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Sustainable Design Optimization in Fast-track Projects: A Case Study of Hospitality in Bali

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ABSTRACT

The hospitality industry in Bali faces a significant challenge in adopting green architectural practices amid the increasing demand for fast development through *fast-track* methods. Although this method accelerates the completion of projects, many criticize its impact on environmental sustainability. This article explores sustainable design optimization strategies in fast-track projects by highlighting elements such as utilizing local materials, energy efficiency, and natural resource management. Case studies on several *eco-friendly* hotels in Bali were used to develop recommendations for architects and developers to implement design models that accelerate construction without neglecting sustainability. This research uses a qualitative approach with case study methods and in-depth interviews with industry experts. The study results show that applying environmentally friendly technology and structured project management can improve sustainability in *fast-track projects*. Therefore, the integration of green design practices into fast construction methods is an essential solution to support the environmental sustainability and hospitality industry in Bali.

Keywords: fast-track, green architecture, sustainability, hospitality, Bali.

INTRODUCTION

Bali, as one of the world's leading tourist destinations, is experiencing very rapid growth in the tourism industry. Based on data from the Central Statistics Agency [1], tourist visits continue to increase yearly, especially after the COVID-19 pandemic began to subside. This visit increase has triggered a high demand for hospitality facilities, including hotels, villas, and resorts. To meet this demand, developers and architects in Bali have applied a fast-track construction method that allows construction to be completed in a shorter time than conventional methods.

However, although *the fast-track* method provides advantages regarding project acceleration, it also has significant challenges, especially regarding sustainability. Projects that use this approach often ignore environmental aspects due to high time pressure, such as lack of energy efficiency planning, the use of unfriendly materials, and increased construction waste. This is contrary to the global trend that increasingly emphasizes the importance of applying green architecture in the construction industry, including the hospitality sector [2].

In addition, regulations related to green development in Indonesia, especially in Bali, are increasingly tightened. [3] concerning Green Spatial Planning and various other local policies require developers to pay attention to sustainability aspects in every development project. Therefore, there needs to be a clear strategy in integrating sustainable design concepts into *fast-track projects*, so that they can still meet market needs without sacrificing environmental and social aspects.

The urgency of this research lies in the need for innovative solutions to balance between accelerated construction and environmental sustainability in hospitality projects in Bali. If not managed properly, accelerated development can exacerbate environmental degradation, such as overexploitation of natural resources and increased pollution from construction waste. In addition, increasingly stringent regulatory and policy challenges require architects and developers to pay more attention to sustainability aspects from the planning stage to implementation.

This research is important to provide new insights on how *fast-track* projects can still adopt green design principles without hindering development time and cost efficiency. By identifying the factors that affect the successful implementation of sustainable design in *fast-track projects*, the results of this study are expected to guide the construction industry in Bali in developing a more environmentally friendly development strategy.

The implementation of sustainable design in *fast-track* projects in the hospitality sector in Bali faces challenges in technical, regulatory, and economic aspects. The main problem is how green design principles can be effectively applied in projects with accelerated schedules, given time and resource constraints. In addition, obstacles such as the limited availability of environmentally friendly materials quickly, high initial investment costs, and a lack of experts in green construction technology are inhibiting factors. Therefore, this research focuses on applying sustainable design in *fast-track* projects, the main challenges faced, and optimal solutions to ensure a balance between development speed and sustainability.

This study aims to identify the optimal strategy for applying sustainable design to fast-track projects in Bali and provide data-driven recommendations for architects, developers, and other stakeholders who want to apply sustainability principles in hospitality projects with short construction times.

In addition, this study aims to analyze how various aspects, such as the selection of environmentally friendly materials, energy efficiency, and waste management, can be integrated into the fast-track method to support long-term sustainability.

