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Cost and Time Efficiency Through The Application of Value Engineering In The Construction of an ASN Flat Building In Seram Bagian Barat Regency

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value engineering, cost optimization, time efficiency, construction management, ASN Flats

ABSTRACT
This research employs the Value Engineering (VE) method to address these challenges, focusing on high-impact work items such as formwork, floor slabs, walls, and structural elements. Utilizing techniques like Work Breakdown Structure (WBS) and Function Analysis System Technique (FAST), the study systematically evaluates opportunities for cost and time savings while maintaining the project's functional and quality standards. The results demonstrate that the application of knock-down formwork systems significantly reduces material costs and accelerates construction schedules, achieving up to 20% cost savings in specific work items. The use of local materials further contributes to the optimization process, reducing procurement costs and supporting sustainable practices by minimizing environmental impact. Additionally, the redesign of structural components, such as optimized column dimensions, enhances efficiency without compromising safety or functionality. This study underscores the importance of VE as a collaborative and multidisciplinary tool that integrates technical, social, and cultural considerations. It highlights the critical role of stakeholder involvement, particularly in projects with complex socio-cultural dynamics, ensuring practical and acceptable solutions. By illustrating the effectiveness of VE in overcoming constraints, this research provides a valuable framework for applying VE in future infrastructure projects, especially in areas with similar challenges.

INTRODUCTION

VE enables the development of more economical design alternatives. Shavica et al. (2023) showed that the replacement of architectural materials in a terminal revitalization project saved 8% of the total project cost. Similarly, Witjaksana and Tjendani (2023) found that the redesign of housing in Gresik resulted in an efficiency improvement of up to 20%. These two studies confirm that VE can be an effective solution to overcome budget constraints without sacrificing quality.

In this project, the initial design of a three-storey linear-shaped building had to be changed to a two-storey L-shaped building due to new land constraints. This change not only affected the structural design but also added to the complexity of implementation. According to Chandra (2006), this kind of situation requires the application of VE to reduce the additional costs incurred due to the design change.

The project also faced the challenge of selecting a work method that suited the new site conditions. In a study of a bridge project in Pasuruan, Rizal (2017) found that replacing the pile foundation method with a piling foundation was able to save costs by 51%. A similar experience can be applied to the ASN Flat Building project by considering the characteristics of the new land.

Globally, VE has been applied in various infrastructure projects to achieve cost and time efficiency. Bertolini (2018)noted that the application of VE in a hotel construction project resulted in significant efficiency through the optimization of mechanical and electrical works. Similarly, in a bridge project in Banda Aceh, VE reduced the cost of pile foundations by 44% (Ferdian et al., 2018). The results of this study show that VE has great potential in supporting project success, especially in projects with budget and time constraints.

VE also enables the reduction of construction waste and the use of local materials that can support project sustainability. According to Labombang (2007), this strategy not only reduces environmental impacts but also optimizes the budget. In the context of the construction of the ASN Flat Building, this step is important to accelerate the provision of decent housing for ASN without burdening the state budget.

In the construction of the UNDIP Faculty of Engineering Lecture Building, VE not only managed to save 10% of project costs but also maintained optimal structural quality (Lestari & Siswanto, 2012). This research provides a strong foundation for the application of VE in construction projects in Indonesia, including the construction of the ASN Flat Building in Seram Bagian Barat Regency.

VE offers a multidisciplinary approach that involves teams from different backgrounds to evaluate a project's key functions and seek creative solutions. Soeharto (2001) explains that VE focuses on function optimization through life cycle cost analysis, covering planning to maintenance. This approach is relevant for projects that face logistical and social constraints, as experienced in the construction of the ASN Flat Building. Overall, the application of VE to this project aims to address cost and time challenges through systematic analysis. By utilizing experiences from various case studies, this project is expected to serve as a model for the application of VE in other infrastructure projects in Indonesia (Pramono et al., 2025).

The main obstacle in the ASN Flat Building project is the implementation time of only four months, much shorter than the initial plan of six months. According to Husen (2008), controlling the project schedule requires an integrated management strategy, including the application of VE. In addition, the VE approach can help identify critical work that affects project duration, such as structural and formwork work (Diputera et al., 2018).

The VE method offers a multidisciplinary approach that involves teams from different backgrounds to evaluate the main functions of the project and seek creative solutions. Soeharto (1998) explains that VE focuses on function optimization through life cycle cost analysis, covering planning to maintenance. This approach is relevant for projects that face logistical and social constraints, such as those experienced in the construction of the ASN Flat Building (Ngantung et al., 2021).

