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Evaluation of Value Engineering Potential in Work Methods and Design of the Primary Canal in the Post-Disaster Gumbasa Irrigation Project

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Abstract.
Post-disaster infrastructure reconstruction presents unique challenges, requiring adaptive construction methodologies to address altered geological conditions and optimize resource utilization. The reconstruction work of the Gumbasa irrigation system after the earthquake, tsunami, and liquefaction disasters experienced obstacles in the implementation of the primary channel due to sandy soil conditions that are prone to landslides. The initial design, using precast shoes, was delayed and over budget due to difficulties during field installation. This study applies the value engineering method to evaluate the potential for cost savings and functional improvements through the analysis of work methods and primary channel design. Quantitative and qualitative approaches are used, with stages including information gathering, function analysis, creative ideation, evaluation, and recommendations. The results showed that the cast-in-situ method was superior, achieving a total cost efficiency of IDR 1,062,223,159, or 1.4% of the initial budget. In the lining shoe item, the savings reached IDR 3,397,623,506, or 29.7% of the initial work value. The project duration decreased from 456 days to 240 days, with a time saving of 216 days, or 47.4%. Evaluation of Value Engineering Potential in Work Methods and Design of the Primary Canal in the Post-Disaster Gumbasa Irrigation Project has proven to be effective in assessing post-disaster infrastructure implementation by providing added value in terms of cost, quality, and time.
Keywords: cast-in-situ; cost savings; irrigation; post-disaster; precast; value engineering.

INTRODUCTION

Infrastructure projects around the world face complex challenges of implementation delays and significant cost overruns (Mahmud et al., 2021). According to Mbugua (2000), an average of 70% of construction projects are delayed, with cost overruns reaching 20–50% of the initial budget. This phenomenon becomes more complex in post-disaster reconstruction projects, where unstable existing conditions require the adaptation of appropriate implementation methods (Naik et al., 2015). This problem is exacerbated by the failure to anticipate changing field conditions due to the impact of natural disasters, so that the initial design often does not match the realities of implementation in the field (Xiao & Proverbs, 2003).

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Delays in construction projects are generally caused by factors such as design mismatches with field conditions, low labor productivity, and technical problems during implementation. According to a study by Tariq (2023), design mismatches with field conditions are significant issues that frequently cause schedule delays in construction projects. Furthermore, low labor productivity can negatively affect the overall performance of the project (Shehata, 2011). Technical problems during implementation also remain a major challenge to completing construction projects on time (Ahmed, 2022). In the context of infrastructure projects, failure to adapt construction methods to post-disaster changing geological conditions is one of the main causes of project inefficiency. For example, Cerè (2017) found that infrastructure failure can lead to cascading damage due to disaster risks, which impact building standards and infrastructure resilience. Additionally, research by Ershadi (2021) identified challenges in construction project procurement management, such as delays in material deliveries and unsustainable equipment use, which can further hinder project efficiency. This condition leads to resource wastage and has the potential to interfere with achieving sustainable infrastructure development targets.

The complexity of modern construction problems demands a more systematic approach in optimizing design and implementation methods. Soetanto et al. (2002) emphasized that the evaluation of contractor performance and the effectiveness of construction methods is crucial in ensuring the success of the project. This is especially true for infrastructure projects with special characteristics, such as unstable soil conditions or locations affected by natural disasters.

On September 28, 2018, an earthquake with a magnitude of 7.3 on the Richter Scale struck Central Sulawesi Province, resulting in massive infrastructure damage in Palu City, Sigi Regency, and Donggala. One of the infrastructures that suffered heavy damage was the Gumbasa irrigation network, which irrigates 8,103 hectares of rice fields. This irrigation system suffered complete damage due to liquefaction that cut off the 350-meter-long primary channel, causing disruption of irrigation water distribution throughout the service area.

The geological condition of Palu City, which is dominated by lowlands and valleys formed from alluvial deposits and rivers, is the main factor in liquefaction. The upper soil layer (1–7 meters) is dominated by relatively young and poorly consolidated sand, making it particularly susceptible to liquefaction in the event of an earthquake. The existing condition of the D.I. Gumbasa channel, which is an irrigation system with open excavations without reinforcement structures, exacerbates the damage caused by high groundwater absorption and continuous soil erosion.

