Original article

ASSESSMENT OF THE FEASIBILITY OF IMPLEMENTING A CONSTRUCTION PROJECT AT THE PRE-INVESTMENT STAGE

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Abstract: The purpose of this study is to determine the feasibility of implementing a construction project at the stage of re-investment based on the principles of development in Ukraine. The methodology of this study was based on a survey that helped identify the key factors of investment budget overruns, as well as economic modelling of construction projects, which helped identify the relationship between risks and financial performance. The data obtained were analysed using correlation analysis to assess the impact of development principles on the effectiveness of management decisions. The findings of this study revealed that a significant number of construction projects face risks that exceed the originally planned budget. The main factors affecting budget overruns were changes in the regulatory environment, underestimation of materials and labour costs, and unpredictable external economic factors. Economic modelling has shown that companies that implement development principles can reduce the risk of budget overruns compared to those that do not. This indicates a significant positive impact of development on management decisions. The correlation analysis revealed a strong correlation between the implementation of development principles and the growth of return on investment.

Keywords: Economics; Planned budget; Management; Risk; Construction.

1. INTRODUCTION

The relevance of the study is determined by the growing need for effective resource management at the pre-investment stage of construction projects, which reduces risks and increases economic efficiency. Studying aspects of development in this area is important for optimizing decision-making processes and ensuring the successful implementation of new projects. The problem of the study is the need to justify the feasibility of implementing a construction project at the pre-investment stage, when significant investments have already been made, but the final result and profit have not yet been achieved. At this stage, there are risks associated with the effectiveness of project management, changes in market conditions, and possible additional costs.

Technological innovations, such as building information modelling (BIM), augmented/virtual reality (AR/VR), 3D printing, and blockchain, can be key to helping construction companies adapt to new conditions and management challenges at the pre-investment stage. Research conducted by K. Lavrukhina et al. (2023), C. Sun et al. (2023), M.S. Malek and Bhatt (2023) has shown that the introduction of BIM

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technologies can significantly increase the efficiency of management processes, reducing risks and improving coordination between project participants. The authors found that BIM technologies help to optimize costs and planning, as well as help to respond more quickly to changes in market conditions. In addition, AR and VR open up new opportunities for project visualization, which facilitates communication with investors and customers, and helps identify potential problems at the early stages of design. 3D printing provides an opportunity to reduce material costs and shorten lead times. However, these studies did not take into account the fact that in the context of uncertainty that accompanies the pre-investment stage, companies may face difficulties in adopting new technologies due to funding constraints and a lack of qualified personnel.

Environmental and social factors can have a significant impact on the feasibility of implementing construction projects at the pre-investment stage, as companies face sustainability and social responsibility requirements. The study by P. Tillmann and K. Humphrey (2023), V. Voitovych et al. (2023), and M. H. Heydari and G. Heravi (2023) demonstrate that ignoring environmental requirements and social aspects leads to significant reputational and financial losses, which reduces the investment attractiveness of projects. Their research confirms that successful projects that take these factors into account demonstrate increased long-term efficiency and sustainability, which is reflected in their ability to attract additional investment and maintain a positive image in the market. However, there is a gap in the research that relates to the lack of analysis of the specific mechanisms by which environmental and social factors influence project financial performance, which limits the understanding of their role in pre-investment decision-making.

Psychological factors, such as fear of loss and overconfidence, can play a key role in investment decisions at the pre-investment stage of construction projects. B. K. Ababio and W. Lu (2023), J. Carlander and P. Thollander (2023), O.A. Tugai et al. (2019), S. Shoar et al. (2023) found that fear of loss leads to investors' reluctance to invest additional funds in projects that seem risky, even if they can be potentially profitable. On the other hand, overconfidence causes investors to underestimate risks and overestimate their capabilities, which often leads to losses and budget overruns. Such emotional factors often interfere with objective project evaluation and balanced decision-making. However, little research has been done on how these psychological factors affect specific decisions to reinvest in construction projects in a volatile market and how this can lead to cost overruns or affect future profitability.

Global economic changes, such as inflation, currency fluctuations and changes in commodity prices, can significantly affect decisions to exceed investment budgets in construction. Studies by M. R. Munaro and S. F. Tavares (2023), Y. Blyakharskyi (2023), M. Stanitsas and K. Kirytopoulos (2023) confirm that rising inflation and exchange rate volatility often lead to higher construction costs, forcing investors to revise their budgets. Their research found that changes in the price of raw materials, such as steel and concrete, can affect the financial performance of projects and lead to the risk of cost overruns, as prices can fluctuate in the market without warning. A gap in these studies is that the impact of global economic trends on investment budget overruns varies by type of construction project and geographic location.

The analysis of the authors' work highlights the importance of technological innovation, environmental and social factors, as well as psychological aspects in decision-making processes during pre-investment in construction projects. Studies show that these elements have a significant impact on the efficiency of management processes, financial performance, and the risk of budget overruns. However, it remains poorly understood how the specific mechanisms of interaction between these factors can change in an unstable market and what consequences this has for the investment attractiveness of projects.

The purpose of this study was to investigate the effectiveness of implementing development principles in the management of construction

projects at the stage of reinvestment. The main objectives of the study include conducting a survey to identify factors that lead to investment budget overruns, economic modelling to determine the relationship between risks and financial performance, and regression and correlation analysis of the impact of development principles on the effectiveness of management decisions.

2. MATERIALS AND METHODS

The study was conducted between March and September 2024. The respondents were found through professional networks (LinkedIn), social media (Facebook, Telegram), as well as through business communities and announcements on web platforms (Google Forms, SurveyMonkey). SurveyMonkey and Google Forms were used to conduct surveys and collect data. The sample of survey participants was not random, but formed in accordance with clearly defined criteria. To be included in the sample, potential participants took a preliminary survey (Appendix A), which determined their compliance with the following criteria: position, at least 5 years of experience in the construction industry, participation in project management at the pre-investment stage, managerial authority in investment decision-making, and participation in projects with budgets of more than USD 5 million. Those who met the criteria were given an extended survey form (Appendix B), which consisted of 15 questions divided into three blocks of 5 questions each. The first block included questions aimed at assessing market changes, the second - internal management decisions, and the third – external economic factors that affect the excess of the investment budget. The maximum number of participants who could take part in the survey was 500.