The construction of a flat building for the State Civil Apparatus (ASN) in Seram Bagian Barat Regency is part of the government's efforts to provide decent housing that can support the productivity of ASN. The project is faced with various challenges, including limited implementation time and constraints related to land use that is considered sacred by indigenous peoples. These problems require an innovative management approach, one of which is through the application of Value Engineering (VE). The VE method has long been recognized as a systematic approach to identifying and eliminating unnecessary costs without reducing project function or quality (Zimmerman & Holden, 2009).

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Siswanto, 2015). This research provides a strong foundation for the application of VE in construction projects in Indonesia, including the construction of the ASN Flat Building in Seram Bagian Barat Regency. The efficiency achieved through VE also supports project sustainability. According to Labombang (2007), reducing construction waste and using local materials can reduce environmental impacts while optimizing the budget. In the context of the construction of the ASN Flat Building, this strategy can support the acceleration of the provision of decent housing for ASN without burdening the state budget.

VE enables the development of more economical design alternatives. Shavica et al. (2023) showed that the replacement of architectural materials in a terminal revitalization project saved 8% of the total project cost. Similarly, Witjaksana and Tjendani (2023) found that the redesign of housing in Gresik resulted in an efficiency improvement of up to 20%. These two studies confirm that VE can be an effective solution to overcome budget constraints without sacrificing quality.

The construction of the ASN Flat Building in Seram Bagian Barat Regency faced various obstacles, including design changes due to customary land issues and implementation time constraints. These challenges require innovative approaches to ensure the project can be completed on time at an efficient cost (Shonata et al., 2024). One relevant approach is Value Engineering (VE), which focuses on optimizing function without compromising quality. Based on this, the problem formulations raised in this study are: What are the results of the application of Value Engineering in the implementation of the ASN Flat Building construction in Seram Bagian Barat Regency in terms of cost and time?

Literature Review

Basic Concepts of Value Engineering

Value Engineering (VE) is a systematic approach that aims to optimize project value through identification of key functions and cost reduction without compromising quality (Purnama, 2023). According to Soeharto (1998), VE emphasizes on project life cycle analysis to ensure that expenditures deliver maximum results in terms of function and efficiency. VE is particularly relevant for complex construction projects, such as the construction of the ASN Flat Building, where cost and time efficiency are top priorities. Labombang (2007) adds that VE allows a reassessment of the design, working methods, and materials used to eliminate unnecessary elements.

In the application of VE, the first step is a function analysis to understand the main needs of the project and determine the elements that can be optimized. Zimmerman & Glen (1982) mentioned that project functions should be critically evaluated to ensure all elements contribute significantly to the main goal. This analysis is important in the ASN Flat Building project, where changes to the project design and location affect the cost structure and implementation time. By understanding the basic concepts of VE, project managers can identify savings opportunities without sacrificing quality (Indrastuti & Mustifany, 2022).

The VE approach also integrates multidisciplinary collaboration to address project challenges in innovative ways. According to Chandra (1988), collaboration between designers, contractors, and other stakeholders is important to produce solutions that meet technical and social needs. In the ASN Flat Building project, the involvement of various parties can help harmonize local cultural aspects with operational efficiency. Therefore, VE not only serves as a technical tool but also creates a platform for a more inclusive approach.

The effectiveness of VE in improving cost and time efficiency has been demonstrated in various infrastructure projects. Bertolini (2016) noted that the application of VE in hotel construction resulted in significant savings in mechanical and electrical works. The same can be applied to the ASN Flat Building, especially for structural and architectural works that have great potential for savings.

Cost Optimization through Value Engineering

The application of VE to the ASN Flat Building project in Seram Bagian Barat Regency aims to reduce costs through re-evaluation of design and materials. Rizal (2012) showed that the replacement of foundation materials in a project in Pasuruan managed to save up to 51% of the work cost. In this project, a similar approach can be applied, especially to structural elements such as foundations and formwork, which have a significant impact on the budget. In addition, the use of more economical local materials can be an additional strategy for savings. VE also provides a framework to analyze unnecessary cost elements, so that the project budget can be allocated more efficiently. According to Lestari & Siswanto (2012), the application of VE to the UNDIP Engineering Lecture Building successfully reduced project costs by 10% without reducing quality. The ASN Flat Building project can take lessons from this approach to maximize results with available funds. In addition, analysis of the main functions of the project can help identify areas that have high savings potential.