To restore the damaged irrigation network, the government carried out a reconstruction project by upgrading the structure that was originally only an open excavation into a concrete channel with precast shoe lining and a channel bottom using sand and geomembrane to make it waterproof. However, the implementation of the initial design faced significant obstacles due to sandy and landslide-prone soil conditions along the 9,900-meter primary channel. This caused the implementation process to be hampered and experience delays because of frequent landslides on the slopes that had been worked on.

The technical problems faced included difficulties in installing precast shoes due to soil falling toward the shoe and the primary channel slab, causing non-uniform slope changes and geomembrane damage. This condition resulted in the need for repeated repair work, both manually and using excavator tools, to ensure the placement of precast concrete and the slope of the channel as planned. Additionally, the placement of upright sand beneath a rigid geomembrane (0.75 mm thick) causes frequent shrinkage and avalanches, impacting the difficulty of the precast shoe installation process and elevation setting.

Repeated slope and channel slab repair work resulted in delays, especially in the items of precast shoe installation, precast lining installation, K-175 cast-in-situ concrete work of primary channel slabs, and K-225 cast-in-situ concrete capping. The deviation in production productivity between the plan and the actual realization of each work item reached a significant level during the 8 months of implementation from May 2022 to December 2022.

Data shows that the daily productivity of primary channel works, particularly concrete structure works, is very low and below the planned productivity. The delayed primary channel precast shoe work impacted subsequent tasks, including precast lining, primary channel cast-in-situ K-175 concrete work, and primary channel capping work. Overall, primary channel work experienced delays almost every month compared to the plan.

The urgency of this research increases considering the impact of delays not only on cost and time aspects but also on the strategic function of irrigation infrastructure in supporting regional food security. Failure to complete projects on time will delay the restoration of agricultural productivity in disaster-affected areas, ultimately affecting the welfare of farming communities and regional food stability.

The development of value engineering methods in construction projects has been the focus of extensive research over recent decades. Kelly (2007) emphasized the importance of making client value explicit in value management workshops to increase the effectiveness of the decision-making process. This research shows that a systematic approach to identification and evaluation of values can produce more optimal solutions than conventional approaches.

Colacchia (1995) developed an estimation methodology for value engineering that emphasizes the importance of cost analysis as an essential factor in determining the feasibility of VE implementation. This study shows that accurate cost estimation is one of the main factors determining success or failure in value engineering implementation in construction projects.

In the context of infrastructure projects, Shahhosseini et al. (2018) conducted a case study on the application of value engineering in the water transmission system of the Ilam gas refinery project in Iran. This study successfully identified cost savings of 12% through design optimization and implementation methods. The results show that value engineering can be effectively applied to infrastructure projects with complex technical characteristics.

Danku & Antwi's (2020) research evaluated the perceived benefits of using value engineering in road projects in Ghana. The study identified an efficiency increase of up to 20% in terms of cost and execution time. The findings show that the application of value engineering provides significant benefits not only economically but also in improving quality and sustainability.

Madushika et al. (2020) developed key performance indicators for value management in the Sri Lankan construction industry. This study identifies critical factors influencing the successful implementation of value management, including management commitment, team expertise, and organizational support. The results provide a practical framework for effective value management implementation in developing countries.

Chen et al. (2022) conducted a comprehensive study of a decade of value engineering applications in construction projects. An analysis of 150 projects showed that value engineering applications can result in cost savings averaging 5–15% by improving quality and accelerating implementation time. The study also identifies the evolution trend of value engineering methodologies increasingly integrated with digital technologies and sustainable approaches.

The novelty of this research lies in the application of value engineering specifically to post-disaster infrastructure projects with unstable soil conditions caused by liquefaction. In contrast to previous studies generally focused on construction projects under normal conditions, this study develops a value engineering approach that is adaptive to extreme geological changes after natural disasters.

Another innovative aspect is the development of a quantitative value index comparison methodology between precast and cast-in-situ methods in the specific context of sandy soils prone to landslides. This study fills a knowledge gap regarding the application of value engineering in infrastructure reconstruction projects in active seismic areas, especially in adapting construction methods to soil characteristic changes after liquefaction.

The methodological contribution of this research is the development of a value engineering framework that integrates geological risk analysis with techno-economic evaluation in selecting construction methods. This approach offers a new perspective in value engineering applications, considering not only cost and time but also technical adaptability to dynamic and uncertain field conditions.