According to Appendix A, 250 male and female representatives took part in the study. These were investors – 111 people, developers – 173 people, and project managers – 216 people. The study covered representatives from the following 5 selected regions of Ukraine: Kyiv region – 151 people, Lviv region – 101 people, Odesa region – 76 people, Kharkiv region – 74 people, and Dnipro region – 98 people. Breakdown by age group: 31–40 years old – 211 people, 41–50 years old – 164 people, 51–60 years old – 125 people. Respondents' work experience in the construction industry is as follows: 5-10 years – 56 people, 11-15 years – 151 people, 16-20 years – 124 people, over 20 years – 169 people. Experience in pre-investment projects: no experience in pre-investment projects – 80 people, experience from 1 to 3 years – 151 people, experience over 3 years – 269 people. Participants with managerial authority in investment decision-making – 405 people. Participation in projects with budgets of more than USD 5 million: 94 people participated in projects with budgets from USD 5 million to USD 15 million, 269 people – from USD 16 million to USD 25 million, 137 people – from USD 26 million and above.

To assess the effectiveness of construction project management, economic modelling was used (Appendix C), which took into account various risk factors: changes in the cost of materials, labour costs, regulatory changes and economic instability. A Monte Carlo simulation tool (Monte Carlo Simulation, 2024) was used. Development principles, such as efficient use of resources and flexibility and adaptability to change, were used as variables that could optimize processes and reduce the risk of exceeding the investment budget (Sobieraj & Metelski, 2023). Correlation analysis was used to determine the level of correlation between the implementation of development principles and the increase in the profitability of construction projects. The correlation coefficients allowed us to establish the strength and direction of the relationship between the use of development approaches and financial performance.

Fuzzy logic and fuzzy set theory were used in economic modeling of the feasibility of a construction project at the pre-economic stage. These strategies proved indispensable for controlling the inherent uncertainty and inaccuracy of data related to numerous aspects, such as material prices, fluctuations in labor costs, and changes in regulatory rules. The study used fuzzy set theory to express these characteristics using degrees of membership instead of fixed values, which facilitated a more nuanced approach to risk assessment and decision-making. The analysis of material cost fluctuations and labor price changes was

performed using fuzzy variables, allowing the model to more accurately reflect the wide range of possible outcomes and uncertainty in project costs.

In addition, fuzzy logic was incorporated into Monte Carlo simulations used to model the impact of economic and regulatory risks on construction budgets. This method provided a deeper understanding of potential risks and the likelihood of budget overruns in various market situations. The inclusion of fuzzy variables in the simulation process improved the accuracy of forecasts regarding fluctuations in material costs, increases in labor costs, and various external economic factors. The use of fuzzy logic in scenario modeling, including static development and optimized promotion, demonstrated how adaptive management methods can reduce risks and improve resource allocation even in volatile market conditions. This methodology, based on fuzzy logic, has contributed to the improvement of adaptive management methods, facilitating more informed and sustainable decisions at the pre-investment stage of construction projects.

Participant data is confidential and was used exclusively for this study. Data processing and analysis were carried out using SPSS 28.0.1 software.

3. RESULTS

3.1. Analysis of survey results

In conformity with Appendix B (Block 1), changes in the real estate market over the past year have significantly reduced the feasibility of new construction projects. This was noted by 113 respondents, including 27 investors, 38 developers and 48 project managers. The predominant age group is 41-50 years old, with 16 to 20 years of experience. The largest number of responses came from Kyiv (36 respondents) and Odesa (24 respondents) regions. The feasibility of implementing new construction projects has been reduced, but only partially, by 157 respondents, including 32 investors, 64 developers, and 61 project managers. The predominant age group is 31-40 years old, with 11 to 15 years of experience. Most responses came from Lviv (44 respondents) and Kyiv (43 respondents) regions. The feasibility of implementing new construction projects in the regions was not affected by 73 respondents, including 15 investors, 26 developers, and 32 project managers. The predominant age group is 31-40 years old, with 5-10 years of experience. Most responses came from Odesa (19 respondents) and Kyiv (25 respondents) regions. The feasibility of implementing new construction projects has increased: 91 respondents said that market changes had a positive impact on their decisions, including 22 investors, 30 developers, and 39 project managers. The predominant age group is 41-50 years old, with over 20 years of experience. Most responses came from representatives of Kharkiv (26 respondents) and Kyiv (29 respondents) regions. The feasibility of implementing new construction projects has significantly increased: 66 respondents indicated a significant positive impact of the changes, including 15 investors, 15 developers, and 36 project managers. The predominant age group is 41-50 years old, with 11 to 15 years of experience. Most responses came from representatives of Dnipro (25 respondents) and Lviv (16 respondents) regions. The results indicate that changes in the real estate market have significantly affected the feasibility of new construction projects, mainly reducing their attractiveness, although some participants point to positive trends in certain market segments.

The question about the significance of changes in prices for construction materials over the past year for project implementation showed the following results. 93 respondents indicated that price changes were critical (24 investors, 37 developers, and 32 project managers), with the predominant age group being 41-50 years old, with over 20 years of experience. Most responses came from representatives of Kyiv (28 respondents) and Dnipro (20 respondents) regions. Prices have risen significantly – 149 respondents (25 investors, 68 developers and 56 project managers), with the predominant age group being 31-40 years old, with 11-15 years of experience. The highest number of responses came from Lviv (48 respondents) and Kharkiv (36 respondents) regions. Changes in prices were moderate – 157 respondents (29 investors, 55 developers, and 73 project managers), with the predominant age group being 31-40 years old, with 5-10

years of experience. Odesa (31 respondents) and Kyiv (40 respondents) regions received the highest number of responses. Changes in prices did not have a significant impact on 54 respondents (12 investors, 19 developers, and 23 project managers), with the predominant age group being 51-60 years old, with 16-20 years of experience. Most responses came from representatives of Dnipro (20 respondents) and Lviv (14 respondents) regions. 47 respondents noted that prices for materials had even fallen, including 21 investors, 12 developers, and 14 project managers. The predominant age group is 41-50 years old, with over 20 years of experience. Most responses came from Kharkiv (15 respondents) and Odesa (10 respondents) regions. The majority of respondents believe that changes in prices for construction materials over the past year have had a significant impact on project implementation.

The data on demand for commercial and residential property over the past year in the surveyed regions are presented in Table 1.

