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Green Building Certification Determining Factors in Bali, Indonesia for Contextual Sustainability

Ni Wayan Meidayanti Mustika[1,*], I Dewa Gede Diasana Putra[2], Ngakan Ketut Acwin Dwijendra[2], I Made Adhika[2]

[1]Department of Architecture, Faculty of Engineering and Planning, Warmadewa University, Bali, Indonesia
[2]Faculty of Engineering, Udayana University, Bali, Indonesia

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Abstract This study aims to identify the factors influencing green building certification in Bali, Indonesia, with a focus on contextual sustainability, particularly socio-cultural aspects. The green building movement is gaining traction globally and has found its way to Indonesia, promoting sustainability in the construction sector through various certification systems such as Greenstar, BREEAM, LEED, DGNB and Greenship. However, implementation in Bali presents unique challenges and opportunities due to its rich cultural heritage and local architectural principles. The first green building certification in Bali began with a pilot project in Gianyar Regency in 2018, indicating a nascent but growing interest. Despite the growing global push for sustainable buildings, adoption in Bali has been modest, with only ten projects certified to date, mostly government buildings. This limited uptake highlights the need to understand the contextual factors influencing green building certification in Bali. The research used a mixed methods approach, integrating qualitative and quantitative analysis. Data collection included in-depth interviews and questionnaires distributed to stakeholders involved in green building projects in Bali. The findings revealed three main groups of influencing factors: Green Building Performance, Rules and Regulations, and Socio-Culture. Among these, socio-cultural aspects emerged as particularly significant, reflecting the importance of aligning green building practices with Balinese architectural traditions and local community values. This study highlights the critical role of contextual factors in green building certification in Bali. Integrating local cultural values and traditional architectural principles with green building standards can increase the acceptance and effectiveness of sustainable building practices in Bali. The findings suggest a pathway towards more sustainable development in Bali that respects and preserves its unique cultural identity while advancing environmental sustainability goals.

Keywords Green Building, Certification, Bali, Contextual Sustainability, Socio-cultural Aspects

1. Introduction

The green building certification phase involves the evaluation and assessment of buildings to determine their sustainability and environmental performance. It promotes sustainable practices in the construction industry by providing assessment tools for the entire life cycle of a project, from design to demolition [1], [2]. Various certification schemes and standards such as Greenstar, BREEAM, LEED, DGNB and Greenship are used to assess and certify the performance of green buildings [3], [4], [5]. These certification aspects include criteria such as appropriate site development, water efficiency, energy efficiency, indoor comfort, sustainable materials and waste management. By achieving green building certification, project teams can demonstrate their commitment to environmental sustainability and help reduce the environmental footprint of the construction industry.

The green building certification movement at the international level has also started to develop in Indonesia, along with the presence of rating tools for building certification. Two rating tools can be used in green building certification in Indonesia, namely Greenship from the Green Building Council Indonesia (GBCI) and the assessment of green building performance based on Regulation No. 21 of 2021 on Green Buildings from the Indonesian Ministry of Public Works and Housing. The current state of the certification system, which is more widely used because it can be integrated into the building permit process, is the government's rating tools. This is also supported by a pilot project - a market building project for the certification of government buildings at the district level, initiated by the Indonesian government with funding from the Ministry of Public Works and Housing.

Several studies have discussed the importance of green building responsiveness to local values and local aspects of the architectural embodiment of the building for contextual sustainability. The approach to architectural design and green building development in Bali is a different phenomenon from general practices because it has to integrate green building principles with a design approach that has been applied before, namely the application of the principles of traditional Balinese architecture [6], [7], [8], [9]. The integration of these two principles in building design will lead to a commitment to ensure the implementation of one design criterion without eliminating the implementation of existing local criteria. This is the background of this research which aims to investigate the extent of green building certification in Bali. The first objective of this study is to identify factors that influence the process of green building certification in Bali for contextual sustainability, especially socio-cultural aspects. The second objective is to find out which factors are most influential in the green building certification process and the performance of certified green buildings. Through this research, it is expected to find factors that influence contextual harmonisation in the green building certification process in Bali that can support the movement to maintain cultural identity and traditional Balinese architectural values in the future.

