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Understanding Decision Making Processes in Sustainable Construction Practices at Urban Infrastructure Projects

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Abstract:

Urban infrastructure development in metropolitan cities such as Jakarta is increasingly characterized by high complexity arising from the integration of environmental sustainability demands, regulatory compliance, resource limitations, and pressures for cost and time efficiency. In this context, decision-making processes extend beyond purely technical considerations and reflect multidimensional interactions among actors, interests, and institutional frameworks that influence the implementation of sustainable construction practices. This study examines the decision-making mechanisms underlying the adoption of sustainable construction practices in urban infrastructure projects, with emphasis on the roles of key actors, decision rationalities, and trade-off dynamics throughout the project life cycle. A qualitative case study approach was employed, focusing on a single urban infrastructure project in Jakarta. Data were collected through semi-structured interviews with six purposively selected key actors, namely the project manager, site engineer, sustainability officer, main contractor representative, planning or supervision consultant, and a government representative as the project owner, complemented by an analysis of project documents and relevant regulatory frameworks. The data were analyzed using thematic analysis to identify decision-making patterns and inter-actor relationships. The findings indicate that decision-making in sustainable construction is shaped by continuous negotiation among regulatory pressures, economic considerations, technical readiness, and varying levels of actors' commitment to sustainability agendas, which result in compromises between environmental performance and project efficiency. The novelty of this study lies in its empirical mapping of decision-making processes as dynamic, contextual, and actor-centered practices, contributing conceptually to sustainable construction studies and offering practical implications for improving governance quality in urban infrastructure projects.

Keywords: Decision-making processes, Sustainable construction, Urban infrastructure projects, Stakeholders.

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Introduction

Urban infrastructure development in the era of global urbanization faces increasingly complex challenges, especially related to the demands of applying environmental sustainability principles in every stage of construction projects (Ajirotutu et al., 2024). Globally, the construction sector is recorded as one of the largest contributors to carbon emissions and significant natural resource consumption, thus encouraging the emergence of various transition agendas towards sustainable development (Almusaed et al., 2024). In the context of developing countries, these pressures are further exacerbated by limited institutional capacity, technological inequality, and the need to accelerate urban development. This condition makes sustainable construction practices not just a technical issue, but a strategic issue that requires cross-actor and interest decision-making.

In Indonesia, especially in large-scale urban infrastructure projects such as Jakarta, the implementation of sustainable construction still faces various structural and operational obstacles (Pramesti & Basaauki, 2025). Increasingly stringent regulations related to the environment and green buildings are often not fully balanced with the readiness of project actors to translate them into practical decisions on the ground. Research shows that the gap between policy and implementation often arises due to the dominance of cost, time, and administrative pressures in public projects (Napitupulu et al., 2024). As a result, sustainability principles are often negotiated and compromised in the project decision-making process, especially in the planning and implementation phases.

Previous studies on sustainable construction have generally focused on identifying drivers and drivers of the adoption of environmentally friendly practices, such as economic incentives, green technology, and government policies (Ahmed et al., 2023; Babalola & Harinarain, 2024). However, most of these studies use a quantitative approach and view project decisions as linear rational outcomes. This approach tends to ignore the social dynamics, power relations, and negotiation processes between actors that take place contextually in urban infrastructure projects. As such, there is still a research gap related to an in-depth understanding of how sustainability decisions are shaped, debated, and agreed upon in real practice of construction projects.

Some qualitative research is beginning to highlight the importance of the actor and institutional dimension in sustainable construction decision-making, but it is still limited to the context of developed countries or the commercial building sector. For example, research by Waseem et al., (2025) emphasizing the role of project leadership and organizational culture, while studies by Vázquez-Brust et al., (2023) highlighting the influence of stakeholder pressure on sustainability decisions. However, studies that specifically map the decision-making process on urban infrastructure projects in developing countries are still relatively rare. This shows that there is a significant empirical knowledge gap, especially related to how public and private actors interact within complex regulatory frameworks.

