



Integrative Risk and Performance-Based SIMBG Model for Sustainable Building Governance in Gianyar, Bali

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ABSTRACT

This study examines the implementation of the Building Management Information System (SIMBG) in Gianyar Regency, Bali, with a focus on its limitations in integrating risk- and performance-based evaluations into the building permit process. Despite being a national digital platform for building approvals (PBG) and functional certificates (SLF), SIMBG implementation remains largely administrative and lacks contextual adaptation to local cultural and environmental conditions. This research aims to develop an integrative model that combines building risk classification, performance evaluation, and local wisdom principles, such as Tri Hita Karana and Asta Kosala Kosali. A mixed-methods approach was employed, involving surveys, interviews, field observations, and Focus Group Discussions (FGD). Quantitative analysis used logistic regression and Analytic Hierarchy Process (AHP), while qualitative data were analyzed thematically. The results indicate that risk classification and performance indicators significantly influence the effectiveness of SIMBG. The proposed model enhances decision-making accuracy, improves regulatory compliance, and supports sustainable building governance. This study contributes to the development of digital public governance theory by integrating risk, performance, and cultural dimensions into a unified regulatory framework.

INTRODUCTION

The transformation of building permit systems in Indonesia has undergone a significant paradigm shift following the implementation of the *Sistem Informasi Manajemen Bangunan Gedung* (SIMBG), a centralized digital platform designed to facilitate the processing of *Persetujuan Bangunan Gedung* (PBG) and *Sertifikat Laik Fungsi* (SLF). This transformation represents a broader national agenda toward digital governance (*e-government*), aiming to enhance efficiency, transparency, and accountability in public service delivery. The legal foundation for this transformation is anchored in Government Regulation No. 16 of 2021, which mandates integrating administrative, technical, and spatial considerations into a unified digital system for building governance. Conceptually, SIMBG is expected to function not merely as an administrative tool but as a decision-support system that ensures compliance with technical standards, spatial planning regulations, and safety requirements.

Despite these regulatory and technological advancements, the practical implementation of SIMBG at the local government level reveals substantial discrepancies between policy expectations and operational realities. In Gianyar Regency, Bali—an area characterized by rapid urban development, tourism-driven infrastructure expansion, and strong adherence to local cultural values—the implementation of SIMBG has encountered multifaceted challenges. Empirical observations indicate a disproportionate trend between the increasing number of PBG applications and the relatively low issuance rate of SLF certificates. This imbalance suggests bottlenecks in the evaluation and verification processes, particularly in ensuring that constructed buildings meet functional, safety, and regulatory standards prior to certification.

Moreover, persistent violations of spatial planning regulations, including unauthorized construction in river setback zones, green open spaces, and disaster-prone areas, further highlight systemic weaknesses in the integration of spatial data within SIMBG. Although spatial planning instruments such as RTRW and RDTR are available, their operational integration with the SIMBG platform remains limited, resulting in fragmented decision-making. This condition reflects a critical gap in digital building governance, where data interoperability and real-time spatial validation have not been fully optimized.

A more fundamental issue lies in the absence of a structured risk-based and performance-based evaluation framework within the SIMBG system. Current evaluation practices tend to adopt a uniform approach, treating different building typologies—ranging from low-risk residential units to high-risk public facilities such as hospitals and sports complexes—under similar procedural standards. This lack of differentiation undermines the principle of proportionality in risk management, as emphasized in international frameworks such as ISO 31000. Consequently, buildings with higher potential impacts on public safety and environmental sustainability are not subjected to sufficiently rigorous assessment processes.

In addition to technical and regulatory limitations, the current SIMBG framework does not adequately incorporate local cultural dimensions, particularly in regions such as Bali, where architectural practices are deeply

rooted in traditional philosophies. Principles such as *Tri Hita Karana*, which emphasizes harmony between humans, nature, and the divine, and *Asta Kosala Kosali*, which governs spatial organization and building orientation, are integral to maintaining the cultural identity and sustainability of the built environment. However, these principles are often treated as peripheral considerations rather than systematically embedded in the evaluation criteria for building permits. As a result, many contemporary developments fail to reflect the contextual and cultural values that define Balinese architecture.