This study aims to evaluate the potential *Evaluation of Value Engineering Potential in Work Methods and Design of the Primary Canal in the Post-Disaster Gumbasa Irrigation Project*. Specifically, it aims to: (1) evaluate the schedule and cost conditions of implementing the primary channel shoe and slab work according to the initial design; (2) compare actual cost and duration to the original plan; (3) calculate time and cost savings after VE implementation; and (4) assess the impact of alternative design implementation on the overall smooth progress of the project.

The practical benefit of this research is that it produces optimal design recommendations and working methods for post-disaster infrastructure projects, especially in unstable soil conditions. The research results can serve as a reference for construction practitioners facing similar challenges in disaster-prone areas. Additionally, this research contributes to the body of knowledge on value engineering application in post-disaster reconstruction.

The theoretical implication is the enrichment of value engineering literature with a specific approach to post-disaster projects. The results are expected to expand understanding of the adaptability of value engineering methodologies in extreme and uncertain field conditions. Practically, this study provides concrete guidance for decision-makers in selecting optimal construction methods for infrastructure projects in post-disaster areas.

The policy implications include recommendations to integrate value engineering analysis into the planning stages of post-disaster reconstruction projects. This integration can help governments optimize reconstruction budget allocation and ensure the effectiveness of infrastructure recovery programs. Furthermore, the results can form the basis for developing technical standards for infrastructure construction in disaster-prone areas that are more adaptive and efficient.

MATERIALS AND METHOD

The research was conducted on the Rehabilitation and Reconstruction of Gumbasa Irrigation System Project (Weir and Main Canal BGKn.7-BGKn.24-2695 Ha) in Sigi Regency and Palu City, Central Sulawesi. The object of the research is the work of a 9,900-meter-long primary channel with a focus on precast shoe components and channel slabs.

The research uses a case study approach with a descriptive quantitative and qualitative mixed method. The research strategy is designed to answer four main research questions using a value engineering framework developed by SAVE International.

The implementation of value engineering follows five systematic stages:

1. Information Stage: Collection of project data, field conditions, and identification of initial design problems
2. Function Analysis Stage: Identify primary and secondary functions using FAST diagrams, calculation of function cost and function value
3. Creative Stage: Brainstorming alternative solutions with a multidisciplinary value engineering team
4. Evaluation Stage: Alternative analysis based on cost, ease of implementation, duration, and quality criteria
5. Recommendation Stage: Selection and implementation of the best solution

Secondary data is obtained from contract documents, Cost Budget Plan (RAB), work drawings, and work progress reports. Data validation is carried out through document triangulation and interviews with key sources including site engineers, quantity surveyors, and project managers.

Value index analysis is carried out using the formula:

Value Index (VI) = Function Worth / Function Cost

where Function Worth is calculated using the proportional scoring method and Function Cost based on the cost allocation of work components.

The team consists of six experienced professionals: Irrigation and Swamp Officials (PPK), consultant practitioners (Team Leaders and Experts), technical implementers, project managers, and engineering section heads. The team composition includes aquatic expertise, construction management, and field practice.

RESULTS AND DISCUSSION

Conditions of Schedules and Costs for Implementation of Initial Design Work

Analysis of the conditions of the implementation of the primary channel slab and slab work according to the initial design showed a significant deviation from the original plan. Based on the bill of quantity (BOQ) data of the initial contract, the total cost of concrete work on the primary channel reached IDR 75,691,599,260 for a channel length of 9,900 meters, with an average cost of IDR 7,645,616 per meter. The planned implementation duration is 456 calendar days with a precast method involving the production, transportation, and installation of concrete shoe components.

The initial design used 28,930 pcs of K-225 reinforced concrete precast shoes measuring 0.4×0.3×0.7 meters. This system is designed to provide a watertight structure with a channel base using 30 cm thick sand The details of the initial design specifications include a 10 cm thick cast-in-situ concrete K-175 concrete channel slab with M8 wiremesh, primary channel lining using 0.1×0.7×1.35 meter reinforced concrete precast with K-225 concrete quality, and primary channel capping using K-225 cast-in-situ concrete quality with M8 wiremesh reinforcement.