Table 1: Demand for real estate

Estimating changes in real estate demand	**Total number of respondents**	**Investors**	**Developers**	**Project managers**	**Predominant age group**	**Work experience**	**The largest number of responses from representatives of the region**
Demand for residential real estate has increased sharply, while demand for commercial real estate has decreased	112	22	40	50	31-40 years old	over 20 years	Kyiv region (35), Dnipro region (24)
Demand for commercial real estate increased, while residential remained stable	138	29	75	34	41-50 years old	11-15 years	Lviv region (45), Kharkiv region (32)
Both segments remain stable	85	15	20	50	51–60 years old	16-20 years	Odesa region (24), Kyiv region (30)
Demand for both types of	87	19	23	45	41-50 years old	5-10 years	Dnipro region (29), Lviv

real estate has decreased							region (22)
Demand for both types of real estate has increased	78	26	15	37	31-40 years old	over 20 years	Kharkiv region (20), Odesa region (18)

Source: compiled by the authors.

The majority of respondents indicated a sharp increase in demand for residential property, while demand for commercial property proved to be unstable. The survey showed that demand for both types of property is strongest in Kyiv and Lviv regions, reflecting the market activity in these regions.

110 respondents believe that changes in regulatory policy have greatly simplified the construction process, allowing for faster project implementation. At the same time, 143 participants noted that the new regulatory policy requires more time to obtain permits, which has led to delays in project implementation. The requirements for project documentation have become stricter, which has complicated the initial stages of project implementation, as reported by 122 respondents. Regulatory changes did not have a significant impact on construction projects for 75 participants, as their companies complied with all regulations in advance. Changes in legislation have led to a review of all construction strategies, especially in terms of environmental standards, as reported by 50 respondents.

132 participants believe that sharp currency fluctuations have made project financing much more difficult due to the increased cost of imported materials. 145 respondents indicated that currency fluctuations forced them to enter into more contracts in local currency to reduce currency risks. 89 participants indicated that minor exchange rate fluctuations did not affect financing, as most of their expenses are incurred in local currency. 74 respondents indicated that exchange rate fluctuations created additional challenges in budget planning, but did not significantly affect overall funding. 60 participants reported that the exchange rate fluctuations had led to revised loan conditions, which resulted in the temporary freezing of some projects. The results demonstrate the multifaceted impact of exchange rate fluctuations on construction project financing, including delays, changes in contractual terms, and risk reallocation.

According to Appendix B (Block 2), the data on the most important management decisions to ensure the economic efficiency of a project at the pre-investment stage correspond to the number of responses from respondents (Figure 1).

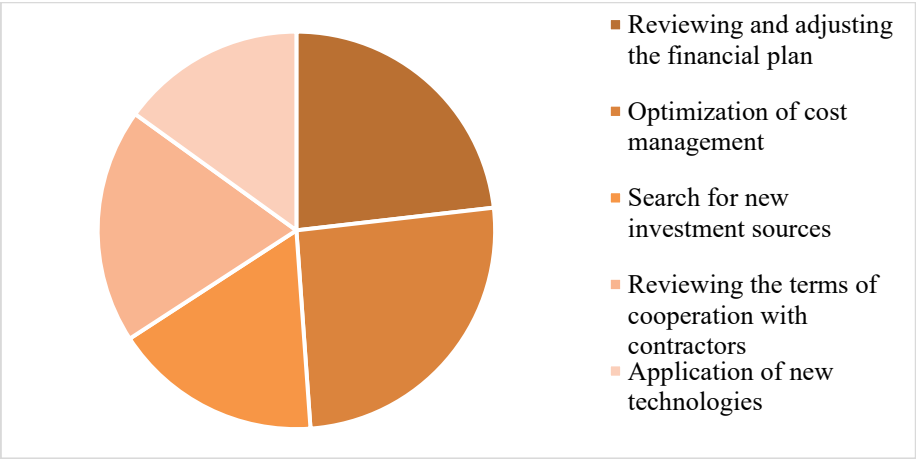

Figure 1: The impact of management decisions
Source: compiled by the authors.

The majority of respondents consider financial planning and cost management to be key aspects for cost-effectiveness in the pre-investment phase, with a focus on finding new financial resources and introducing innovations in construction processes. The survey results showed that 176 respondents use risk management (the process of identifying, assessing and managing risks to minimize their impact on a project or activity (Maalek and Maalek, 2023)) on a regular basis at all stages of pre-investment. 139 people often analyse risks, but they are not always decisive in decision-making. 114 participants use risk management occasionally for strategic decisions, while 54 do so only in the event of major changes or unforeseen circumstances. Only 17 respondents reported that they do not use risk management at this stage at all.

184 respondents regularly review financial strategies at every stage of project implementation. 137 do so in the event of significant changes in the market or cost of resources. 106 participants review strategies only when there are problems with funding or budget overruns. 49 respondents rarely review strategies and stick to the original plans. Only 24 do not review financial strategies after they are approved at the initial stage of the project.

161 respondents believe that changes in the internal management structure of the company have had a positive impact on the implementation of construction projects, contributing to more efficient management and faster decision-making. 113 participants indicated a partial positive impact of the changes, affecting only some departments. 92 respondents indicated that the changes did not have a significant impact on project delivery, as internal processes remained stable. 64 participants reported delays in project implementation due to the adaptation of new employees. 35 respondents believe that the changes have had a negative impact on project implementation, causing disorganization. 35 people said there were no changes.

174 respondents believe that the introduction of new technologies has significantly increased the efficiency of construction processes, reduced costs and improving the quality of projects. 138 participants indicated that new technologies helped to achieve some financial goals, but required significant initial investment. 105 respondents indicated a partial effect from the introduction of technologies, which led to increased productivity, but without a significant reduction in costs. 52 participants stated that technology did not have a significant impact on achieving financial or managerial goals due to limited use. 31 respondents indicated that the introduction of new technologies has led to increased costs and has not yielded the expected results due to difficulties in staff adaptation. The findings indicate that respondents prefer active management and implementation of new technologies, emphasizing the importance of adapting to changing market conditions and the need to regularly review financial strategies to achieve success in construction projects.