These challenges collectively indicate a significant research gap in the current discourse on digital building governance, particularly in the integration of risk management, performance evaluation, and cultural contextualization within a unified regulatory framework. Existing studies on SIMBG predominantly focus on administrative efficiency and system usability, with limited attention to its role as a comprehensive decision-making system that incorporates multidimensional evaluation criteria.

In response to these gaps, this study aims to develop an integrative SIMBG model that combines risk classification, building performance evaluation, and local cultural values into a coherent and operational framework. The proposed model seeks to transform SIMBG from a predominantly administrative platform into a dynamic, adaptive, and context-sensitive system that supports evidence-based decision-making in building governance. By incorporating risk-based differentiation, performance-based assessment, and culturally informed criteria, the model is expected to enhance the effectiveness, accuracy, and sustainability of building permit processes, particularly in regions with complex socio-cultural and environmental characteristics such as Gianyar Regency.

THEORETICAL FRAMEWORK

This study develops an integrative theoretical framework by synthesizing multiple disciplinary perspectives, including digital governance, risk management, building performance evaluation, and cultural architecture. The integration of these theoretical domains is essential for addressing the complexity of building governance systems, particularly in the context of digital transformation and local cultural adaptation.

Digital Governance Theory

Digital governance represents a transformation of traditional public administration into a technology-driven system that enhances efficiency, transparency, and accountability. In the context of building permit systems, digital platforms such as SIMBG are expected to serve not only as administrative tools but also as intelligent systems that support decision-making.

The Technology Acceptance Model (TAM), introduced by Davis (1989), provides a fundamental framework for understanding user interaction with digital systems. According to TAM, the effectiveness of a system is determined by two primary constructs: perceived usefulness and perceived ease of use. These constructs influence user acceptance, which in turn affects system performance and implementation success. Within SIMBG, these variables manifest as the

platform's usability, the clarity of procedures, the accessibility of data, and the system's responsiveness.

However, while TAM explains system adoption, it does not fully capture the complexity of regulatory decision-making in governance development. Therefore, this study extends digital governance theory by positioning SIMBG not only as a user-oriented system but also as a decision-support system that integrates technical, spatial, and regulatory dimensions.

Risk Management Theory

Risk management theory provides a structured approach to identifying, analyzing, and mitigating uncertainties that may affect system outcomes. The ISO 31000 framework emphasizes that risk assessment should consider both the probability of occurrence and the magnitude of impact. In the context of building governance, risk is associated with multiple dimensions, including building function, location, and potential socio-environmental impact.

Buildings such as hospitals, government facilities, and public infrastructure inherently carry higher levels of risk compared to residential structures. Therefore, applying a uniform evaluation process across all building types contradicts the principle of proportional risk management. The Project Management Body of Knowledge (PMBOK) further reinforces the importance of risk differentiation in decision-making processes.

Despite its relevance, risk management theory has not been systematically integrated into digital building permit systems such as SIMBG. This creates a theoretical gap in which regulatory decisions are made without a structured, risk-based framework. This study addresses this gap by incorporating risk classification as a primary variable influencing building evaluation processes.

Building Performance Theory

Building performance theory emphasizes evaluating buildings based on their ability to meet functional, safety, environmental, and user comfort requirements. The Post Occupancy Evaluation (POE) framework, developed by Preiser et al. (1988), provides a comprehensive method for assessing building performance after construction and occupancy.

POE evaluates buildings across multiple dimensions, including structural safety, functional efficiency, environmental sustainability, accessibility, and user satisfaction. These dimensions are critical in determining whether a building is suitable for its intended use, particularly in the context of SLF certification.

However, in current practice, building performance evaluation is rarely integrated into the permitting process. Instead, it is treated as a post-construction assessment rather than a regulatory requirement. This creates a disconnect between design approval (PBG) and operational validation (SLF). Consequently, buildings may receive approval without adequate consideration of their long-term performance.

This study bridges this gap by integrating performance indicators into the SIMBG evaluation process, transforming performance evaluation from a reactive assessment into a proactive regulatory instrument.