The calculation of the implementation RAB for the initial design shows that the precast shoe work item has a volume of 28,930 pcs with a contract value of IDR 12,318,394,000 and an implementation cost of IDR 11,438,972,272, resulting in an index of work items of 1.08. The planned productivity for the installation of precast shoes is 66 pcs/day using 2 units of cranes with a capacity of 3 tons, with a total duration of 439 working days for installation and 299 days for precast production using 97 moldings.

However, implementation in the field faces serious obstacles due to the existing sandy soil conditions and are prone to landslides. Realization data shows that the productivity of precast shoes only reaches 33 pcs/day, experiencing a deviation of 67 pcs/day from the target. This condition caused an average delay of 2.67% per month during the period from July 2022 to March 2023. The main problems identified include:

1. **Repeated Slope Avalanches**: Excavated and formed primary channel soil often falls towards the primary channel shoe and slab, causing non-uniform slope deformation and geomembrane damage.
2. **Difficulty in Setting Elevation**: The position of the precast shoe on top of the rigid 0.75 mm geomembrane causes difficulty in achieving the elevation and straightness as planned.
3. **Shrinkage of Urug Sand**: The placement of upright sand under the geomembrane causes frequent shrinkage and avalanches of the right and left end of the shoe towards the precast shoe.

Table 1. Comparison of Plan Productivity and Initial Design Realization

Job Items	Plan Productivity	Productivity Realization	Deviation	Percentage Deviation
Precast Shoes (pcs/day)	66	33	-33	-50%
Lining Precast (pcs/hari)	45	28	-17	-38%
Concrete K-175 (m^3/wire)	47	32	-15	-32%
Caping Concrete (m^3/hari)	35	25	-10	-29%

Actual Cost and Duration Deviation from Initial Plan

The deviation analysis shows that the execution of the work experiences significant cost overruns and time extensions. Repetitive repair work results in additional heavy equipment operating costs, additional labor wages, and unexpected fuel consumption. The delay in the precast shoe work had a domino impact on the subsequent work, namely the installation of precast lining, cast-in-situ K-175 concrete casting, and concrete cap casting.

The project's S-curve data shows a consistent negative deviation with an average of 2.67% delays per month. The weight of the progress of the realization of primary channel work lags behind the plan in almost every reporting period. This condition indicates that the precast method is not suitable for post-liquefaction field conditions which have sandy and unstable soil characteristics.

Factors that contribute to the deviation include: (1) Contractor performance that is hampered by field conditions that are not according to prediction; (2) Project management processes that must adapt work methods reactively; (3) Limited resources in handling repetitive repair work; and (4) Weather and accessibility conditions that aggravate the field situation.

Identify and Analyze Functions Using Value Engineering

The implementation of the value engineering methodology begins with the identification of the main functions of the primary channel system. Based on a comprehensive analysis, eight main functions that must be fulfilled by the channel system were identified, which are categorized based on the hierarchy of Higher Order Function (HOF), Lower Order Function (LOF), Basic Function (BF), and Secondary Function (SF).

Table 2. Identify Primary Channel Functions with Precast Methods

Component	Function (Verb)	Function (Noun)	Category
Precast method aqueduct	Drain	Water	PRAISE
	Endure	Soil deformation	HOF
	Guard	Water pressure resistance	BF
	Hold	Ground load	BF
	Protect	From erosion damage	BF
	Press	Construction costs	SF
	Accelerate	Construction	SF
	Facilitate	Supervision	SF

To understand the logical relationship between functions, a FAST (Function Analysis System Technique) diagram was prepared that showed the critical path of the function that must be assigned to the primary channel component. FAST diagrams help in visualizing how each function contributes to the achievement of the system's main objectives.

Calculation of Function Cost dan Function Worth

The value engineering analysis was followed by the calculation of function cost and function worth for each identified function. Function cost is calculated based on the actual cost allocation of the work components that support each function, while function value is calculated using the proportional scoring method.

Table 3. Calculation of Function Worth Using the Scoring Method

Function	Importance Score	Function Worth (Rp)
Channeling water	10	12.208.322.461
Withstands soil loads	8	9.766.657.969
Soil deformation resistance	10	12.208.322.461
Accelerating construction	7	8.545.825.723
Reduce construction costs	6	7.324.993.477
Makes supervision easier	6	7.324.993.477
Maintains resistance to water pressure	8	9.766.657.969
Protects against erosion damage	7	8.545.825.723
Total	**62**	**75.691.599.260**

Function worth is calculated using the formula:

Function Worth = (Score / Total Score) × Total Target Cost

The calculation of function costs is carried out by allocating the cost of work components based on the proportion of their contribution to each function. This process involves discussions with the value engineering team to determine the percentage of involvement each component has towards a particular function.