According to Appendix B (Block 3), the survey results on the main factors that influence project investment budget overruns showed the following trends. Changes in the cost of materials and resources were mentioned as the main factor by 302 respondents (87 investors, 124 developers, and 91 project managers). Delays in the execution of work due to adverse weather conditions or other external factors affect the budget, according to 218 respondents (59 investors, 73 developers, and 86 project managers). Unforeseen technical problems that arise during the implementation phase were mentioned by 245 participants (66 investors, 98 developers and 81 project managers). Inadequate planning and inaccurate cost estimates caused budget overruns for 276 respondents (79 investors, 112 developers, and 85 project managers). Changes in customer requirements or project documents affected the budget, according to 164 respondents (48 investors, 62 developers, and 54 project managers). Other factors (currency fluctuations, shortage of skilled labour, changes in legislation, and difficulties in obtaining permits and licences for projects) were mentioned by 59 respondents (19 investors, 18 developers, and 22 project managers).

The results of the study on the importance of proper planning (accurate budget calculation,

clear work schedule, risk assessment, resource optimization, technical documentation, and performance monitoring (Daboun et al., 2023)) to avoid budget overruns showed certain trends. Planning is considered critically important by 204 respondents (66 investors, 58 developers, 80 project managers), mostly in the 41-50 age group with more than 20 years of experience, with the largest number of responses coming from Kyiv region (58 people). The role of planning was identified as very important by 165 respondents (23 investors, 72 developers, 70 project managers), most of whom were aged 31-40 and had 11-15 years of experience, with the largest number of responses from Lviv region (45 people). Planning is considered important, but dependent on external factors, by 82 respondents (10 investors, 29 developers, 43 project managers), most of whom are in the 31-40 age group with 11-15 years of experience, with the largest number of responses from Kyiv region (30 people). The role of planning was partially recognized as important by 33 respondents (8 investors, 10 developers, 15 project managers), mostly in the 51-60 age group with 16-20 years of experience, with the largest number of responses from Odesa region (12 people). Planning is not considered crucial by 16 respondents (4 investors, 6 developers, 6 project managers), mostly in the 41-50 age group with more than 20 years of experience, with the largest number of responses from Kharkiv region (6 people).

The results of the survey on the frequency of budget overruns due to changes in the cost of materials and works show that 135 respondents, most of whom have more than 20 years of experience, have faced this problem very often, and the largest number of responses came from participants in the 41-50 age group and from Kyiv and Dnipro regions. Often, changes in the cost of materials affect the budget, according to 159 respondents, dominated by developers and project managers, especially in the 31-40 age group, with the highest number of responses from Kyiv and Kharkiv regions. Sometimes this happens in 111 cases, particularly among participants with 11-15 years of experience and in the 31-40 age group, with the largest number of responses coming from Lviv and Odesa regions. Rarely, this situation was noted by 61 respondents, mostly those with more than 20 years of experience, with the largest number of responses from participants in the 51-60 age group and from Kharkiv and Dnipro oblasts. This is never the case for 34 respondents, mostly investors with 16-20 years of experience, with the majority of responses coming from participants in the 51-60 age group and from Odesa and Lviv regions.

Regarding the measures that respondents take to minimize investment budget overruns, the data reflecting the number of responses from respondents was obtained (Figure 2).

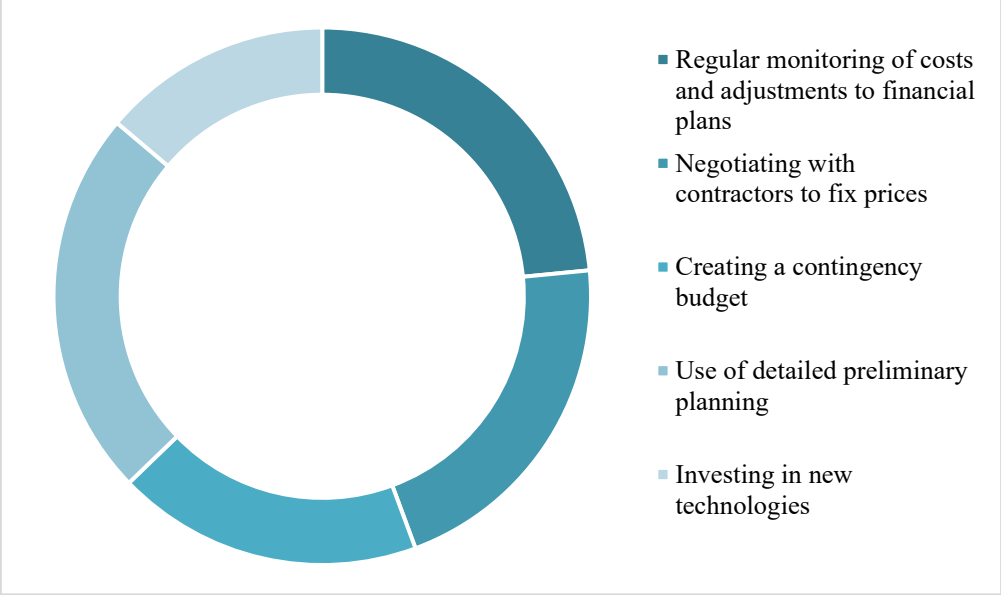

Figure 2: Measures to avoid budget overruns
Source: compiled by the authors.

Regular monitoring of costs allows for real-time detection of budget deviations and the ability to take corrective action (Shen et al., 2023). Contracts with fixed prices for materials and work reduce the risk of financial losses due to price fluctuations (Jiang et al., 2023). The availability of contingency funds allows for a quick response to unforeseen costs without jeopardizing the project's main budget (Chan et al., 2023). Careful cost estimation at the initial stage of the project helps reduce the likelihood of budget overruns due to underestimation of costs (Erfani & Tavakolan, 2023). The use of innovative technologies (drones, 3D printing, artificial intelligence, VR) and construction management methods helps to reduce costs and increase the overall efficiency of projects (Gurgun et al., 2024). The diagram shows that the largest share of respondents considers it important to regularly monitor costs and negotiate with contractors to minimize investment budget overruns.

203 respondents believe that changes in the economic situation have a significant impact on budget overruns in construction projects. These changes partially affect 132 people, while 85 respondents said that the impact can be reduced by making reserves or adjusting the strategy. Only 80 people believe that changes in the economic situation have little or no impact on the budget. The majority of respondents recognize the significant impact of economic changes on the budget, emphasizing the need to adapt strategies to reduce the risk of exceeding it.