2. Literature Review

2.1. Contextual Sustainability in Built Environment

The contextual concept of sustainability in green building certification is very important because it recognises that sustainability is not a concept that applies to all settings in general, but is strongly influenced by the local context in particular. Contextual sustainability refers to the consideration of specific contexts and their influence on sustainability initiatives. It involves understanding the local context within the institutional, cultural and normative elements that shape the development and effectiveness of sustainability [10]. Furthermore, contextual sustainability recognises the importance of understanding the (pre)conditions in which local energy transition initiatives operate and how these conditions influence the co-design process [11].

The reasons why the concept of contextual sustainability is important are: (1) The ability to adapt to local circumstances. Contextual sustainability recognises that what works in one place may not be appropriate elsewhere. By taking into account local norms, culture and environmental conditions, organisations can effectively tailor their sustainability efforts; (2) A holistic approach: Contextual sustainability ensures a holistic approach by assessing an organisation's impact across these dimensions. It prevents a narrow focus on one aspect to the detriment of others; (3) Avoidance of harm, because without context, well-intentioned sustainability practices may inadvertently harm communities or ecosystems; (4) Resilience, where organisations operating sustainably within their context are better equipped to withstand shocks and adapt to change. Understanding local vulnerabilities and resources enables more resilient strategies; (5) Long-term viability, where sustainable practices adapted to local realities are more likely to endure. Organisations that adapt to their context build long-term viability, foster positive relationships with stakeholders and ensure continued success.

2.2. Indonesia's Government Green Building Certification System

The definition of Green Building according to the Regulation of the Ministry of Public Works and Public Housing No. 21 year 2021 is a building that meets the technical standards of building construction and has significant measurable performance in aspects of saving energy, water and other resources through the application of Green Building Principles by the functions and classifications in each stage of its implementation. Green Building Principles [2] include: a). The formulation of common goals, understanding and action plans; b). Reducing the use of resources, both in terms of land, materials, water, natural resources and human resources; c). Reducing the generation of waste, both physical and non-physical; d). Reuse of used resources; e). Use of recycled resources; f). Protection and management of the living environment through conservation efforts; g) Mitigation of safety, health, climate change and disaster risks; h). Life cycle orientation; i) Orientation towards achieving the desired quality; j). Technological innovation for continuous improvement; and k). Increased institutional, leadership and management support for implementation.

Green building certification in Indonesia applies generally and equally to all buildings to be certified within the scope of Indonesia according to Regulation No. 21 Year 2021 and Circular Letter No. 1 Year 2022 on Technical Guidelines for Green Building Performance Assessment of Indonesia's Ministry of Public Works and Public Housing. Specifically, it is mandatory to be certified as a certified green building for the government building with a minimum area of 5000 m^2. The phases in the certification and performance assessment of green buildings consist of the technical design phase, construction implementation, use and demolition. The criteria in each phase in general can be seen in Table 1 below.

Table 1. Green Building Rating Tools according to Regulation No. 21 year 2021 of Indonesia's Ministry of Public Works and Public Housing

Phase	Performance Criteria
Design	a. Site Management b. Energy efficiency c. Water efficiency d. Indoor Air quality e. Use of environmentally friendly materials f. Solid Waste Management g. Wastewater management
Construction	a. Green construction process b. Green behavior practices. c. Green Supply chain
Use and operational	a. Development of operational standards and procedures for Green Building utilization b. Implementation of operational standards and procedures for green building utilization
Demolition	a. Demolition methods with no damage to reusable materials b. Post-demolition site quality improvement efforts

The certification process when referring to Regulation No. 21 Year 2021 and Circular No. 1 Year 2022 on Green Building Practices in Indonesia will be integrated into the building permit application process. These green building performance criteria will apply throughout Indonesia, including the province of Bali. This requirement makes the certification process quite complex, as it must simultaneously meet the green building performance assessment and building permit requirements. More specifically, the building requirements in Bali Province have special provisions related to the mandatory requirement to apply traditional Balinese architectural principles as a local architectural identity. These two requirements will therefore influence how Bali's green buildings will look when certified.