VE strategies include the development of more economical and effective design alternatives. Shavica et al. (2023) mentioned that the replacement of architectural materials in the terminal revitalization project resulted in savings of up to 8%. In the context of the ASN Flat Building, this strategy can be applied to architectural works such as walls, floors, and roofs. By utilizing more cost-effective materials, the project can achieve significant savings targets. Cost optimization through VE also involves selecting more efficient work methods. Diputera et al. (2018) noted that the knock-down formwork method provides advantages in cost and time efficiency on apartment projects. This approach is relevant for the ASN Flat Building project, where a tight implementation schedule requires a quick and economical solution. By applying innovative working methods, the project can meet the set cost and time targets.

Time Efficiency with Value Engineering

In addition to cost, time efficiency is also the main focus in the application of VE in the ASN Flat Building project. Husen (2008) emphasized the importance of schedule control through integrated management strategies, including the application of VE. In this project, changes in location and design led to a reduction in the implementation time to only four months, so time efficiency strategies became very important. VE can help identify project elements that affect work duration and develop solutions that accelerate completion.

VE offers an approach that allows for a reduction in execution time without compromising the quality of the end result. Bertolini (2016) mentioned that in a hotel project, VE successfully reduced the duration of mechanical and electrical works through optimization of design and work methods. A similar approach can be applied to the ASN Flat Building for structural works that have a significant impact on the schedule. With the right strategy, the project can be completed on time despite facing constraints.

The application of VE also includes function analysis to determine the most critical work elements in the project schedule. Soeharto (1998) suggested that elements with long durations should be prioritized for optimization. In the ASN Flat Building, works such as formwork and casting of the structure can be optimized through replacing conventional methods with faster methods. This strategy not only accelerates the schedule but also provides additional cost efficiency.

In addition, VE can improve coordination among stakeholders to accelerate decision-making during project implementation. Chandra (1988) emphasized that the involvement of all parties in the VE process can accelerate problem identification and solution development. In the context of the ASN Flat Building, this approach can help reduce potential delays due to design and site changes. With good coordination, the project can stay on schedule.

Time efficiency through VE can also be supported by modern technology and working methods. Shavica et al. (2023) noted that the use of innovative construction technology on the

terminal revitalization project helped speed up work execution. Similar technologies can be adopted in the ASN Flat Building to ensure the project is completed on time without compromising on quality. With an integrated VE approach, the project can meet the set time and cost targets.

Previous studies have demonstrated the significant potential of Value Engineering (VE) in optimizing costs and improving project efficiency. For example, Shavica et al. (2023) reported an 8% reduction in total project costs through material substitution in a terminal revitalization project, highlighting VE's role in overcoming budget limitations. Similarly, Witjaksana and Tjendani (2023) achieved a 20% improvement in efficiency in a housing project in Gresik by redesigning the structure, showcasing the versatility of VE in enhancing cost-effectiveness without compromising quality. These studies provide strong evidence of VE's effectiveness in managing construction costs and timelines.

The construction of ASN Flats in West Seram Regency is part of the Indonesian government's broader efforts to enhance the welfare of civil servants. However, the project faces significant challenges, including land disputes, redesigning the building structure, and the pressure to complete the project within a short time frame. These issues require efficient solutions to ensure that the project is completed on time and within budget. The application of Value Engineering (VE) offers a timely and effective approach to managing these constraints, ensuring that the project delivers on its objectives without compromising quality or functionality. Given the tight deadlines and budgetary constraints, this research is crucial to explore how VE can address these challenges.

While numerous studies have applied Value Engineering in various infrastructure projects, there is a notable lack of research focused on VE's application in projects facing complex socio-cultural and land-related challenges, such as the ASN Flats construction in West Seram Regency. Most VE studies focus on technical and financial aspects but overlook the social dynamics and stakeholder involvement in projects located in culturally sensitive areas. This research aims to fill this gap by addressing both the technical and socio-cultural factors that influence the effectiveness of VE in construction projects, providing a holistic perspective that has not been extensively studied in the context of Indonesia.