3.2. Analysis of modelling results

The results of the Static Development scenario using the Monte Carlo simulation tool show that the investor group experienced a moderate increase in the total project cost by 5.2-7.1%, with an average increase in material costs of up to 3.6%. Labour costs, which increased by 2.5%, resulted in additional personnel costs of 1.6-2% of the original budget. The probability of budget overruns due to risks associated with supply volatility is estimated at 12%. For the group of developers, the impact of changes in material costs was moderate, with fluctuations of 2.8%, which led to a slight impact on construction costs (up to 4%). Regulatory changes had almost no impact on the project, with investors in this category proving to be less vulnerable to changes in legislation. The probability of delays in project completion due to insufficient regulatory stability is estimated at 10%. Project managers were also impacted by rising labour costs, which led to a 1.8% increase in the overall budget. The economic stability of the market allowed for effective cost control, although the project cost was projected to increase by 6%. Risks included a 15% chance of cost increases due to delays in labour and materials.

The regional analysis shows that in the Kyiv region, a stable market with projected fluctuations in material costs of up to 3.2% keeps the risks at 11%. Lviv region showed an increase in labour costs of up to 2.5%, which led to a slight increase in total costs of 3%. Odesa region has a 14% risk of budget overrun due to delays in the supply of materials. Kharkiv region showed a 15% risk of delays due to external factors, with a 4.5% increase in costs. Dnipro oblast showed a slight increase in material costs to 2.8% and a risk of 12%. With stable market development, the impact of changes in material and labour costs on the total cost of a construction project is moderate.

The modelling results of the Optimized Advancement with Development scenario indicate positive changes in the impact of economic factors on the cost of a construction project. In the investor group, there was a moderate decrease in the total project cost of 3.5-5.2% due to active resource management, despite an increase in material costs of up to 9.8%. Labour costs increased by 4.4%, but this did not result in significant additional costs, as the overall budget was reduced due to optimization. The probability of budget overruns due to risks associated with changes in supplies is estimated at 10.7%. Among developers, changes in the cost of materials also had a moderate impact, with a fluctuation of 6.3%, which reduced the cost of construction to 2.5%. Regulatory changes continue to have a minimal impact on the project, and developers are demonstrating effective risk management, with an estimated probability of 11.4%. Project managers also benefited from increased resource

management efficiency, which led to a 4.6% reduction in the overall budget. Despite the increase in labour costs to 5.2%, the total project cost decreased by 5.1%, which shows the positive impact of optimization. The risks of budget overruns due to delays in the supply of materials are estimated at 12.2%.

In the Kyiv region, the optimization of material costs to 8.7% keeps the risks at 10.1%. Lviv region showed an increase in labour costs to 5.6%, but this led to a 4.3% reduction in total costs. In the Odesa region, the risk of budget overruns due to delays in the supply of materials decreased to 10.8%. Kharkiv region showed a decrease in risks to 11.5% with a moderate increase in costs by 6.2%. Dnipro region remained stable, with a slight increase in material costs to 7.4% and risks at 12.4%. Optimization of resource management helped to reduce the overall project costs, even as prices for materials and labour rose.

The results of the modelling under the Negative Stress scenario indicate a significant negative impact of economic and regulatory factors on the cost of the construction project. The investor group saw a significant increase in the cost of materials at 18.5%, which led to a 12.2% increase in the total project budget. Labour costs increased by 10.7%, resulting in additional personnel costs of 2.8% of the original budget. The probability of budget overruns due to risks associated with economic instability is estimated at 45%. Among developers, changes in the cost of materials also had a significant impact, with fluctuations of 15.3%, which led to an increase in construction costs of up to 8.9%. Regulatory changes, which included new rules, put additional pressure on projects, with the probability of delays in completion estimated at 35%. Project managers were significantly impacted by rising labour costs, which led to an 11.1% increase in the overall budget. The economic volatility of the market has led to significant cost fluctuations, with an expected increase in project costs of 17.5%. The risks of budget overruns due to delays in the supply of materials are estimated at 42%.

In the Kyiv region, market volatility has led to projected fluctuations in material costs of up to 19.2%, with risks at 48%. Lviv region showed an increase in labour costs of up to 11.5%, which led to a 10% increase in total costs. In the Odesa region, the risk of budget overruns due to delays in the supply of materials decreased to 40%. Kharkiv region showed the risk of delays due to external factors at 43%, with a 12.1% increase in costs. Dnipro region remained in an unstable market with a significant increase in material costs to 15.4% and risks at 45%. Negative economic and regulatory factors have a significant impact on the increase in the cost of construction projects. The modelling results of the Flexible Adaptation with Development scenario indicate a positive impact of flexible management on the cost of a construction project in a context of moderate economic instability. The investor group saw a moderate increase in the cost of materials at 12.3%, which led to a 7.5% increase in the total project budget. Labour costs increased to 6.8%, resulting in additional personnel costs of 2.2% of the original budget. The probability of exceeding the budget due to risks associated with economic instability is estimated at 12%. Among developers, changes in the cost of materials also had a significant impact, with fluctuations of 11.5%, resulting in an increase in construction costs of 5.9%. Regulatory changes, which included new requirements, put moderate pressure on projects, with the probability of delays in completion estimated at 20%. Project managers were moderately impacted by rising labour costs, which resulted in a 6.4% increase in the overall budget. The economic volatility of the market has allowed for cost fluctuations to be forecast, with an expected increase in project costs of 13.5%. The risks of budget overruns due to delays in the supply of materials are estimated at 10%.

In the Kyiv region, market volatility has led to projected fluctuations in material costs of up to 12.8%, with risks at 15%. Lviv region showed an increase in labour costs of up to 7.2%, which led to a 5% increase in total costs. In the Odesa region, the risk of budget overruns due to delays in the supply of materials remained at 10%. Kharkiv region showed a risk of delays due to external factors at 18%, with a 6.4% increase in costs. Dnipro oblast remained in a stable market with a moderate increase in material costs to 10.5% and risks at 12%. The development principle of ‘flexible

management and adaptive approaches' has a positive impact on cost control and mitigation of budget overrun risks in the context of moderate economic instability.

3.3. Results of correlation analysis

A correlation analysis was conducted between four scenarios (Table 2) representing different approaches to construction project management. It was conducted based on data on the risks of exceeding the initial project budget.

Table 2: Correlation analysis data

Scenario	Scenario 1: Static development	Scenario 2: Optimized advancement with development	Scenario 3: Negative stress	Scenario 4: Flexible adaptation with development
1: Static development	1,000	0.421	-0.580	0.352
2: Optimized advancement with development	0.424	1,000	-0.622	0.725
3: Negative stress	-0.579	-0.619	1,000	-0.299
4: Flexible adaptation with development	0.352	0.720	-0.301	1,000

Source: compiled by the authors.