Cultural Architecture Theory

Cultural architecture theory highlights the influence of socio-cultural values on spatial organization and built form. Rapoport (1969) emphasizes that architecture is not merely a technical product but a cultural expression shaped by human behavior, beliefs, and environmental adaptation.

In the context of Bali, architectural practices are deeply rooted in local philosophies such as *Tri Hita Karana* and *Asta Kosala Kosali*. *Tri Hita Karana* promotes harmony between humans, nature, and the divine, while *Asta Kosala Kosali* provides guidelines for spatial organization, orientation, and proportionality in building design. These principles are essential in maintaining the cultural identity and sustainability of the built environment.

Despite their importance, these cultural values are not formally integrated into the SIMBG evaluation framework. This omission results in a regulatory system that prioritizes technical compliance over cultural contextualization. Consequently, many modern developments in Bali lack alignment with local architectural identity.

This study incorporates cultural architecture theory as a moderating variable, recognizing that local values can influence the relationship between regulatory systems and building performance outcomes.

Synthesis And Research Gap

The integration of the four theoretical perspectives—digital governance, risk management, building performance, and cultural architecture—reveals a significant gap in the current implementation of building governance systems, particularly within Indonesia's Sistem Informasi Manajemen Bangunan Gedung (SIMBG). Existing practices remain predominantly administrative, focusing largely on procedural compliance and document verification rather than incorporating analytical and adaptive mechanisms. As a result, several critical limitations emerge. First, there is a lack of risk-based differentiation in evaluation processes, in which buildings with varying levels of complexity and potential impact are assessed using relatively uniform criteria. Second, the lack of performance-based indicators limits the system's ability to evaluate whether buildings meet functional, safety, and sustainability standards beyond formal documentation. Third, cultural values, which play a crucial role in shaping architectural identity and spatial practices in regions such as Bali, are not systematically integrated into regulatory frameworks. Finally, there is no unified decision-making model that integrates these dimensions into a cohesive, operational system.

This study addresses these gaps by proposing a new conceptual framework that integrates digital governance mechanisms with risk classification, performance-based evaluation, and local cultural values into a single, coherent model. The framework aims to transform SIMBG from a static administrative tool into a dynamic, context-sensitive system that supports more accurate, efficient, and sustainable building governance.

Conceptual Framework

The conceptual framework developed in this study, as illustrated in Figure 1, demonstrates the interrelationships among key variables influencing building governance within the SIMBG system. The framework is structured around a set of independent variables, a moderating variable, and a dependent variable, which together form an integrated decision-making model. The independent variables consist of building risk and SIMBG system performance. Building risk encompasses functional risk, location-based risk, as well as environmental and socio-economic impacts associated with a building. These dimensions reflect the potential consequences of building failure or non-compliance and therefore play a critical role in determining the level of scrutiny required during evaluation. Meanwhile, SIMBG system performance encompasses factors such as system usability, data accuracy, regulatory compliance, and process efficiency, all of which influence the digital platform's effectiveness in supporting decision-making.