This research has theoretical, practical, and policy benefits. Theoretically, this research contributes to enriching the literature on integrating sustainable design in the fast-track method and studying green architecture in hotel development in Bali. Practically, the results of this study guide architects, contractors, and developers in designing hospitality projects that are fast but still prioritize sustainability principles. In terms of policy, this study supports the formulation of more effective regulations for implementing green design in the hospitality sector. It provides recommendations to local governments in supervising and implementing sustainable development policies.

This study offers a model of integration of *the fast-track* method with green design that has not been widely discussed in the context of hospitality in Bali. Using case studies from several hospitality projects in Bali, the study highlights technology-based approaches such as Building Information Modeling (BIM) and sustainable local materials as solutions to overcome time and regulatory constraints in construction acceleration projects.

In addition, the study also emphasizes the importance of efficient project management, waste reduction strategies, and a policy-based approach to ensure that the acceleration of development in the hospitality sector remains aligned with the principles of environmental and social sustainability. The results of this research are expected to be a reference for the construction industry, academics, and policymakers in developing more innovative and environmentally responsible development strategies.

Sustainable Design

Sustainable design is an approach in architecture and building planning that aims to optimize the use of natural resources and reduce negative impacts on the environment. [2] argue that sustainable design focuses not only on energy efficiency, but also on the *cradle-to-cradle* concept, where the life cycle of materials is thoroughly calculated to minimize waste and carbon emissions. The application of sustainable design in construction not only improves the operational efficiency of buildings but also provides long-term benefits to the environment and the economy.

Fast-track Construction

Fast-track construction is a construction method that accelerates the development process by overlapping the stages of project design and implementation. According to [4], this method allows construction to begin before the overall design is completed, saving time and increasing project productivity. However, this method also faces challenges, such as complex coordination between

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various stakeholders and the potential risk of design errors that can arise due to the lack of time for careful revision and planning.

Green Architecture in Hospitality

Green architecture in the hospitality sector refers to applying eco-friendly design principles that aim to improve energy efficiency, reduce water consumption, and minimize the environmental impact of hotel and resort buildings. [5] examined how applying green technology in the hospitality industry can improve guest satisfaction and reduce the carbon footprint of hotel operations. One example of the application of green architecture in hospitality is the use of renewable energy systems, natural ventilation design, and sustainable local materials.

Previous Research

Researchers have widely conducted studies on integrating sustainable design in fast-track projects, especially in the context of hospitality and fast construction.

1. Examined how the principles of *green architecture* are applied in the construction of hotels in Bali. Their study shows that although some hotels have adopted green design principles, there are still obstacles in their implementation, especially regarding regulations and development costs [6].
2. Evaluated the impact of hotel design on guest satisfaction and sustainability. The study highlights how hotel designs that prioritize sustainability principles can increase economic value and appeal to travelers who are increasingly aware of environmental issues [7].
3. Discuss the challenges and risks that arise in rapid construction projects. They found that projects with *fast-track* methods often face obstacles in coordination between various parties involved and a lack of time to optimize sustainability aspects in design and construction [8].

Based on this literature review, it can be concluded that despite the challenges in implementing green design in *fast-track* projects, a technology-based approach and more flexible policies can improve the effectiveness of sustainability implementation in hospitality projects in Bali.

RESEARCH METHODS

This study uses a qualitative approach with a case study method to examine the application of sustainable design in *fast-track* projects in the hospitality sector in Bali. This approach was chosen because it allows for an in-depth exploration of the phenomena occurring in the field, considering contextual aspects that influence the successful application of sustainability principles in rapid construction. Case studies are used to understand how various factors—including regulations, design, materials, and project management interact in hospitality projects that implement *fast-track methods*.