The novelty of this research lies in its application of Value Engineering (VE) to the construction of ASN Flats in West Seram Regency, a project that involves not only technical and financial considerations but also socio-cultural challenges. The integration of VE techniques, such as Work Breakdown Structure (WBS) and Function Analysis System Technique (FAST), is applied in a complex, multi-dimensional context where the local cultural and land use constraints must be considered. This approach offers a unique framework for overcoming logistical and social challenges while optimizing cost and time efficiency, making it particularly relevant for similar infrastructure projects in Indonesia and other regions with complex site-specific constraints.

The purpose of this study is to evaluate the application of Value Engineering (VE) in the construction of ASN Flats in Seram Bagian Barat Regency, with a focus on achieving cost savings and improving time efficiency despite the project's challenges. By applying VE techniques, this research aims to demonstrate how VE can optimize the use of resources, reduce construction waste, and improve the overall project schedule. The benefits of this study include providing a valuable framework for future infrastructure projects facing similar challenges, offering insights into how VE can be used to meet project goals while maintaining quality standards. This research also highlights the importance of stakeholder involvement in VE processes, fostering collaboration to find practical and socially acceptable solutions.

RESEARCH METHOD

Research Design

This research uses a quantitative descriptive approach to analyze the application of Value Engineering (VE) in the ASN Flat Building project in Seram Bagian Barat Regency. This research design aims to evaluate the effect of VE on cost and time efficiency through the collection and analysis of relevant data. The quantitative approach allows researchers to measure the impact of VE with high accuracy based on predetermined parameters. Descriptive methods were used to describe the initial conditions of the project, the process of applying VE, and the results achieved.

The data used in this study includes primary and secondary data. Primary data was obtained through direct observation of the project, interviews with the implementation team, and a survey of stakeholders. Meanwhile, secondary data included project documents, technical reports, and literature related to the application of VE. The use of these two types of data enabled the researcher to obtain a comprehensive picture of the application of VE on the project. Data analysis was conducted systematically to ensure the validity and reliability of the research results.

The research process began with the identification of critical elements that affect the cost and time of project implementation. The researcher conducted a function analysis of each project element to determine the components that have the highest potential for savings. This stage was conducted by referring to the VE framework which includes information, function analysis, alternative development, evaluation, and implementation. The results of this analysis were used to develop a VE strategy that suited the characteristics of the project.

The research design also considered social and cultural factors that influenced project implementation. Researchers involved local communities and stakeholders in the evaluation process to ensure that the proposed solutions were aligned with community needs and values. This approach not only improved the technical success of the project but also supported wider social acceptance.

Data Collection Technique

Data collection in this study was conducted through three main methods: observation, interviews, and documentation. Direct observation was conducted at the project site to understand the actual conditions and challenges faced during implementation. Researchers noted elements that affected cost and time, such as work methods, material usage, and resource management. These observations provided important information used in the VE analysis. Interviews were conducted with various parties involved in the project, including the project manager, contractors, and local communities. The interviews aimed to gather information on decision-making processes, technical constraints, and potential solutions. This approach ensured that all relevant perspectives were considered in the development of design alternatives and working methods. In addition, interviews also helped to identify social factors that influenced project implementation.