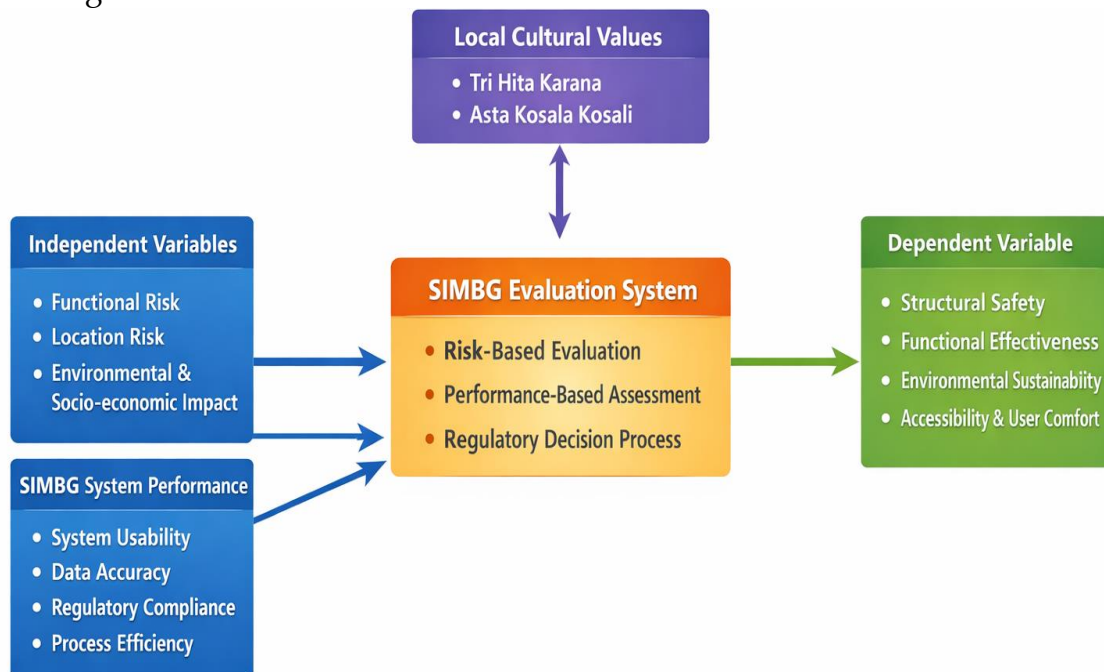


Figure 1. Conceptual Framework of Integrative Risk and Performance-Based SIMBG Model for Sustainable Building Governance

The framework also incorporates local cultural values as a moderating variable, specifically *Tri Hita Karana* and *Asta Kosala Kosali*. These principles influence how technical and regulatory criteria are interpreted and applied within the local context, ensuring that building development aligns with cultural identity, spatial harmony, and environmental balance. The inclusion of cultural values as a moderating factor represents an important advancement, as it acknowledges that governance systems must be responsive not only to technical requirements but also to socio-cultural conditions.

The dependent variable in this framework is building performance, measured across multiple dimensions: structural safety, functional effectiveness, environmental sustainability, and accessibility and user comfort. These

indicators provide a comprehensive assessment of whether a building meets the required standards for safe and sustainable operation. Overall, the framework illustrates a dynamic interaction among risk, system performance, and cultural values that shapes building performance outcomes, thereby providing a holistic approach to digital building governance.

Theoretical Contribution (Novelty)

This study offers several important theoretical contributions that advance existing knowledge in the fields of digital governance, risk management, and sustainable architecture. First, it expands digital governance theory by introducing a risk- and performance-based regulatory approach within a digital permitting system. Unlike conventional e-government models that primarily focus on administrative efficiency, this study emphasizes the need for adaptive, analytical mechanisms capable of responding to varying levels of building complexity and impact.

Second, the study integrates ISO 31000 risk management principles into building permit systems, thereby bridging the gap between risk theory and regulatory practice. This integration enables a more structured and proportionate evaluation process, in which decisions are informed by the potential risks associated with different building types.

Third, the research extends the application of Post Occupancy Evaluation (POE) by transforming it into both a pre- and post-regulatory evaluation framework. By incorporating performance indicators into the permitting process, the study shifts the role of POE from a purely evaluative tool to a preventive and decision-support mechanism within building governance systems.

Finally, the study introduces cultural architecture as a moderating variable within governance models, representing a novel contribution that is particularly relevant in culturally rich contexts such as Bali. By embedding *Tri Hita Karana* and *Asta Kosala Kosali* into the framework, the study demonstrates how cultural values can enhance regulatory effectiveness, stakeholder acceptance, and sustainability outcomes.

Taken together, the proposed framework represents a paradigm shift from conventional e-government systems to a contextualized digital building-governance model that is adaptive, multidimensional, and culturally responsive. This model not only addresses existing gaps in SIMBG implementation but also provides a foundation for future development of more integrated and sustainable governance systems.

METHODS

This study adopts a mixed-methods approach using an explanatory sequential design, as proposed by Creswell and Plano Clark (2018), to comprehensively examine the implementation of the Sistem Informasi Manajemen Bangunan Gedung (SIMBG) and to develop an integrative model based on risk, performance, and cultural values. This approach is considered appropriate because it enables the researcher to first identify statistical relationships among key variables through quantitative analysis and

subsequently deepen the understanding of these relationships through qualitative exploration. By combining both approaches sequentially, the study ensures a more holistic and robust interpretation of the research problem, particularly in capturing the technical, institutional, and socio-cultural dimensions of building governance.