Based on these gaps, this study explicitly aims to examine and understand the decision-making process in the application of sustainable construction practices in urban infrastructure projects. The main focus of the research is directed at the identification of key actors, the rationality of the decisions used, as well as the trade-off dynamics between environmental, economic, and technical interests throughout the project life cycle. Using a qualitative approach through in-depth case studies, this study seeks to capture the reality of decision-making as a dynamic and contextual process. This goal is expected to be able to provide a more comprehensive understanding compared to the normative approach

that has been dominant.

Theoretically, this research contributes to the development of sustainable construction studies by enriching actor-based decision-making perspectives and institutional contexts. The research findings are expected to complement the theory of project decision-making which has tended to be rational-technocratic, by showing the role of negotiation, compromise, and regulatory interpretation in real practice (Aal, 2025). In addition, this research also expands the discourse on sustainability by placing it as a social and political process, not just the achievement of technical indicators. Thus, this study makes a relevant conceptual contribution to the development of project management theory and sustainable development.

From a practical perspective, the results of this study are expected to provide strategic implications for policymakers, project owners, and construction practitioners in improving the quality of urban infrastructure project governance. A better understanding of decision-making patterns can be the basis for designing more adaptive and realistic policies and coordination mechanisms. In addition, the findings of this study can be used as a reference in strengthening the capacity of project actors to be better able to integrate the sustainability agenda without sacrificing project efficiency. Thus, this research has the potential to encourage the implementation of more effective and contextual sustainable construction in Indonesia's urban environment.

Method

Design and Research Approach

This study uses a qualitative approach with a case study design to deeply understand the decision-making process in the application of sustainable construction practices in urban infrastructure projects. The qualitative approach was chosen because this study focuses on the exploration of meaning, interaction dynamics, and rationality of actors in the real context of the project, which cannot be reduced to quantitatively measurable variables. The case study design allows researchers to examine the phenomenon holistically within the constraints of a specific context, namely an urban infrastructure project in Jakarta that is currently or has just been implemented (Taherdoost, 2022).

Research Location and Sampling Strategy

The location of the study was set on one purposively selected urban infrastructure project in the Jakarta area because the project explicitly adopts the principles of sustainable construction and involves many institutional stakeholders. The research population includes all key actors directly involved in the project planning, implementation, and oversight process. The sampling technique used is non-probability sampling with the purposive sampling method, which is the selection of informants based on role, authority, and direct involvement in project decision-making (Makwana et al., 2023). This approach aims to ensure that the data obtained is information-rich and relevant to the focus of the research.

Characteristics and Number of Research Informants

The number of informants in this study is six, each representing one group of key actors in the project. The informants consisted of: one project manager, one site engineer, one sustainability officer, one main contractor representative, one planning consultant or supervisor, and one government representative as the project owner. Each informant was

chosen because they have a strategic role in decision-making related to technical, economic, and sustainability aspects. The number of informants is considered adequate because qualitative research emphasizes the depth of the data and achieving information saturation, not on statistical representations (Mwita, 2022).

Data Collection Techniques and Sources

The main data collection technique in this study is semi-structured interviews, which allow researchers to obtain in-depth data while being flexible in exploring the experiences and views of informants. The interview guide is structured based on a conceptual framework of project decision-making and sustainable construction developed from the current literature, thus ensuring the linkage between empirical and theoretical data (Thomas et al., 2023). In addition to interviews, this research also uses document analysis, including project documents, technical reports, contracts, and regulations related to sustainability and urban infrastructure. This combination of techniques aims to increase the richness of the data and strengthen the validity of the findings through source triangulation.

Data Legitimacy and Trust Strategy

To maintain the validity of the data, this study applies several qualitative validity strategies, including data triangulation, member checking, and trail audits. Triangulation is carried out by comparing the data from interviews between actors and matching them with relevant project and regulatory documents. Member checking is carried out by confirming the summary of the interview results to the informant to ensure the accuracy of the researcher's interpretation. This approach is in line with qualitative research quality standards that emphasize the credibility, dependability, and confirmability of data (Almusaed et al., 2025).

