ КОМЕРЦІЙНОЮ РОЗРОБКОЮ ІТ-ПРОЄКТІВ В УМОВАХ ВІДДАЛЕНО-ПРАЦЮЮЧОЇ КОМАНДИ

Анотація. *Ця стаття присвячена аналізу методів управління комерційною розробкою ІТ-проєктів в умовах віддаленої роботи команд. Основною метою є визначення найбільш ефективних підходів до управління проєктами за відсутності фізичної присутності учасників, що особливо актуально через зростання популярності дистанційної роботи. Нині інформаційні технології швидко розвиваються, і комерційна розробка ІТ-проєктів відіграє ключову роль у цій галузі. Завдяки сучасним технологіям і глобалізації дедалі більше команд працює віддалено, що створює як нові можливості, так і певні труднощі. Серед основних викликів для віддалених команд – забезпечення ефективної комунікації, організація координації завдань та збереження мотивації учасників. Також важливо адаптувати традиційні методології, такі як Agile та Scrum, до умов дистанційної роботи, оскільки брак фізичної взаємодії може викликати непорозуміння, зниження продуктивності і підвищення ризиків втрати важливої інформації. У дослідженні проводиться порівняння традиційних і нових підходів до управління. Серед рекомендацій – впровадження платформ для комунікації, таких як Slack або Zoom, що значно спрощують обмін інформацією і координацію. Крім того, для забезпечення командного духу та підтримки продуктивності рекомендується проводити регулярні онлайн-зустрічі як офіційного, так і неформального характеру. Значна увага приділяється також питанням управління ризиками та інформаційної безпеки – віддалений доступ до корпоративних даних потребує додаткових заходів захисту, таких як шифрування інформації та багатофакторна аутентифікація. Дослідження засвідчує, що, попри певні недоліки, віддалена робота за умови впровадження адаптивних та гнучких підходів до управління може забезпечити високий рівень продуктивності. У завершальній частині статті наведено рекомендації з впровадження методик, які виявилися найбільш ефективними для віддалених ІТ-команд. Такий підхід допоможе компаніям залишатися конкурентоспроможними й успішно реалізовувати свої проєкти навіть за умов дистанційної роботи.*

Ключові слова: управління проєктами; віддалені команди; ІТ-розробка; гнучкі методології; продуктивність; комунікаційні платформи; координація завдань; мотивація команди; безпека даних; управління ризиками

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