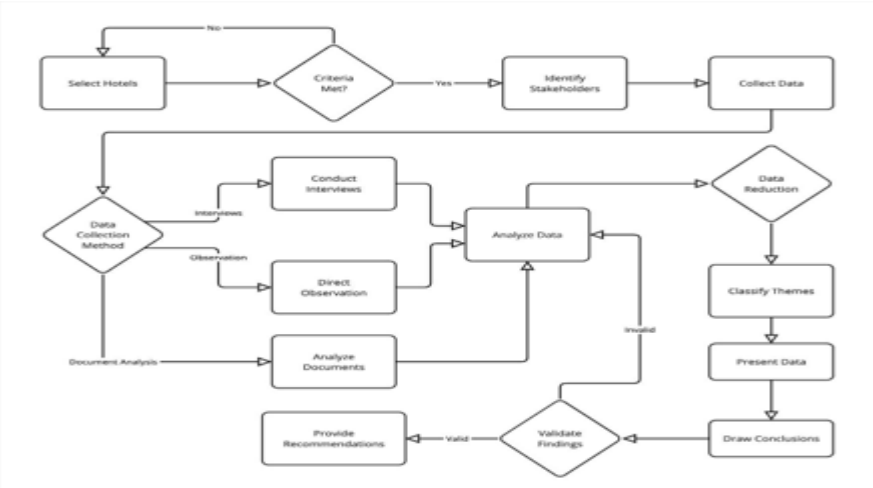

Figure 1. Research Flow chart

The research location is focused on several *eco-friendly* hotels in Bali that have applied *the fast-track* method in their construction. The selection of hotels is based on certain criteria, namely hotels that have received sustainability certification or have strict environmental policies, hotels that use the fast-track method in the construction process, and hotels that have adequate project documentation data for analysis.

The research subjects consist of several key stakeholders, namely architects involved in the design and implementation of sustainable design, property developers who make strategic decisions related to the acceleration of development, and regulators and policymakers who oversee the implementation of sustainability standards in the hospitality sector in Bali.

Data is collected using several main techniques, namely in-depth interviews, direct observation, and document analysis. In-depth interviews are conducted with architects, developers, and regulators using semi-structured interview guidelines. The questions focused on their experience implementing sustainable design in *fast-track projects*, the challenges faced, and the strategies implemented. Direct observation was carried out by visiting the project site to observe the application of sustainability concepts in design elements, material selection, and project management. Meanwhile, the document analysis involves reviewing technical drawings, sustainability reports, and relevant regulatory policies to gain a more comprehensive understanding of the implementation of green design in rapid projects.

The data obtained was analyzed with a thematic approach consisting of several stages. The first stage is data reduction, where information from interviews, observations, and documents is classified based on key themes, such as energy efficiency, local material utilization, and construction waste management. Furthermore, the data is presented in tables, diagrams, and direct quotes from respondents to clarify the study's findings. The final stage is the drawing of conclusions, which is carried out by analyzing the findings to answer the formulation of the problem that has been established and comparing it against the theory that has been discussed in the literature review.

To ensure the validity and reliability of the research, data triangulation was carried out by comparing the results of interviews, observations, and project documents. In addition, the validation of the findings was carried out through discussions with experts in the field of green architecture and rapid construction. These measures aim to ensure that the research results have a high level of accuracy and can provide relevant insights for the construction industry and academia.

With this methodology, this research is expected to provide in-depth insights into the optimal strategy for implementing sustainable design in *fast-track projects*, as well as provide practical recommendations for developers, architects, and policymakers in the hospitality sector in Bali.

RESULT AND DISCUSSION

Applying Sustainable Design Principles in Fast-track Projects

The results of the study show that the implementation of sustainable design in *fast-track* projects in the hospitality sector in Bali has been carried out with various strategies to ensure energy efficiency, reduce carbon footprint, and increase building resilience to climate change. One of the key strategies is the use of local materials that have a low carbon footprint and are easier to obtain, such as natural stone, bamboo, and wood that are certified sustainable. The use of these materials not only reduces dependence on imported materials which has an impact on cost and time, but also supports the local economy by empowering local craftsmen and manufacturers of building materials.