Stages and Flow of Research Implementation

The research procedure is carried out gradually and systematically. The initial stage includes identifying research problems, searching the literature, and preparing conceptual frameworks and interview guidelines. The next stage is the collection of field data through interviews and documentation which is carried out in person or online according to field conditions. After the data is collected, the researcher performs verbatim transcription, data organization, and initial analysis process before entering the interpretation and conclusion stage. All stages are carried out sequentially to maintain methodological consistency and transparency of the research.

Qualitative Data Analysis Techniques

Data analysis was carried out using thematic analysis, which aims to identify patterns, themes, and relationships between concepts in qualitative data. The analysis process follows stages of open coding, code grouping, and the formation of key themes that represent the dynamics of sustainable construction decision-making (Naeem et al., 2023). Analysis is assisted by the latest version of NVivo software to make it easier to manage data, track code, and visualize relationships between themes. This approach allows for systematic, transparent, and traceable analysis, thereby reinforcing the quality of the research findings.

Results

1. Negotiation between Regulatory Pressures and Project Operational Reality

The results of the study show that the decision-making process in the application of sustainable construction practices in urban infrastructure projects takes place through a continuous negotiation mechanism between formal regulatory demands and the operational reality of the project. Environmental and sustainability regulation serves as a normative framework that provides a general direction, but in practice it is not mechanically applied. Project actors are actively interpreting, adjusting, and even reprioritizing the regulatory provisions to keep pace with the technical conditions of the field, time constraints, and administrative pressures of the project. These findings confirm that sustainability is not positioned as a stand-alone goal, but rather as part of a decision-making process that is always negotiated alongside the interests of other projects.

These dynamics are clearly revealed when the actors explain how regulations are understood and applied in daily practice. One of the informants emphasized that regulation remains the main reference, but its implementation demands operational flexibility. This is reflected in the following statement. *"The regulation is the main reference, but in the field we have to adjust to the technical conditions and project time, so not everything can be applied ideally"* (M, November 12, 2025). A similar view was also conveyed by other informants who highlighted the importance of the discussion process when sustainability standards are faced with work completion targets. *"When sustainability standards collide with work schedules, we usually sit down together to find a middle ground"* (E, November 18, 2025). From the perspective of the project owner, such flexibility is seen as part of the policy implementation strategy. *"As project owners, we emphasize that the principle must be carried out, but the form of implementation can adjust to the conditions of the project"* (G, 25 November 2025).

The interpretation of the statement, which is reinforced through the analysis of contract documents, project progress reports, and technical regulations related to urban infrastructure, shows that sustainability regulations operate as a space of discretion for actors. Sustainability clauses in project documents tend to be formulated in general terms and open up opportunities for adaptation at the implementation level. This condition allows for compromises that are considered rational by actors when environmental obligations are faced with the demands of completing work. Thus, sustainability decision-making proves to be contextual and dynamic, shaped by ongoing negotiations between formal norms and actual project practices.

2. The Dominance of Economic Considerations in Sustainability Decision Compromise

The findings of the study reveal that economic considerations are a very dominant factor in determining the extent to which sustainability principles can be implemented in urban infrastructure projects. Although all actors normatively express support for sustainable construction practices, final decisions are often influenced by budget constraints and cost-efficiency demands. In this context, sustainability is understood as an ideal value that must be adjusted to the financial capabilities of the project, so that the decisions taken lead more towards a form of sustainability that is considered realistic and economically acceptable.

The dominance of economic rationality appears consistently in the actors' explanations of the decision-making processes they face. One informant explained that normative agreements on sustainability often change when faced with budget constraints.

"When it comes to sustainability, everyone agrees, but once it comes to the cost, there must be adjustments because the project budget has been set" (K, November 15, 2025). This view was reinforced by other informants who highlighted the cost limitations in material selection. *"Eco-friendly materials are attractive, but they are often unrealistic to include in the project cost structure"* (P, November 20, 2025). In practice, the final decision is directed at the choice that is considered the most financially secure. *"We ended up choosing a solution that was still financially safe even though the environmental impact was not maximized"* (M, 22 November 2025).