2.3. Building Rules and Regulation in Bali

The characteristics of building design in Bali are very famous for the principle in maintaining the traditional Balinese cultural and architectural identity [12], [13], [14], [15]. In terms of regulation, this is also strongly supported by the existence of Regional Regulation No. 5 of 2005 [16] concerning building architecture requirements and related regulations at the smaller government level such as Mayor and Regent Regulations. As a reference to the visualisation of the regulation is referred in Figure 1.

The identity of Balinese architectural design can be recognised by the distinctiveness of the composition and shape of the building, the development of the building typology, the shape of the roof which is very easy to recognise, the use of local materials and also the use of a very specific ornamental variety which adds to the aesthetic beauty of the building. The factor of the philosophy of life of the Balinese people with the background of Hinduism along with the culture of customs also strongly supports the sustainability of Balinese architectural identity in contemporary buildings [17].

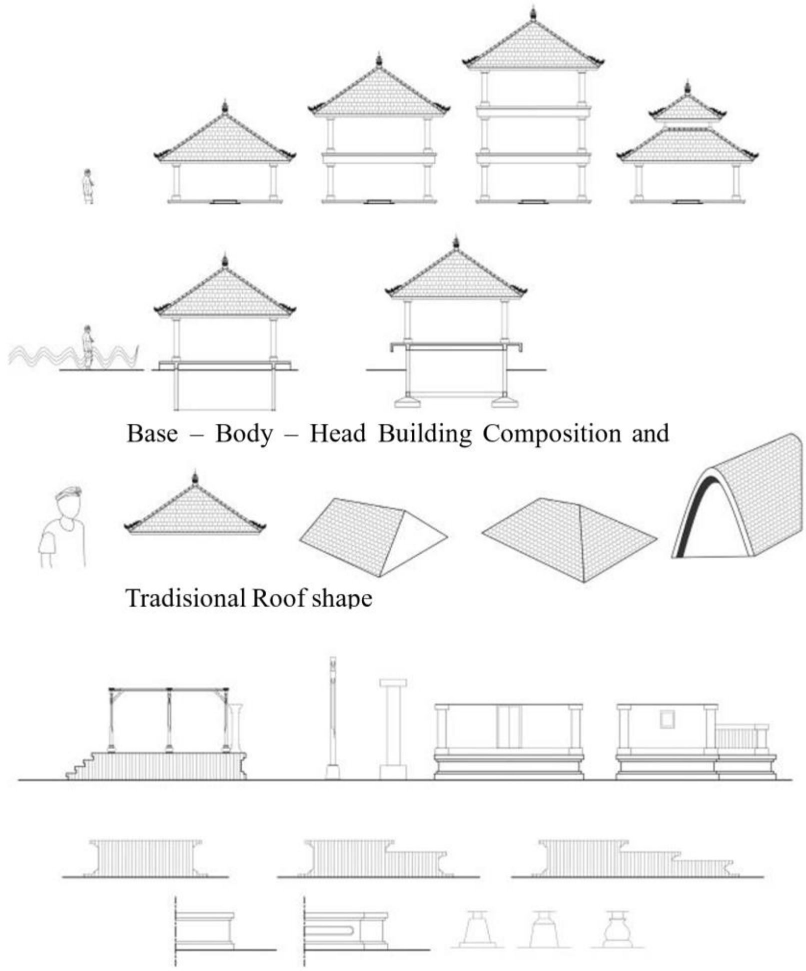

Figure 1. Balinese Traditional Architecture Basic principles according to Bali Province Regional Regulation No 5 Year 2005

3. Research Gap

Existing research still examines related topics separately, specifically research related to Balinese architectural identity. The research on how Balinese architectural identity has been carried out is related to the process of adapting building design responses to technological developments and the diversity of new architectural styles [14] [18] [19]. At a conceptual level, the term 'sustainability' is used to refer to the long-term viability of local wisdom concepts related to cosmology and religion. These include the concepts of Tri Hita Karana and Tri Angga, as well as other related concepts. The ongoing debate about the sustainability of Balinese architectural traditions and their integration with modern development is a central point of contention in the field of Balinese architectural studies [14]. This debate has been further elucidated by subsequent studies, including those by Balinese researcher [20], [21].