The research is conducted in Gianyar Regency, Bali, a strategic study area characterized by rapid development, rising demand for building permits, and a strong cultural context rooted in traditional Balinese architecture. The study focuses on three representative building types with varying levels of risk and functional complexity: RSUD Sanjiwani Gianyar, a high-risk public health facility; the Gianyar Government Center (Puspem), an administrative complex; and the Gianyar Sports Complex (GOR), a public facility with high occupancy. These case studies are selected purposively to reflect different categories of building risk and to provide a comprehensive basis for evaluating the effectiveness of SIMBG implementation across diverse building typologies.

Data collection is carried out through multiple techniques to ensure data triangulation and validity. Quantitative data are obtained through a structured survey administered to at least 100 respondents, including architects, contractors, developers, and building permit applicants with experience using the SIMBG platform. The questionnaire is designed using a Likert scale ranging from one to five to measure respondents' perceptions of building risk classification, building performance indicators, system usability, and regulatory compliance. The sampling method used is purposive sampling, ensuring that all respondents possess relevant knowledge and practical experience in the SIMBG process.

To complement the quantitative data, qualitative data are collected through in-depth interviews and Focus Group Discussions (FGDs) involving key stakeholders, including officials from the Public Works and Spatial Planning Office (PUPR), SIMBG operators, professional consultants, and cultural experts. These qualitative methods aim to explore operational challenges, decision-making processes, and the integration of local cultural values into the building permit system. In addition, field observations are conducted at the selected case study locations to assess actual building conditions and performance. The observations focus on critical aspects such as structural safety, fire protection systems, accessibility, environmental performance, and compliance with spatial planning regulations. This direct assessment allows for a comparison between documented approvals and real-world building conditions.

Furthermore, document analysis is conducted to provide a regulatory and administrative context for the study. This includes the examination of SIMBG application records, PBG and SLF documentation, spatial planning documents such as RTRW and RDTR, and relevant national and local regulations. The integration of primary and secondary data sources enhances the reliability and comprehensiveness of the research findings.

Data analysis is performed using both quantitative and qualitative techniques. Quantitative data are analyzed through validity and reliability testing to ensure the consistency of the measurement instruments, followed by logistic regression analysis to examine the influence of independent variables,

namely building risk and SIMBG system performance, on the dependent variable, which is building performance. In addition, the Analytic Hierarchy Process (AHP) is applied to determine the relative weights of different risk factors, including functional risk, location risk, and socio-environmental impact. This method allows for structured decision-making and prioritization of variables based on expert judgment.

Qualitative data are analyzed using thematic analysis based on the framework developed by Miles, Huberman, and Saldaña (2014). This process involves coding, categorizing, and interpreting data to identify key themes and patterns related to system implementation, regulatory challenges, and cultural integration. The qualitative findings are then triangulated with quantitative results to ensure consistency and to provide a deeper contextual understanding of the research outcomes.

The final stage of the research involves developing and validating the proposed integrative SIMBG model. Validation is conducted through expert judgment involving five to seven experts from academic, governmental, and professional backgrounds, who evaluate the conceptual validity, practical applicability, and cultural relevance of the model. In addition, model simulation is performed using real building cases that have undergone the SIMBG process to assess the model's effectiveness in improving decision-making accuracy and consistency. This validation process ensures that the proposed model is not only theoretically sound but also operationally feasible and adaptable to real-world conditions.

Overall, the methodological approach of this study provides a comprehensive framework that integrates quantitative analysis, qualitative insights, and practical validation. This integrated methodology enhances the reliability of the findings and supports the development of a context-sensitive, adaptive digital governance model for building regulation.

RESULTS

The results of this study are derived from a combination of quantitative and qualitative analyses, aimed at evaluating the effectiveness of SIMBG implementation and developing an integrative model based on risk, performance, and cultural values. The findings reveal several significant relationships among the variables studied, indicating that the current building permit system can be substantially improved through a more structured and contextualized evaluation approach.