Analysis of project budget documents, cost evaluation reports, and contract addendum reinforces these findings by showing that environmental aspects are generally positioned as additional considerations once cost and time aspects are met. Sustainability decisions are often directly linked to short-term financial implications, rather than long-term environmental benefits. These findings confirm that the compromise between environmental performance and project efficiency is a direct consequence of the dominance of economic considerations in the sustainable construction decision-making process.

3. Technical Readiness as a Practical Limitation for Sustainability Implementation

The results show that the technical readiness and capacity of project actors are important factors that limit sustainability choices in decision-making. Decisions are influenced not only by regulations and budgets, but also by the actor's level of technical understanding, experience, and trust in the environmentally friendly methods or technologies available. When sustainability solutions are perceived to be immature or at risk to the quality and safety of work, actors tend to opt for more conventional and tested approaches.

This limitation of technical readiness was conveyed directly by the informants based on their experience in the field. One of the informants emphasized that conceptual understanding has not always been followed by readiness for implementation. *"In terms of the concept of sustainability, we understand, but from a technical point of view, not everyone is ready to implement new methods"* (E, November 14, 2025). Concerns about technical risks are also a major consideration in decision-making. *"We are worried that untested technology will actually cause problems in the field"* (K, November 19, 2025). As a result, decisions are more often directed at approaches that have been proven to be safe. *"Decisions are usually made based on methods that have been proven to be safe, not the most environmentally ideal"* (O, 27 November 2025).

A review of the project's technical report and the minutes of the coordination meeting shows that discussions on sustainability innovation often stop at the conceptual planning stage when faced with limited technical capacity. The document shows a strong preference for conventional methods that are considered more controlled and less risky. This confirms that sustainability in practice is highly dependent on the technical readiness of the actors, so that the decisions taken reflect the compromise between environmental aspirations and the technical safety of the project.

4. Actors' Commitment and Power Relations in Determining the Direction of Decisions

The findings indicate that the level of commitment of actors to the sustainability agenda as well as their position in the project power structure play a crucial role in

determining the direction of decisions. Actors with strategic authority have greater influence in determining whether sustainability is a top priority or just an additional consideration. Thus, sustainability decision-making is not only technocratic, but also a social process influenced by inter-stakeholder power relations.

These dynamics are reflected by the informants when explaining how the final decision is determined. An informant emphasized that the commitment of the project leader greatly determines the position of sustainability issues. *"If the project leader does not encourage, sustainability issues usually immediately drop in priority"* (O, November 16, 2025). Another informant emphasized that formal authority is the final determinant in the decision-making process. *"In the end, the decision is on the party in charge of the budget and contract"* (P, November 21, 2025). From the point of view of technical actors, their space of influence is limited. *"We can propose many things, but the realization is very dependent on the actors who have authority"* (E, 28 November 2025).

Analysis of the project's organizational structure and decision-making documents shows that actors with formal authority are the main determinants of sustainability compromises taken. It confirms that sustainability is the result of social interaction, negotiation of interests, and the distribution of power in projects. Thus, this study confirms that the decision-making process in sustainable construction is dynamic, contextual, and actor-centered, and systematically results in a compromise between environmental performance and project efficiency.

Discussion

Decision-making in sustainable construction on urban infrastructure projects has proven to be dynamic and based on inter-stakeholder negotiations. These findings confirm the view in the literature that sustainability is not implemented through linear normative compliance, but rather through interpretive processes influenced by the institutional and operational context of the project (Karlsson & Fredriksson, 2025). Previous research has also shown that environmental regulation often serves as a flexible frame of reference, rather than as a deterministic instrument in construction practice (Nagayo et al., 2025). The main contribution of this research lies in the empirical mapping of how regulation becomes an arena of actors' discretion, thus enriching the theoretical understanding of sustainability as a negotiated social practice, not just a policy target.