Studies related to green building research in Bali have not been widely conducted because the application of green building concepts in Bali is still relatively new and the acceleration occurred only after the issuance of government regulations in the form of Green Building Regulation and the initiation of commercial green building projects in the form of markets in various cities in Indonesia including Gianyar, Bali. The application of the green building concept in educational buildings with a case study at Green School Bali using concept analysis refers to the Green Building Council parameters resulting in a study that is still very general. [22]. The most recent research is related to the perception of Balinese users regarding the application of Green Hotels in Bali [23]. Other research with discussion of green building parameters that are still at the concept level and not in-depth analysis was carried out by assessing Badung Market in Bali [24] and an assessment of one residential house [25].

And also there are recent researches about sustainable materials that can be used in green buildings in Bali [26] and researches related to sustainable socio-cultural aspects in the behavior of green building users in Bali have been conducted [17] However, from the overall review of research that has been conducted, there is no research that focuses on the green building certification process in the province of Bali. Given the lack of research on Green Building in Bali, there is a significant opportunity for novel contributions to the body of knowledge on green building certification in this region.

4. Methodology

This research uses a mixed methods approach, which is a combination of qualitative and quantitative methods [27], [28]. The mixed method approach used is a sequential explanatory method where qualitative methods are first used to explore in-depth information about a phenomenon, and then quantitative methods are used to analyse the information obtained. The qualitative method in this study was used to identify the determinants of green building certification in Bali. The quantitative method is used to analyse the dominant and non-dominant factors that influence the certification process.

The first phase of the research is the qualitative research phase. At this stage, data collection is carried out using the in-depth interview method. Qualitative data is collected in the form of transcripts of the results of the in-depth interviews. The analysis stage begins with a qualitative approach using a content analysis method. This content analysis method is commonly used in research that involves tracing the emergence of content in the form of certain words, themes or concepts in qualitative data. This content analysis method is also commonly used in green building research. The qualitative data in this study is a transcript of discourse obtained from an in-depth interview process during the data collection stage [29], [30]. The steps in content analysis include defining the research question, selecting the sample, collecting the data, coding, analysing and interpreting the findings [31].

The second stage is the quantitative research stage. Data is collected in this part of the study using a questionnaire, resulting in quantitative data in the form of numerical data from the results of the questionnaire responses. The quantitative analysis phase begins with the compilation of a questionnaire that is returned to the stakeholders involved in the green building certification process in Bali. The questionnaire contains questions on factors that have been grouped and coded from the previous stage. The questionnaire data will then be analysed using factor analysis methods with the help of statistical software. At the beginning of the quantitative analysis, validity and reliability tests were carried out. Test validity refers to the extent to which a measuring instrument can accurately measure the specified variables. In the context of this analysis, validity is tested using the product-moment correlation technique, taking into account the significance value (Sig.), which is less than 0.05, and the correlation coefficient (r). Reliability testing refers to the consistency of measuring instruments in producing results in this study using Cronbach's alpha. Cronbach's alpha (α) is used to estimate the internal reliability of the question sets or items that make up the scale. Higher α values indicate greater reliability. In general, $\alpha \geqslant 0.6$ is considered acceptable, but a value of $\geqslant 0.7$ or higher is considered good.

5. Results and Discussion

5.1. Research Preparation

Green building certification in Bali started with a pilot project to certify one of the government owned buildings in Gianyar Regency in 2018, and to encourage the certification of green buildings in other areas. However, the green buildings in Bali that have been certified so far are not too many in number, only 9 projects, and also limited to government owned buildings. The locations of these certified buildings are in 5 of the 9 regencies in Bali Province. The building data in question can be seen in Table 2.