Precast Method Value Index Analysis

After obtaining the function cost and function value values, the value index is calculated using the formula:

Value Index (VI) = Function Worth / Function Cost

Table 4. Precast Method Value Index Analysis

Function	Function Worth (Rp)	Function Cost (Rp)	Value Index
Channeling water	12.208.322.461	11.475.269.371	1,06

Function	Function Worth (Rp)	Function Cost (Rp)	Value Index
Withstands soil loads	9.766.657.969	14.845.995.923	0,66
Soil deformation resistance	12.208.322.461	10.983.563.288	1,11
Accelerating construction	8.545.825.723	13.138.863.254	0,65
Reduce construction costs	7.324.993.477	7.159.001.701	1,02
Makes supervision easier	7.324.993.477	15.684.116.201	0,47
Maintains resistance to water pressure	9.766.657.969	6.946.837.603	1,41
Protects against erosion damage	8.545.825.723	1.958.709.615	4,36

The results of the value index analysis show that some functions have low efficiency (VI < 1), in particular:

- Easier supervision (VI = 0.47)
- Accelerating construction (VI = 0.65)
- Withstand soil load (VI = 0.66)

This indicates that the costs incurred to fulfill these functions are not proportional to the value or benefit generated in the context of the precast method.

Development and Evaluation of Design Alternatives

Based on the results of the value index analysis which showed low efficiency in several critical functions, the creative stage was carried out through brainstorming with a multidisciplinary value engineering team. This process results in three main alternatives:

1. **Self-Compacting Concrete (SCC):** Using self-flowing concrete without manual compaction
2. **Stay-in-Place Formwork**: Cast concrete in place with formwork that does not need to be dismantled
3. **Cast-in-Situ Concrete**: Concrete casting directly on site (in-situ)

Table 5. Evaluation of Design Alternatives Based on Technical and Economic Criteria

Alternative	Construction Costs	Ease of Implementation	Duration of Implementation	Quality of Work
Self-Compacting Concrete	More Expensive	Easy, no compaction required	Faster	Concrete Quality is More Consistent
Stay-in-Place Formwork	More Expensive	No need to disassemble formwork	Faster	Relatively Equal
Cast-in-Situ Concrete	Cheaper	Easy with a 10±2 slump	Faster, Less Repair	Relatively Equal

Table 6. Estimated Cost of Design Alternatives

Alternative	Volume (m^3)	Unit Price (Rp)	Total Cost (Rp)
Self-Compacting Concrete	2.624,53	1.581.951	3.844.330.415
Stay-in-Place Formwork	2.551,63	1.644.015	3.995.153.614
Cast-in-Situ Concrete	2.551,63	1.331.451	3.235.585.355

Based on a comprehensive evaluation, the cast-in-situ method was chosen as the optimal alternative because it provides advantages in terms of the most economical construction cost, ease of implementation in sandy soil conditions, and flexibility of adaptation to dynamic field conditions.

Cast-in-Situ Method Value Index Analysis

After the selection of cast-in-situ alternatives, the function cost is recalculated by maintaining the same base function value to maintain consistency of comparison. The calculation of function costs is adjusted based on the estimated cost of work using the cast-in-situ method.

Table 7. Comparison of Precast and Cast-in-Situ Value Index Methods

Function	VI Precast	VI Cast-in-Situ	Preferences
Channeling water	1,06	1,48	Cast-in-situ is more efficient
Withstands soil loads	0,66	0,76	Cast-in-situ is better
Soil deformation resistance	1,11	1,13	Almost balanced
Accelerating construction	0,65	0,74	Cast-in-situ is better
Reduce construction costs	1,02	1,08	Cast-in-situ is a little better
Makes supervision easier	0,47	0,48	Almost balanced
Maintains resistance to water pressure	1,41	1,45	Almost balanced
Protects against erosion damage	4,36	4,36	Balanced

The results of the comparison showed a consistent increase in the value index in the cast-in-situ method, in particular in the function of "channeling water" which increased from 1.06 to 1.48, and "accelerating construction" which increased from 0.65 to 0.74.