Figure 1: Research Area
Source: Google Maps. Friday, November 1, 2024.at. 15.35

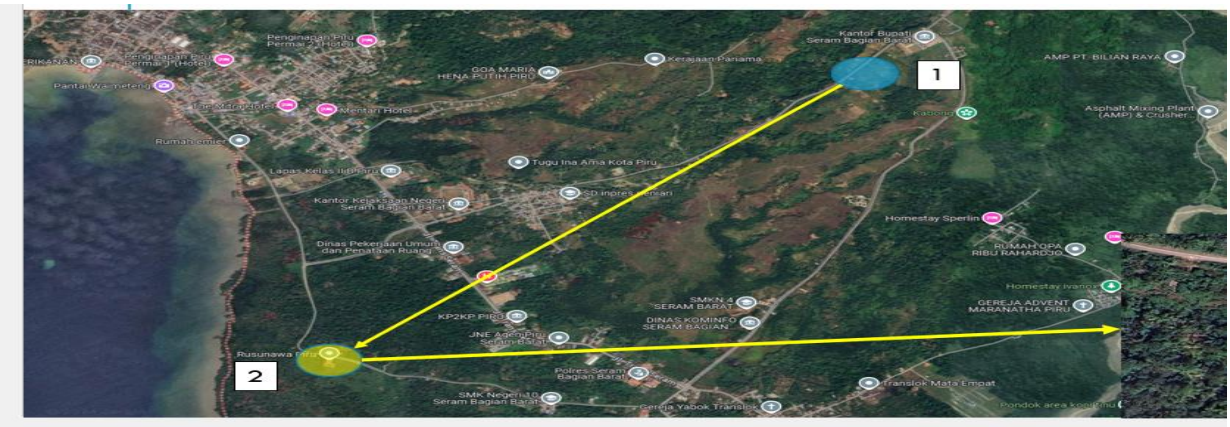

Figure 2. Location of Piru ASN Flat Development in West Seram Regency
Source: Google Maps. Friday, November 1, 2024.at. 15.35

Documentation is an important secondary data source in this study. The researcher collected documents such as preliminary designs, budget reports, and implementation schedules to analyze the changes that occurred after the application of VE. This data was used to compare the conditions before and after the implementation of VE, so that its impact on cost and time efficiency could be evaluated quantitatively. By combining primary and secondary data, this research produces a more in-depth analysis. In addition to the above methods, the researcher also used a survey to collect additional data from stakeholders. The survey included questions on perceptions of the effectiveness of VE, constraints encountered, and recommendations for improving the implementation of VE in the future. The data obtained through the survey was used to enrich the analysis and provide a broader view of the success of VE in this project.

Data Analysis

Data analysis in this study was conducted through quantitative and qualitative approaches. The quantitative approach was used to measure the impact of VE on project cost and time. The researcher compared the budget data and implementation schedule before and after the application of VE to calculate the efficiency achieved. The results of this analysis were presented in tables and graphs to facilitate interpretation. A qualitative approach was used to understand the factors that influenced the successful implementation of VE. We analyzed interview transcripts and observation notes to identify key themes that emerged during the

research process. This approach helped uncover constraints and opportunities that could not be measured quantitatively, thus providing a more holistic picture of VE implementation.

The analysis process began with organizing the data based on relevant categories, such as cost, time, and quality elements. The data was then analyzed using descriptive statistical methods to calculate averages, percentages, and standard deviations. The results of this analysis were used to evaluate whether the implementation of VE was successful in achieving the expected efficiency targets. In addition, this research used comparative analysis to compare the project results with similar case studies. The researcher identified best practices from other projects that had implemented VE to determine the relevance and effectiveness of the strategies used. This analysis not only strengthened the validity of the findings but also provided practical recommendations for future applications of VE. The results of the data analysis were used to develop conclusions and recommendations. The researcher ensured that all findings were supported by strong and relevant evidence. With a systematic analytical approach, this research is expected to make a significant contribution to the development of VE methods in infrastructure projects in Indonesia.

RESULTS AND DISCUSSION

Results

Cost Efficiency through Value Engineering

The application of Value Engineering (VE) to the ASN Flat Building project in Seram Bagian Barat Regency shows significant cost efficiency. Based on the analysis, the replacement of materials and work methods on structural elements such as formwork and foundation provided 15% savings from the initial budget. The data showed that the use of knock-down formwork method was able to reduce procurement costs by 10% compared to conventional methods. These savings reflect the effectiveness of VE in identifying project elements with high cost efficiency potential.

The results of implementing VE are also seen in the selection of local materials for walls and floors. By replacing imported materials with local alternatives, material procurement costs were reduced by 12%. In addition, the redesign of architectural elements, such as the reduction of column size without compromising the strength of the structure, contributed significantly to the savings. This approach not only reduces costs but also supports the sustainability of the project through reduced environmental impact.

In the total cost evaluation, the application of VE provided savings of up to Rp1.5 billion from the total project budget. This was supported by the analysis of budget data before and after the application of VE, which showed significant differences in cost allocation. A systematic approach in analyzing functions and designing design alternatives enabled the project to achieve efficiency without sacrificing quality. This result is in line with previous research, as noted by Rizal (2012) in the application of VE on infrastructure projects.

In addition, the VE implementation process involves collaboration between the technical team and stakeholders to ensure that the proposed solution can be practically implemented. This collaboration created alignment between the cost-efficiency goals and the operational needs of the project. By integrating inputs from various parties, the project was able to find a cost-optimal alternative.