Table 2. Certified Green Building in Bali

	Building and Location	Certified in phase
1.	Gianyar Regency	
	Sukawati Market Block A	Design and Construction
	Sukawati Market Block B	Design and Construction
	Sukawati Market Block C	Design and Construction
2.	Buleleng Regency	
	Turyapada Tower	Design
3.	Karangasem Regency	
	Manik Mas Multistorey Parking Facilities	Design and construction
	Bencingah commercial area	Design and Construction
4.	Denpasar City	
	Denpasar Financial Training Center	Design (on process)
	Tunas Jaya Sanur Office Building	Design (on process)
5.	Negara Regency	
	State Public Market	Design

Source: processed from various sources, 2023

After mapping the certified green building project, the preparation continued with the tracking of stakeholders involved in green building projects in Bali. This was done to identify participants for this research. At this stage, a search was also carried out to identify government institutions as building owners or managers, while ensuring that stakeholder practitioners were included. This process was carried out to ensure that the selected participants were people who had an adequate understanding of the context of green building certification in Bali. This process resulted in 46 participants with sufficient insight and competence in the content of this research. The distribution of the background of the participants is shown in Table 3 below.

Table 3. Basic Information of interviewees and questionnaire population

Classification categories	Classifications basis	amount
Age	20 – 30 years	3
	31 – 40 years	17
	41 – 50 years	20
	Above 50 years	6
Gender	Male	28
	Female	18
Education	Undergraduate	11
	Master's degree and above	35
Regional origin	Bali area	28
	Other area	18
Green Building Project experience	0-1 years	14
	1-3 years	19
	More than 3 years	13
Roles in Green Building Project	Green building practitioners	19
	Government Expert	17
	Government employee related to Building permit	10

5.2. Factor Identification

The stage of identifying these factors is through conducting in-depth interviews with selected resource persons who are representatives of stakeholders involved in the certification of green buildings in Bali. From the results of the interviews conducted with stakeholders involved in the process of green building certification in Bali, three groups of statements emerge from the results of the interviews, namely: (1) Green building performance; (2) Rules and regulations; and (3) Socio-culture. The factors and sub-factors can be seen in Figure 2. The further explanation is as follows:

A. Green Building Performance

The performance of this green building is a factor related to the process of fulfilling the performance of the green building by the rating tools used in the performance assessment. In general, what many speakers conveyed this related to was the importance of fulfilling green building performance as an integral condition in the certification process. Some things that strongly influence the fulfilment of green building performance are (1) the competence of human resources involved in the certification process; (2) the value of investment and financing; (3) green building technology; (4) integration with local architecture; (5) the level of fulfilment of the performance of the targeted green building.

The competence of the human resources involved in the certification of green buildings is essential for planning and assessing performance in accordance with the assessment tools used. The competence of these human resources represents the human factor in the success of green buildings. The human resources referred to in this context are green building practitioners involved in green building projects as designers, performance assessors, construction supervisors and administrators. There are also bureaucratic or governmental stakeholders, such as the Indonesian Ministry of Public Works and Public Housing, who are involved in the implementation of building permits and the certification process. Another group of human resources are skilled green building practitioners who assist technical services in assessing the performance of green buildings. Based on the interviews, it was found that the level of understanding and competence of the human resources involved is not at the same level. The implementation of the certification process at the regency level needs to be supported by the competence of stakeholders who have the same understanding and level.

Investment and financing factors, which are frequently mentioned in the interview results, are closely related to the relatively higher initial investment for buildings that are not designed from the outset as green buildings. From the planning stage, financing will be relatively higher because of the need to involve green building consultants at the same time as building design. Construction costs will also be higher, as there are special rules for green building that need to be taken into account. In particular, the cost of materials and building automation will have a significant impact on construction costs.

Green building technology also comes up often in this interview, as the level of development is quite rapid and has begun to be widely used in Bali. One of them is the use of solar panels for alternative energy sources, which is even regulated in the Governor's Regulation No. 45 of 2019 on Bali Clean Energy. The issue of reinvestment is discussed in relation to the availability and affordability of technology components in green buildings. Prior to construction, the planning stage also actually requires the mastery of simulation technology to fulfil the performance of green building performance to facilitate the estimation of building performance achievements.