In addition, the application of renewable energy technology is an important part of the implementation of sustainable design. The hotels used in the case study have adopted solar panels as the main source of energy for their operational needs. The use of this renewable energy system contributes to reducing electricity consumption from the main grid and reducing carbon emissions generated during hotel operations. Rainwater management systems and *grey water recycling* technology have also begun to be implemented to improve water use efficiency and reduce dependence on conventional water resources.

Passive design optimization is also a strategy implemented in *fast-track projects* to improve energy efficiency and occupant comfort. The use of natural ventilation, the orientation of the building that

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is adjusted to the movement of the sun, and the use of *shading devices* are important elements in reducing energy consumption for room cooling. The application of passive design is supported by a literature review [2] which emphasizes the importance of *the cradle-to-cradle* concept in sustainable development. The results of this study support this theory by showing that the use of local materials and passive design strategies not only reduces environmental impact, but also accelerates the construction process in *fast-track* projects with more efficient costs.

From the aspect of project management, this study finds that the application of modular construction systems can improve construction efficiency in *fast-track* projects while maintaining design sustainability. With this method, building elements can be produced off-site and assembled directly at the construction site, reducing material waste and speeding up construction time. This is in line with [9] study which states that the modular construction approach is able to improve resource efficiency without sacrificing architectural quality and environmental sustainability.

Overall, the results of this study confirm that the application of sustainable design in *fast-track* projects in the hospitality sector can be carried out with various strategies that are integrated with each other. The use of local materials, the application of renewable energy technologies, and the optimization of passive design are key factors in ensuring that rapid construction projects maintain sustainability principles. However, the main challenges faced in the implementation of this strategy are the lack of skilled workers in green technology and regulations that are often not flexible enough to accommodate sustainable construction methods.

Thus, collaboration between developers, local governments, and academics is needed to increase workforce capacity and develop regulations that support the application of sustainability principles in *fast-track* projects. In addition, it is important to continue to conduct further research on the effectiveness of various sustainability technologies in the context of rapid construction, so that a more optimal implementation model can be applied in future projects.

Challenges in Implementing Green Design in Projects with Accelerated Schedules

The implementation of green design in *fast-track* projects faces a variety of complex challenges, especially in terms of materials, costs, human resources, and regulations. One of the main challenges is the limited availability of green materials that can be produced and distributed in a short time. Many sustainable materials such as bamboo, certified wood, and eco-friendly concrete require a longer production process than conventional materials, so they do not always match the speed demands of fast-track *projects*.

In addition, higher initial costs are a significant obstacle in the implementation of green design. Sustainable materials are often more expensive than standard building materials, mainly due to more complex production processes and limited supply chains. While in the long run investments in green design can reduce operational costs through lower energy efficiency and maintenance, many developers are still reluctant to adopt them due to tight project budget pressures.

Human resources who have competence in green construction technology are also still limited. Many construction workers are not yet familiar with sustainable building techniques and systems, so additional training is needed to ensure effective implementation of green design. This lack of expertise can slow down the construction process and increase the risk of errors in the application of green technologies, such as stormwater management systems, optimal natural lighting, and natural ventilation designed to reduce energy consumption.

From a regulatory perspective, strict rules related to sustainability requirements often slow down decision-making in *fast-track* projects. While these regulations aim to encourage greener development, it often takes additional time to obtain the appropriate approvals and permits. Some projects have experienced delays due to design or material selection revisions to meet applicable sustainability standards.

According [11], the *fast-track* method has weaknesses in coordination between project planning and execution, which often leads to delays or inefficient design changes. The results of this study show that these obstacles also occur in the implementation of green design, where many projects have to be revised due to the lack of careful initial planning regarding the materials and energy systems to

be used. Delays in design decisions due to regulations and limited experts cause project costs to be higher and hinder smooth construction.