Economic considerations emerged as a key factor that formed compromises in sustainability decisions. These findings are in line with the theory of limited rationality in project decision-making, which explains that actors tend to choose the options deemed most feasible within the constraints of available resources (Jacobsson & Söderholm, 2022; Dhami & Sunstein, 2022). International studies show that cost pressures and short-term efficiency demands are still major barriers to the adoption of sustainable construction practices, especially in developing countries (Bayeroju et al., 2022; Aliu et al., 2025). However, the novelty of this research lies in the explanation that economic rationality does not eliminate sustainability, but rather forms sustainability practices that are compromising and contextual. Thus, sustainability is realized as a result of negotiations between environmental value and project financial viability.

The technical readiness and capacity of actors have proven to be instrumental in limiting or enabling the implementation of sustainability. These findings support a capability-based view approach that emphasizes that the adoption of sustainability innovation is highly dependent on actors' knowledge, experience, and level of trust in the available technologies (Adomako & Tran, 2025). Previous research has shown that limited

technical capacity often encourages actors to choose conventional methods that are considered safer even though they are less environmentally optimal (Kim et al., 2022). The contribution of this research lies in the affirmation that technical limitations are not only individual, but also institutionalized in project organizational practices. These findings broaden the understanding that improving sustainability requires investment in technical learning and strengthening the capacity of actors, rather than simply tightening regulations.

Actor commitment and power relations are also important determinants in the direction of sustainability decisions. These findings are consistent with the governance and political economy perspectives in sustainable construction studies, which emphasize that project decisions are heavily influenced by the distribution of authority and control over resources (Maqbool et al., 2022). Previous studies have shown that actors with budget authority tend to have a dominant influence in determining project priorities, including on sustainability issues (Otundo Richard, 2024) (Shawoo et al., 2023). The novelty of this research lies in the empirical portrayal that sustainability often depends on the personal commitment of key actors, rather than solely on the formal structure of the organization. These findings reinforce the argument that sustainability is an issue of leadership and power, not just a technical or administrative one.

The four themes of the research can be integrated into a broader conceptual framework regarding decision-making in urban infrastructure projects. Sustainability decisions are shaped by the simultaneous interaction between regulatory pressures, economic considerations, technical readiness, and actors' level of commitment. These findings expand on conventional decision-making models that tend to separate those factors separately. By placing decision-making as an actor-centered and contextual process, this research contributes to the development of a more realistic and practice-based theory of sustainable construction. The theoretical implication is the need for an integrative approach that recognizes the social and institutional complexities in sustainability implementation.

Although it makes a strong conceptual contribution, this study has limitations that need to be examined. The focus on a case study of an urban infrastructure project in Jakarta limits the generalization of the findings statistically, but provides significant depth of analysis in understanding the mechanisms of sustainability decisions in contextual. Follow-up research is recommended to use cross-project or cross-city comparative design to test the consistency of identified decision-negotiation patterns. In addition, the incorporation of qualitative and quantitative approaches in subsequent research has the potential to provide a more comprehensive understanding of the relationship between power structures, technical capacity, and project sustainability performance.

Conclusion

This study concludes that decision-making in the application of sustainable construction practices in urban infrastructure projects is a dynamic, contextual, and actor-centric process, shaped through continuous negotiation between regulatory pressures, economic considerations, technical readiness, and stakeholder commitment levels. Sustainability decisions are not generated through linear normative compliance, but rather through an interpretive process that systematically creates a compromise between environmental performance and project efficiency throughout the project lifecycle. These findings confirm that sustainability in urban infrastructure projects should be understood as a social and institutional practice, not just a technical issue, so improving the quality of

their implementation requires strengthening project governance, actor capacity, and more adaptive decision-making mechanisms. Thus, this study makes a conceptual contribution to the development of sustainable construction studies while offering practical implications for improving the quality of urban infrastructure project management in the context of developing countries.

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