Scenario 1 and Scenario 2 have a positive correlation. This indicates that the integration of development principles can improve the results of static development. Scenario 3 has a negative correlation with all scenarios. This indicates that increased stress levels can reduce project performance. Scenario 4 has a strong positive correlation with Scenario 2, indicating that flexibility in adapting to development principles can further improve project outcomes. The results of the correlation analysis confirm the importance of implementing development principles and flexibility in the management of construction projects. The interrelationships between the scenarios indicate that improved profitability is achieved by reducing negative stress factors and actively implementing development.

4. DISCUSSION

The findings of the study demonstrate the importance of taking into account economic and regulatory aspects when managing construction projects. This study helped to identify the impact of agile management on reducing the risk of budget overruns and controlling costs, which allows for the development of effective strategies to adapt to a changing market. Knowing how various factors, such as fluctuations in material costs, stress levels, and the adaptability of management approaches, affect project outcomes allows managers to make more sustainable decisions. This contributes to improved management efficiency, which is critical to maintaining the competitiveness of construction companies.

Negative changes in the real estate market significantly reduce the feasibility of new construction projects. This fact is consistent with the study by S. Payan et al. (2023), which noted that economic instability and price fluctuations in the construction materials market significantly affect decisions about investing in new projects. The results of its research show that 73% of respondents from the real estate sector have postponed or revised their projects due to negative market dynamics. Both surveys show that changes in the economy and market risks are increasing uncertainty among key players in the construction market, forcing them to be more cautious in their decisions.

Most respondents indicated that changes in prices for construction materials had a significant impact on the implementation of construction projects. The results are in line

with a study by M. Liu and P. Liu (2024), which showed that the sharp rise in the cost of construction materials in recent years has led to a significant slowdown in the pace of construction projects, especially for large development companies. In his study, more than 70% of market participants pointed to the critical impact of rising prices on construction costs and timelines. Both studies highlight a common problem: a sharp rise in material prices, which significantly increases the overall construction budget and reduces its profitability. This is especially important for projects that are already in the active stage of implementation, as any changes in the cost of materials lead to delays and revisions to financial plans.

The new regulatory policy requires more time to obtain permits, which leads to delays in project implementation, contradicting the study by N.T.T. Dung and N.Q. Toan (2024), which showed that regulatory changes, on the contrary, simplified the permitting process and helped speed up construction processes. N.T.T. Dung and N.Q. Toan note that the digitalization of processes and the introduction of simplified procedures have reduced bureaucratic barriers and accelerated construction. In the same study, the opposite trend was observed: the new requirements made the initial stages of construction projects more complicated due to the increased time for paperwork. This difference may be due to regional differences or project specifics, where stricter regulations caused additional delays.

Most of the respondents said that they constantly use risk management at all stages of pre-investment. This fact does not coincide with the study by J. Szreder (2023), which showed that only about 39% of companies apply risk management at all stages of investment projects, and most organizations limit its use to the planning and completion stages. J. Szreder notes that most companies underestimate the importance of continuous risk monitoring during project implementation, which often leads to budget and time overruns. The difference in conclusions may be due to the fact that in this study, the respondents represented more systematic and mature companies with a high level of management processes, where risk management is integrated into all stages of the project. In contrast, the J. Szreder study focuses on smaller organizations and companies with weaker management control, where risk management is seen as an auxiliary tool.

Financial planning and cost management are key management decisions to ensure economic efficiency at the pre-investment stage, which coincides with the results of the study by J. Sobieraj and D. Metelski (2023). They found that budgeting and financial control processes are critical to minimize the risk of cost overruns and ensure optimal use of financial resources in construction projects. J. Sobieraj and D. Metelski emphasize that effective cash flow management allows companies to maintain liquidity and flexibility in the event of unforeseen costs or delays. Both studies confirm the importance of a systematic approach to financial management at the pre-investment stage, as effective financial planning not only helps to reduce costs but also provides flexibility in implementing projects in changing market conditions.

Changes in the cost of resources, such as labour and logistics, are one of the key factors that can lead to project investment budget overruns. This fact does not coincide with the study by J. Peng et al. (2023), which points out that delays in the execution of works due to adverse weather conditions are the most significant factor. J. Peng et al. highlight those delays associated with this factor can lead to significant costs, as extending the deadlines entails additional labour and resource costs. The study by J. Peng et al. focuses on long-term projects where external conditions (weather, economic situation) have a significant impact on implementation. Instead, this survey covers current market conditions, where rapid changes in resource prices may be more relevant.

Proper planning, including accurate budgeting, a clear schedule and risk assessment, is recognized as critical to avoiding budget overruns. This fact is in line with the study by T. Yuan et al. (2023), who also point out the importance of careful planning in construction projects. They emphasize that good planning is the basis for successful project implementation, as it allows predicting risks,

optimizing the use of resources and avoiding unforeseen costs. Both surveys demonstrate that construction professionals, regardless of their experience, understand the importance of a systematic approach to planning to ensure the cost-effectiveness of a project. This consistency suggests that a focus on planning should be at the heart of construction management practices, as it helps to establish a clear framework and criteria for measuring the success of construction projects.

The introduction of new technologies has significantly increased the efficiency of construction processes, reduced costs and improving the quality of projects. The results are in line with the study by E.K. Zadeh and A.B. Khoulenjani (2023), which found that the use of technologies such as automation, 3D printing, and artificial intelligence significantly increases the productivity of construction projects and helps reduce costs by optimizing processes and reducing the need for manual labour. E.K. Zadeh and A.B. Khoulenjani emphasize that the introduction of such technologies allows for efficient resource management and minimization of unforeseen costs, which is consistent with the findings of our study. Both studies demonstrate a common trend towards the use of innovation to achieve better financial and operational results, which confirms the importance of adapting the construction industry to technological change.

Integrating development principles into construction projects can significantly increase their profitability. These results are partially consistent with the study by S. Giahchy et al. (2023), who emphasize that the introduction of flexible project management methods such as Agile and Lean, combined with development-based strategic planning, helps to reduce budgetary risks and improve resource management efficiency through cost optimization and improved resource allocation. Both studies emphasize the importance of integrating adaptive approaches to mitigate risks associated with economic volatility and unpredictable factors, such as changes in market trends, currency fluctuations or irregularity in material supply. The results of this study and S. Giahchy et al. confirm the feasibility of implementing development principles in construction projects to achieve sustainability and competitiveness.