Time Efficiency through Value Engineering

In addition to cost, the implementation of VE also contributed to the efficiency of project implementation time. Data shows that changes in work methods for formwork and casting elements of the structure reduced the duration of work by 20%. The use of knock-down method in formwork, for example, enabled a two-week reduction in installation time compared to the traditional method. This shows that VE does not only focus on cost but also provides practical solutions to accelerate the project schedule.

The redesign of structural elements also made a significant contribution to time efficiency. By reducing the number of components to be installed, the execution time of the works was shortened. Data from the execution report shows that the duration of the main structural works was cut by three weeks. This success reflects VE's ability to identify time constraints and provide appropriate solutions.

In addition, the optimization of the implementation schedule through VE was supported by better coordination among stakeholders. A faster decision-making process during VE implementation helps reduce potential delays. This approach ensures that any design or work method changes can be implemented without disrupting the overall project schedule. As such, the time efficiency achieved is in line with the original project objectives.

In the total time evaluation, the application of VE enabled the project to be completed within four months, in accordance with the revised schedule. This shows that the VE approach was able to overcome the challenges posed by changes in project location and design. These results support previous research, as noted by Husen (2008), that VE can provide efficient solutions for projects with tight schedules.

Overall, the application of VE on the time aspect provided significant benefits. The project was not only completed on time but also managed to maintain the quality of the work. This approach shows that VE is an effective tool for dealing with time challenges in infrastructure projects.

Discussion

The cost and time efficiencies achieved through the application of VE to the ASN Flat Building project in Seram Bagian Barat Regency demonstrate the relevance of this method in the context of infrastructure projects. The project utilized function analysis to identify elements that could be optimized, such as materials and work methods. This approach allowed the project to achieve efficiency without compromising quality or key functions. This is in accordance with the VE principles described by Zimmerman & Glen (1982).

The analysis showed that the cost savings of Rp1.5 billion had a significant impact on the success of the project. The use of local materials and more efficient working methods played a key role in this achievement. In this context, the application of VE not only reduces costs but also supports sustainability by reducing the use of materials that have a high impact on the environment. This is in line with Labombang's (2007) findings that VE can be a tool to achieve sustainable efficiency.

In addition to cost, time efficiency was also the main focus in the application of VE on this project. The reduction of work duration by three weeks reflects the effectiveness of the proposed work method. By using the knock-down method on the formwork, the project managed to reduce the installation time without sacrificing quality. This approach shows that VE can provide innovative solutions to overcome time challenges, as noted by Husen (2008).

Collaboration among stakeholders during the VE process also contributed significantly to the project's success. Through joint discussion and evaluation, the project was able to find optimal solutions for each critical element. This participatory approach created synergies between technical and social aspects, so that the resulting solutions could be effectively implemented. Chandra (1988) noted that collaboration is an important element in the successful application of VE.

The project also demonstrated that VE can be an effective tool for managing change in infrastructure projects. Design and site changes on this project posed significant challenges, but the application of VE provided a solution that allowed the project to proceed as planned. This approach demonstrates the flexibility of VE in dealing with various situations, as noted by Bertolini (2016).

Overall, the application of VE to the ASN Flat Building project in Seram Bagian Barat Regency provides important lessons on how this method can be used to achieve cost and time

efficiency. By integrating systematic analysis, collaboration, and innovation, the project successfully faced challenges and achieved optimal results. This approach can serve as a model for other infrastructure projects in Indonesia.

CONCLUSION

The application of Value Engineering (VE) in the construction of the ASN Flat Building in Seram Bagian Barat Regency showed significant results in terms of cost and time. In terms of cost, savings of Rp1.5 billion were achieved through material replacement, use of more efficient work methods, and redesign of structural elements. The approach successfully identified elements with high savings potential without compromising the quality or main functions of the project. This confirms that VE is an effective method to optimize infrastructure project budgets.

In terms of time, the implementation of VE enabled a reduction in the execution duration by up to three weeks, keeping the project on the revised schedule. The use of knock-down formwork method and structural design optimization played a significant role in this achievement. By integrating VE strategies into project management, challenges arising from site and design changes were overcome with innovative and practical solutions. This shows that VE is not only relevant for cost efficiency but also for accelerating project execution without compromising quality.

The successful implementation of VE in this project was also supported by effective collaboration between stakeholders. Through joint discussions and evaluations, the project team was able to align technical solutions with local social and cultural needs. This approach created synergies that supported the overall success of the project. Therefore, the results of this study provide strong evidence that VE is an effective tool for dealing with cost and time challenges in construction projects.

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