First, the analysis demonstrates that *risk classification plays a critical role in improving the accuracy of technical evaluation processes*, particularly for buildings with high functional and environmental risks. Logistic regression results indicate that buildings categorized as high-risk – such as hospitals, government facilities, and large public infrastructure – require more comprehensive and rigorous evaluation procedures than low-risk residential buildings. The absence of differentiated treatment in the current SIMBG system often leads to inefficiencies and inconsistencies in decision-making. By incorporating risk classification into

the evaluation process, the system becomes more adaptive and can allocate resources and scrutiny proportionally to the level of risk involved.

Second, the findings highlight that *building performance indicators significantly enhance decision-making quality*, especially in the issuance of *Sertifikat Laik Fungsi* (SLF). The integration of performance-based criteria—such as structural safety, functional adequacy, environmental sustainability, and accessibility—provides a more comprehensive basis for assessing whether a building is suitable for operation. The results indicate that when performance indicators are systematically applied, the likelihood of discrepancies between approved designs and actual building conditions is reduced. This contributes to improved reliability and accountability in the certification process, ensuring that buildings meet both technical and functional standards before being declared operational.

Third, the study reveals that *integrating local cultural values significantly strengthens regulatory compliance and contextual relevance*. Qualitative findings from interviews and FGDs indicate that incorporating principles such as *Tri Hita Karana* and *Asta Kosala Kosali* into the evaluation framework enhances stakeholder acceptance and aligns building practices with local identity. This integration not only improves compliance with cultural and environmental norms but also contributes to the sustainability of the built environment. In regions such as Gianyar, where cultural values play a central role in spatial planning and architectural design, incorporating these principles is essential to achieving a balanced and context-sensitive governance system.

Based on these findings, a risk-based classification of buildings is proposed to support differentiated evaluation procedures within the SIMBG framework. This classification categorizes buildings into three main levels based on their functional complexity, occupancy, and potential impact on public safety and the environment.

Table 1. Risk-Based Building Classification

| Risk Level | Criteria |
|------------|---|
| Low | Residential buildings with low occupancy and minimal environmental impact |
| Medium | Commercial buildings with moderate occupancy and operational complexity |
| High | Public facilities such as hospitals, government buildings, and mass gathering infrastructures |

The proposed classification provides a structured basis for determining the level of evaluation required for each building type, thereby enhancing the efficiency and effectiveness of the SIMBG process.

Furthermore, the relationship among the key variables in this study can be conceptually represented through the following model equation:

$$Y = f(\text{Risk} + \text{System Performance} + \text{Cultural Integration}) \dots\dots\dots (1)$$

This equation illustrates that *building performance* (*Y*) is influenced by the combined effects of building risk, SIMBG system performance, and the integration of local cultural values. The model emphasizes that optimal building

governance cannot rely solely on technical or administrative factors but must also consider contextual and cultural dimensions.

Overall, the results confirm that integrating risk classification, performance evaluation, and cultural values into the SIMBG system significantly enhances its effectiveness as a digital governance tool. The proposed model not only improves the accuracy and reliability of decision-making processes but also ensures that building development aligns with regulatory standards, safety requirements, and local cultural identity.

DISCUSSION

The findings of this study confirm that the implementation of the *Sistem Informasi Manajemen Bangunan Gedung* (SIMBG) in Gianyar Regency remains predominantly administrative, with limited capability to function as an adaptive and intelligent decision-support system. The current system is largely oriented toward procedural verification and document compliance, rather than incorporating analytical mechanisms that differentiate building risk levels or systematically evaluate building performance. This condition reflects a broader limitation in digital governance systems, where technological adoption is not accompanied by substantive transformation in decision-making processes. As highlighted by Laudon and Laudon (2020), digital systems often fail to deliver optimal outcomes when they are not contextualized to local institutional, environmental, and socio-cultural conditions. In the case of Gianyar, the absence of contextual integration has resulted in inefficiencies, inconsistencies in evaluation outcomes, and a limited capacity to ensure compliance with both technical and spatial regulations.