161 respondents believe that changes in the internal management structure of the company have had a positive impact on the implementation of construction projects, contributing to more efficient management and faster decision-making. This is not in line with the study by R.A. Abougamil et al. (2023), which argues that changes in the internal management structure can lead to temporary disorganization and delays in project delivery, especially during the onboarding phase of new employees. R.A. Abougamil et al. note that when implementing new structural changes, uncertainty, and confusion can arise among the team. This discrepancy can be explained by the fact that the respondents in this study worked in organizations that already had experience of adapting to change, which contributed to positive results. In contrast, the study by R.A. Abougamil et al. examined companies that are just beginning the transformation process, and therefore their employees may not yet be ready for change, which negatively affects project implementation.

During the discussions, it was confirmed that changes in management structures and the introduction of new technologies can have a significant impact on the efficiency of construction projects. It was noted that the integration of development principles and flexible management approaches can reduce the risks associated with economic instability and fluctuations in resources. This highlights the importance of carefully managing change and continuously monitoring its impact on projects to achieve sustainable results in the construction industry.

5. CONCLUSIONS

This study thoroughly evaluated the viability of executing building projects during the pre-investment phase, highlighting the incorporation of development principles into management practices. The results indicate that using these principles can substantially reduce the risks of budget overruns and improve the economic efficiency of construction projects. The examination of several management situations revealed that projects integrating

development principles exhibit greater resilience to external economic volatility. Among the assessed scenarios, adaptable management strategies shown the highest efficacy, especially in addressing escalating costs attributed to increases in material and labour prices.

The study highlights the significance of flexible adaptation in management, demonstrating that projects employing these strategies can get superior cost control even in adverse market situations. The "Optimised Advancement with Development" scenario also shown efficient resource management, hence mitigating the dangers of budget overruns. Conversely, the "Negative Stress" scenario, marked by heightened stress and inflexibility, resulted in substantial cost escalations and budget overruns, emphasising the essential importance of adaptive solutions in construction project management.

Furthermore, the correlation study substantiated the beneficial effect of development principles on project performance, demonstrating that adaptable and refined management tactics yield superior financial results. The study's findings highlight the necessity of accounting for both economic and regulatory elements in project management, particularly during the pre-investment phase, to guarantee sustainability and competitiveness within the construction sector. Future study may investigate the effects of environmental and social aspects on building projects, the significance of digital technologies, and international development practices to enhance comprehension of their impact on project feasibility and success.

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Appendix A

Respondent selection

No.	Questions/Answer options
1.	Gender: • Male • Female
2.	Profession: • Investor • Developer • Project Manager
3.	Region of residence: • Kyiv • Lviv • Odesa • Kharkiv • Dnipro
4.	Age category: • 31-40 years old • 41-50 years old • 51-60 years old
5.	Experience in the construction industry: • 5-10 years • 11-15 years • 16 - 20 years • Over 20 years
6.	Experience in pre- investment projects: • No experience • 1-3 years • Over 3 years
7.	Do you have managerial authority to make investment decisions? • Yes • No
8.	Over the past six months, what budget have you worked with in projects? • USD 5 million – USD 15 million • USD 16 million – USD 25 million • USD 26 million or more
9.	Do you agree to participate in the study, as well as to the processing and use of your data for scientific purposes? • Yes • No

Source: compiled by the authors.

Appendix B

The impact of various factors on the project budget

No.	Question	Answers
Block 1. Assessment of market changes		
1.	How have changes in the real estate market affected the feasibility of new construction projects?	○ Significantly reduced feasibility as demand for real estate fell sharply and construction costs increased significantly. ○ Reduced feasibility, but only partially, as some market segments remained stable, although costs still increased. ○ Did not affect feasibility, as the real estate market remains stable, despite some fluctuations. ○ Increased feasibility, as investments in some segments, such as commercial real estate or social housing, have increased in the market. ○ Significantly increased feasibility as market changes created new opportunities for construction projects and stimulated investment.
2.	How significant do you think the changes in prices for construction materials over the past year have been for the implementation of construction projects?	○ The price changes were critical and seriously affected all stages of construction projects, forcing budgets to be revised. ○ Prices have increased significantly, leading to adjustments to plans and postponement of some projects. ○ Price changes were moderate, and this caused only minor adjustments to project budgets. ○ Changes in prices did not have a significant impact on the implementation of construction projects. ○ Material prices have even decreased for some types of materials, which has contributed to more active project implementation.
3.	Have you seen any changes in demand for commercial and residential property in your region over the past year?	○ Demand for residential real estate has increased sharply, while demand for commercial real estate has decreased. ○ Demand for commercial real estate increased due to the development of the business sector, but demand for residential real estate remained stable. ○ Both real estate segments remain stable without significant fluctuations in demand. ○ Demand for both types of real estate has decreased significantly due to economic difficulties in the region. ○ Demand for both types of real estate has increased significantly due to new investment programs and government support.
4.	How has the change in regulatory policy (laws, regulations) affected the implementation of construction projects in your company?	○ The change in regulatory policy has significantly simplified construction processes, allowing for faster project implementation. ○ The new regulatory policy requires more time to obtain permits, which has led to delays in project implementation. ○ Requirements for project documentation have become stricter, which has complicated the initial stages of project implementation. ○ Regulatory changes did not have a significant impact on construction projects, as the company complied with all regulations in advance. ○ Changes in legislation have led to a review of all construction strategies, especially in matters of environmental standards.
5.	How have exchange rate fluctuations affected the financing of construction projects?	○ Sharp fluctuations in the exchange rate have seriously complicated project financing due to the increase in the cost of imported materials. ○ Currency fluctuations have forced more contracts to be concluded in local currency to reduce currency risks.