Implementation and Results of Value Engineering Implementation

The implementation of the design review resulted in new technical specifications with shoes and slabs of 10 cm thick cast-in-situ concrete channels K-225 that are continuously worked in a monolith. The system uses M8 wire mesh repeating with a 15 cm overlapping and casting per segment of 5.5 meters. The productivity achieved is 15 segments per day with a total implementation duration of 240 calendar days.

Table 8. Comparison of Initial Design Performance and Design Review

Aspects	Initial Design (Precast)	Review Design (Cast-in-Situ)	Difference	Efficiency Percentage
Total Project Cost (Rp)	75.691.599.260	74.629.376.101	1.062.223.159	1,4%
Shoe Lining Cost (Rp)	11.438.972.272	8.041.348.766	3.397.623.506	29,7%
Duration of Execution (days)	456	240	216	47,4%
Quality of Duct Flooring	K-175	K-225	Increased	-
Quality of Channel Shoes	K-225	K-225	Heaven	-

Time and Cost Savings Analysis

The application of value engineering results in significant savings in various aspects. Overall, the total cost of the work experienced an efficiency of IDR 1,062,223,159 or around 1.4% of the total initial budget. In the lining shoe work item, the cost efficiency achieved reached IDR 3,397,623,506 or around 29.7% of the initial work value.

In terms of time, the duration of work decreased drastically from 456 calendar days to 240 days, resulting in a time saving of 216 days or about 47.4%. This acceleration is achieved through:

1. **Elimination of Precast Production Time**: No more 299 days production time required for precast shoe manufacturing
2. **Setting Time Reduction**: The cast-in-situ method eliminates complicated elevation and straightness setting times
3. **Minimization of Repair Work**: Significant reduction in repair work due to slope avalanches
4. **Work Sequence Optimization**: Floor and shoe casting can be done simultaneously in a monolith

Impact of implementation on the overall smooth running of the project

The implementation of cast-in-situ design alternatives has a significant positive impact on the overall smooth running of the project. The increased productivity of the cast-in-situ method allows for the acceleration of further work, including the installation of precast lining and casting of concrete caping. The monolith structure resulting from the cast-in-situ method provides better stability to sandy soil conditions, thereby reducing the risk of deformation and structural damage.

From a resource management aspect, cast-in-situ implementation reduces the need for crane tools for precast installation, molding for precast production, and special installation manpower. This results in operational efficiencies that contribute to cost savings and execution time.

The improvement of the quality of the duct floor from K-175 to K-225 provides structural added value without sacrificing cost efficiency. The monolith system also reduces the risk of leakage in the joints and improves the durability of the structure in the long term.

Validation of Results with Actual Field Conditions

The comparison between the value engineering prediction and the actual implementation conditions shows high suitability. The function of "channeling water" has proven to be easier to control its elevation with the cast-in-situ method, thus reducing the risk of water not flowing as it should. The function of "holding ground load" indicates a higher level of concrete quality due to stricter quality control during the in-situ casting process.

During the cast-in-situ casting process, the concrete can adapt to the existing shrinkage, so that the function of "soil deformation resistance" is achieved more optimally. Actual productivity reached the target of 15 segments per day as planned, validating the "accelerate construction" function that had been predicted in the value engineering analysis.

CONCLUSIONS

Value engineering has demonstrated its effectiveness in evaluating and optimizing post-disaster infrastructure projects, as evidenced by the Gumbasa irrigation project, which achieved a total cost saving of IDR 1,062,223,159 (1.4%) and a time saving of 216 days (47.4%) compared to the initial plan. Notably, the shoe lining items realized a significant cost efficiency of 29.7% (IDR 3,397,623,506). The cast-in-situ method proved advantageous over the precast approach in sandy, post-liquefaction soil conditions, showing a higher value index across most analyzed functions. Furthermore, upgrading the concrete quality from K-175 to K-225 added structural value without compromising cost and time efficiency. This study recommends the systematic application of value engineering in similar challenging post-disaster infrastructure projects. For future research, it is suggested to explore the integration of value engineering with emerging digital technologies and risk assessment tools to further enhance adaptability and decision-making in diverse and dynamic disaster-affected environments.

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