The integration of a risk-based approach into the SIMBG framework represents a critical advancement in addressing these limitations. By aligning with the principles of ISO 31000, this study emphasizes the importance of proportional evaluation based on the potential impact of different building types. High-risk buildings, such as hospitals, government facilities, and public infrastructure, require more rigorous and comprehensive evaluation procedures than low-risk residential buildings. However, the existing SIMBG system does not adequately differentiate between these categories, leading to inefficiencies in resource allocation and evaluation accuracy. The proposed model introduces a structured classification of building risk, enabling a more targeted and adaptive evaluation process that enhances both effectiveness and accountability in regulatory decision-making.

At the same time, the incorporation of building performance indicators into the SIMBG framework extends the application of Post Occupancy Evaluation (POE) theory beyond its traditional role. Conventionally, POE is applied after a building is occupied to assess its functionality, safety, and environmental performance (Preiser et al., 1988). In contrast, this study demonstrates that performance indicators can be integrated into the permitting process as a proactive evaluation mechanism. By embedding performance-based criteria into the evaluation of PBG and SLF, the system is transformed from a reactive assessment tool into a preventive regulatory instrument. This integration

reduces the gap between design approval and operational validation, ensuring that buildings are not only compliant on paper but also capable of performing effectively in real-world conditions.

A further critical dimension of this study is the integration of local cultural values into the building governance framework. The inclusion of *Tri Hita Karana* and *Asta Kosala Kosali* introduces a culturally grounded perspective that complements technical and regulatory considerations. These principles emphasize harmony between humans, nature, and the spiritual realm, as well as spatial order and proportionality in architectural design. The findings indicate that incorporating these values into the SIMBG evaluation process enhances regulatory compliance, strengthens stakeholder acceptance, and ensures that development aligns with local identity. This is particularly significant in Bali, where cultural values are deeply embedded in spatial planning and architectural expression. The integration of cultural principles thus contributes not only to regulatory effectiveness but also to the sustainability and authenticity of the built environment.



Figure 2. Integrative Risk and Performance-Based SIMBG Model for Sustainable Building Governance in Gianyar

The relationships among risk, system performance, building performance, and cultural values are further conceptualized in Figure 2, which presents the Integrative Risk and Performance-Based SIMBG Model for Sustainable Building Governance in Gianyar. The model illustrates a layered, dynamic system in which building risk and SIMBG system performance serve as primary inputs influencing the evaluation process within the SIMBG platform. These inputs are processed through several interconnected modules, including risk classification, technical evaluation, performance assessment, and cultural evaluation. The cultural dimension, represented by *Tri Hita Karana* and *Asta Kosala Kosali*, functions as a moderating variable that shapes how technical and regulatory criteria are interpreted and applied. The output of this integrated process is building performance, which encompasses safety, functionality, sustainability,

and accessibility. Ultimately, the model yields broader outcomes, including improved decision-making accuracy, enhanced regulatory compliance, and sustainable building governance.

The integration depicted in Figure 2 demonstrates that effective building governance cannot rely solely on administrative procedures or technical standards. Instead, it requires a multidimensional approach that combines risk-based differentiation, performance-based evaluation, and cultural contextualization within a unified digital system. This model represents a paradigm shift from conventional e-government systems toward a more adaptive and context-sensitive digital governance framework. By embedding risk, performance, and cultural values into the SIMBG system, the proposed model not only improves the efficiency and reliability of the building permit process but also ensures that development outcomes are aligned with sustainability principles and local identity.

Overall, the discussion highlights that transforming SIMBG into an integrative, risk- and performance-based system is essential to addressing the current limitations of building governance in Gianyar. The proposed model provides both theoretical and practical contributions by bridging the gap between digital governance, risk management, building performance evaluation, and cultural architecture. As such, it offers a replicable framework that can be adapted to other regions facing similar challenges in balancing regulatory efficiency, technical accuracy, and cultural sustainability.

CONCLUSIONS AND RECOMMENDATIONS

This study concludes that the current implementation of the *Sistem Informasi Manajemen Bangunan Gedung* (SIMBG) in Gianyar Regency requires significant enhancement to function effectively as a comprehensive digital governance system. The findings indicate that the existing system remains predominantly administrative, lacking adaptive mechanisms for risk-based differentiation and performance-based evaluation. As a result, the system is not yet fully capable of addressing the varying levels of complexity and impact associated with different building types. The absence of structured risk classification and performance indicators has contributed to inefficiencies in the evaluation process, particularly in ensuring the alignment between building design, construction, and operational performance.