		○ Minor exchange rate fluctuations did not affect the financing process, as most expenses are incurred in local currency. ○ Exchange rate fluctuations created additional challenges in budget planning, but did not significantly affect overall financing. ○ Due to exchange rate fluctuations, lending conditions were revised, which led to a temporary freeze of some projects.
Block 2. Internal management decisions		
6.	What management decisions do you consider most important to ensure the economic efficiency of the project at the pre-investment stage? (Multiple options are available)	○ Review and adjust the financial plan taking into account changing market conditions and resource costs. ○ Optimization of cost management, in particular, the implementation of savings at all stages of construction without loss of quality. ○ Searching for new investment sources or partners to raise additional funds to complete the project. ○ Reviewing the terms of cooperation with contractors and suppliers to minimize costs and ensure stable supplies. ○ Applying new technologies and construction methods to increase the efficiency of project implementation.
7.	How often does your company use risk management when making decisions at the pre-investment stage?	○ Risk management is an integral part of the decision-making process at all stages of the project. ○ Often, risks are analyzed, but are not always decisive in making final decisions. ○ Periodically, risk management is used for important strategic decisions, but not for daily operations. ○ Rarely, risks are assessed only in the event of major changes or unforeseen circumstances. ○ We do not use risk management at this stage, decisions are made based on other factors.
8.	Do you review the financial strategies of projects after the initial stages of their implementation?	○ Yes, we regularly review financial strategies at each stage of project implementation to adapt to new conditions. ○ Yes, financial strategies are reviewed when there are significant changes in the market or the cost of resources. ○ We only review strategies if there are funding issues or budget overruns. ○ We rarely revise financial strategies, usually sticking to our original plans. ○ We do not revise financial strategies after they are approved at the initial stage of the project.
9.	How have changes in the company's internal management structure affected the implementation of construction projects?	○ The changes had a positive impact, contributing to more effective management, faster decision-making, and improved results. ○ The changes had a partial positive impact, particularly in some departments, but the overall impact was insignificant. ○ The changes did not have a significant impact on project implementation, internal processes remained stable. ○ The changes led to some delays due to the adaptation period of new employees or managers. ○ The mines negatively affected the project implementation process, causing disorganization and slowing down decision-making. ○ There were no changes.
10.	To what extent has the introduction of new technologies in construction contributed to the achievement of financial and management goals?	○ The introduction of new technologies has significantly increased the efficiency of construction processes, which has reduced costs and improved the quality of projects. ○ New technologies have helped achieve some financial goals, but require large investments at the initial stage. ○ The introduction of technology had a partial effect, contributing to increased productivity, but did not lead to a significant reduction in costs.

		○ Technologies did not have a significant impact on achieving financial or management goals due to their limited use. ○ The introduction of new technologies has led to increased costs and has not allowed the expected results to be achieved due to difficulties in adapting personnel.
Block 3. Factors influencing the exceeding of the planned project budget		
11.	What are the main factors that influence the project's investment budget overrun? (You can select multiple options)	○ Changes in the cost of materials and resources leading to unforeseen additional construction costs. ○ Delays in work performance due to adverse weather conditions or other external factors. ○ Unforeseen technical problems during the project implementation stage, requiring additional costs to resolve them. ○ Insufficient planning and inaccurate preliminary cost estimates in the initial stages of the project. ○ Changes in customer requirements or design documents that require additional funding for implementation. ○ Other.
12.	How important is the role of proper planning at the initial stage in avoiding budget overruns?	○ Critically important, as good planning reduces the likelihood of unforeseen costs and delays. ○ Very important, but cannot completely eliminate all factors that may affect budget overruns. ○ Important, but more dependent on external factors, such as market changes or unforeseen circumstances. ○ Partly important because some problems can arise regardless of the initial planning. ○ It is not crucial, as budget overruns are mainly influenced by external factors.
13.	How often are budget overruns in your projects caused by changes in the cost of materials and labor?	○ Very often, especially in an unstable economic situation, this leads to regular price increases. ○ Often, but we try to anticipate such changes and include them in the initial budget. ○ Sometimes, mostly this happens during long-term projects, when the cost of resources increases gradually. ○ Rarely, we usually work with reliable suppliers who guarantee stable prices. ○ Never, because the budget is formed taking into account potential market fluctuations.
14.	What measures do you take to minimize investment budget overruns? (You can select multiple options)	○ Regular monitoring of expenses and timely adjustment of financial plans to reduce the impact of unforeseen expenses. ○ Negotiating with contractors to fix prices for materials and work at the stage of signing contracts. ○ Creating a reserve budget to cover possible cost overruns in the event of unforeseen circumstances. ○ Using detailed pre-planning and cost estimates to minimize the risks of budget overruns. ○ Investing in new technologies and construction management methods that reduce costs and increase efficiency.
15.	How do changes in the economic situation affect budget overruns in construction projects?	○ Significantly affected, as the increase in the cost of materials and work directly leads to budget overruns. ○ They have a partial impact, especially in the case of a sharp increase in prices for basic construction resources. ○ The impact of changes in the economy is noticeable, but it can be partially reduced through reserves or strategy adjustments. ○ Changes in the economic situation do not have a critical impact if anticipating possible risks in advance and adapt the budget. ○ They have practically no impact, since the main budget is formed taking into account potential changes in the economy.

Source: compiled by the authors.

Appendix C

Economic modelling scenarios

Criterion	Scenario 1: Static development	Scenario 2: Optimized advancement with development	Scenario 3: Negative stress	Scenario 4: Flexible adaptation with development
Description	Stable market with no significant changes. Material and labor costs are almost unchanged. Regulatory changes are minimal	Using development principles to optimize the construction process. Active resource management reduces costs	Negative developments, rising material and labor costs due to external factors. Regulatory changes create additional pressure	Moderate economic instability with active use of development approaches. The project adapts to changes while maintaining control over the budget
Change in the cost of materials	up to 2-5%	up to 7 -10%, but thanks to optimization, costs are reduced	up to 15-20%	10-15%, but measures to reduce costs through rational procurement planning
Labor costs	growth up to 3%	growth of up to 5%, but thanks to the use of effective management methods, costs are kept under control	growth up to 12%	growth of up to 7%, but methods of increasing labor efficiency are used
Regulatory changes	minimal	minimal impact through pre-planning and project adaptation	new rules or laws requiring project adaptation	new requirements, but the project is adapted due to prior preparation
Economic stability	moderate stability, without major fluctuations in the market	moderate changes are expected, but the risks of budget overruns are reduced through planning	significant market fluctuations affecting material supplies and costs	the project remains resilient to fluctuations thanks to flexible resource management
Risks	10-15%	the probability of exceeding the budget is reduced to 10-12%	40-50%	up to 15%
Target	Demonstration of the project's functioning under conditions of stable development and controlled costs	Demonstration of reducing the negative impact of economic factors on the cost of the project and minimizing risks	Determining the impact of negative economic and regulatory factors on the project cost and budget adjustments	Showing how flexible management and development approaches help achieve a balance between costs and changes in the market

Source: compiled by the authors.