To address these challenges, a more adaptive strategy is needed in *fast-track* project management that integrates green design from the early planning stages. *Building Information Modeling* (BIM) technology can help in design simulation and sustainability analysis so that the selection of materials and energy systems can be designed more effectively. In addition, collaboration between the government, academia, and the construction industry is key in increasing the availability of more economical green materials and improving workforce training to support the implementation of sustainable construction in fast-paced projects.

With a more mature strategy and more flexible policy support, the challenges in implementing green design in *fast-track projects can be minimized, allowing the construction industry to achieve a more optimal* balance between accelerated development and environmental sustainability.

The Optimal Solution to Balance the Speed of Development and Sustainability

To overcome the challenges in implementing green design in *fast-track* projects, this study recommends several strategic solutions that can be implemented to achieve a balance between accelerating development and environmental sustainability. One of the main solutions is the application of *Building Information Modeling* (BIM) technology, which can optimize planning, improve project coordination efficiency, and reduce the risk of design errors and sudden changes during the construction process. BIM allows for more accurate sustainability simulations, so that aspects of green design can be optimally integrated from the early stages of planning [12]-[14].

In addition to the implementation of BIM, increasing workforce training in green technology aspects is an important step to ensure more effective implementation of sustainable design. Currently, the lack of a workforce with expertise in green technology is often a major obstacle in *fast-track* projects. Therefore, special training programs that focus on green construction methods, energy efficiency, and the use of sustainable materials need to be developed so that the workforce can understand and apply sustainability principles in fast construction.

The study also found that the application of modular and prefabricated designs can be an effective solution in reducing construction time without sacrificing sustainability aspects. The modular design allows building components to be manufactured off-site with better quality control and shorter construction times. This method also reduces construction waste and improves energy efficiency, according to the findings of [15]-[17], which highlights how green architecture in the hospitality sector provides long-term benefits in terms of both operational efficiency and customer satisfaction. The study shows that the implementation of modular design in several *eco-friendly* hotels in Bali has succeeded in improving energy efficiency while significantly accelerating construction time.

Flexible regulations and incentives for developers who implement green standards are also needed to support the implementation of sustainable design in *fast-track* projects. Local governments can play a role by providing ease of licensing for projects that implement green design and providing incentives in the form of tax breaks or subsidies in the use of sustainable materials. Thus, developers will be more encouraged to adopt sustainability principles in their projects without having to face bureaucratic obstacles that hinder the acceleration of development [18]-[21].

Overall, the study confirms that although the implementation of sustainable design in *fast-track projects* has complex challenges, technology-based solutions, flexible regulations, and the utilization of modular construction methods can help achieve a balance between accelerated development and environmental sustainability. With the right strategy, the hospitality industry in Bali can continue to grow without sacrificing the principles of green development, creating a more sustainable environment, and increasing the competitiveness of the hospitality sector in the face of the global trend of more environmentally friendly development.

CONCLUSION

The results of this study show that the application of sustainable design in *fast-track* projects can be done with the right strategy, such as using Building Information Modeling (BIM) technology to

optimize planning and using more environmentally friendly local materials. This technology allows developers to conduct design simulations, reduce construction errors, and ensure resource efficiency in the rapid construction process. While implementing sustainable design concepts has significant potential benefits, the main challenges faced are limited time in project planning and execution and compliance with evolving environmental regulations. Based on the research's results, several recommendations can be applied to improve the implementation of sustainable design in fast-track projects. First, local governments need to provide incentives to developers who implement green standards in their projects. These incentives can take the form of tax reductions, acceleration of the licensing process, or subsidies for the use of environmentally friendly technology. Second, improving education and training for construction workers is essential to increasing their understanding of green design. Third, further research needs to be conducted to explore the application of green design in *fast-track projects* in other sectors, such as the manufacturing industry and public infrastructure. With the widespread implementation *of fast-track* methods in various fields, a more in-depth study of how sustainability principles can be adapted in different contexts is needed. In addition, further research can be focused on how regulations can better support developers in adopting green design without hindering project efficiency.

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