The proposed integrative model developed in this study demonstrates that incorporating building risk classification, system performance variables, and performance-based evaluation significantly improves the efficiency, accuracy, and reliability of decision-making within the SIMBG framework. By introducing a structured approach that differentiates evaluation procedures by building risk level, the model enables a more proportionate and targeted regulatory process. Furthermore, the integration of performance indicators ensures that buildings are assessed not only for compliance with technical documents but also for their functional, environmental, and operational performance. This transformation enhances the credibility and effectiveness of both the *Persetujuan Bangunan Gedung* (PBG) and *Sertifikat Laik Fungsi* (SLF) processes.

An important conclusion of this study is the critical role of cultural integration in achieving sustainable building governance, particularly in regions such as Bali, where local values strongly influence spatial and architectural practices. The incorporation of *Tri Hita Karana* and *Asta Kosala Kosali* into the evaluation framework ensures that development is aligned with local identity, environmental harmony, and social values. This cultural dimension not only enhances regulatory compliance but also strengthens stakeholder acceptance and supports the long-term sustainability of the built environment. Therefore, the integration of cultural principles is not merely complementary but essential in the development of context-sensitive governance systems.

Based on these findings, several key recommendations can be proposed to improve the implementation of SIMBG in Gianyar and potentially in other regions with similar characteristics. First, it is recommended that a formal risk classification system be adopted within the SIMBG framework to differentiate evaluation procedures based on building function, location, and potential impact. This classification should be integrated into the digital workflow to ensure that high-risk buildings receive more rigorous assessment and supervision. Second, building performance indicators, particularly those derived from Post Occupancy Evaluation (POE), should be incorporated into the SLF process as a standard requirement. This would enable a more comprehensive evaluation of building readiness and reduce the gap between design approval and actual performance.

Furthermore, it is recommended that local governments develop regulatory instruments, such as a *Peraturan Bupati* (Perbup), to formalize the implementation of the proposed integrative model. Such regulations should provide clear guidelines on risk classification, performance evaluation criteria, and the incorporation of local cultural values into building permit processes. This policy framework would ensure consistency, legal certainty, and institutional support for implementing a more adaptive and context-sensitive SIMBG system.

In conclusion, this study provides both theoretical and practical contributions by proposing a multidimensional model that integrates digital governance, risk management, building performance evaluation, and cultural architecture into a unified framework. The implementation of this model has the potential to transform SIMBG into a more effective, adaptive, and sustainable system, capable of supporting safe, functional, and culturally responsive building development.

FURTHER STUDY

Despite the comprehensive approach adopted in this study, several limitations provide opportunities for further research. Future studies are recommended to expand the implementation of the proposed integrative SIMBG model across different regions in Indonesia with varying socio-cultural, environmental, and regulatory contexts. Such comparative studies would enable evaluation of the model's adaptability and scalability, particularly in regions that do not share Bali's cultural characteristics. By applying the model in diverse

settings, researchers can refine its components and develop a more generalized framework for national-level implementation.

In addition, further research should explore integrating the SIMBG system with Geographic Information System (GIS)-based spatial data to enhance the accuracy and efficiency of spatial validation processes. The incorporation of real-time spatial data, including zoning regulations, disaster-prone areas, and environmental constraints, would strengthen SIMBG's decision-making capacity and reduce spatial planning violations. This integration is essential for achieving a more holistic digital governance system that connects regulatory, technical, and spatial dimensions.

Moreover, the development of Artificial Intelligence (AI)-based decision support systems presents a promising direction for future research. By utilizing machine learning algorithms and predictive analytics, SIMBG could evolve into a more intelligent platform capable of automatically classifying building risk, identifying potential regulatory inconsistencies, and providing recommendations for technical evaluation. Such advancements would not only improve efficiency but also enhance the consistency and objectivity of decision-making processes. Therefore, future research should focus on designing and testing AI-driven modules that can be integrated into the SIMBG framework to support adaptive and data-driven building governance.

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