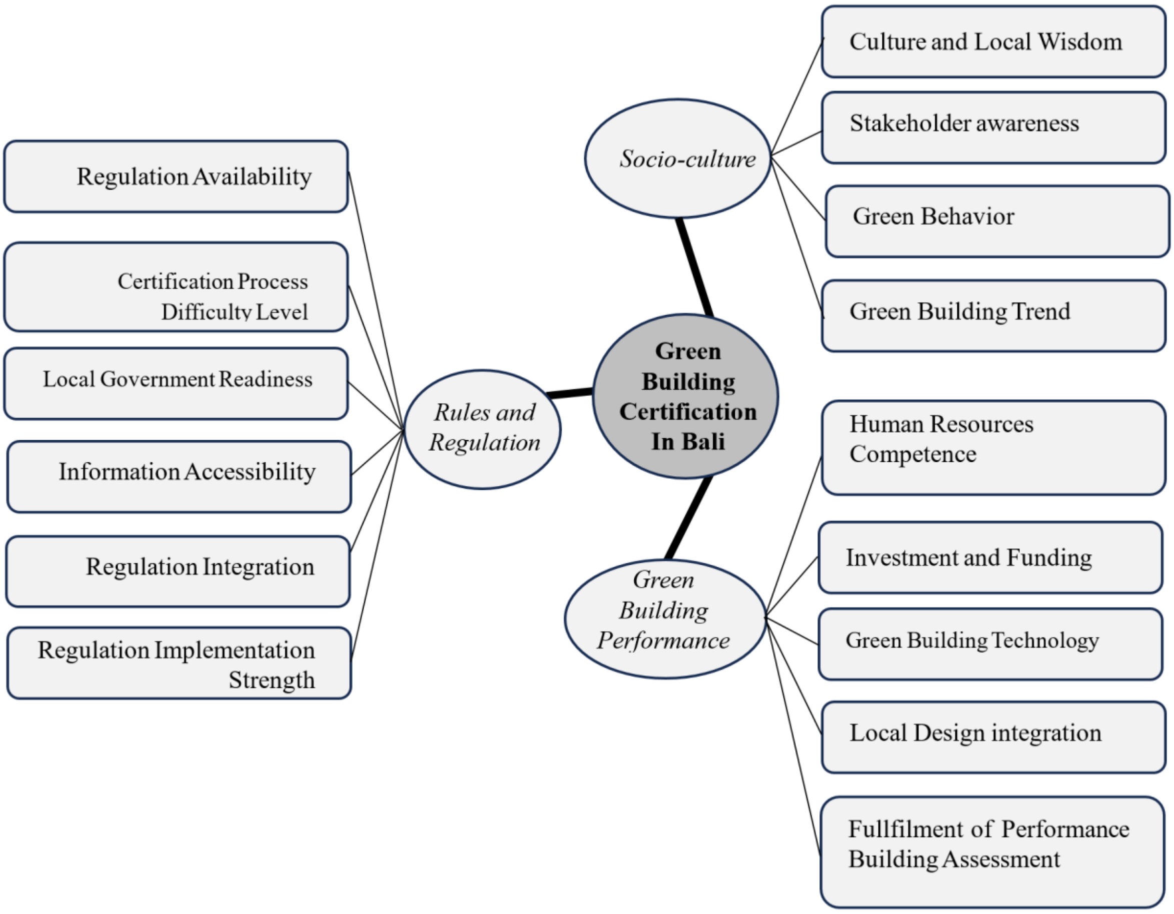

Figure 2. Green Building certification Factor Identification

The design of green buildings to meet the criteria for assessing the performance of green buildings must also take into account the local architecture and the availability of supporting components that have been included in these criteria. One example that is widely discussed is local materials and local climatic contexts. An important part that also appears a lot in interviews is the level achieved in green building performance assessment. The achievement levels regulated in the rating tools according to Government regulation are the *Utama* (the highest), *Madya* (the Intermediate level) and *Pratama* (the basic level). The higher the achievement of the target level, it can be ascertained that the effort made in fulfillment will increase. The process begins with the implementation of low-cost passive design strategies and progresses to the incorporation of green building technology, which often necessitates a significant initial financial investment. This factor will be greatly influenced by the purpose of certification and the commitment of the building owner or applicant in the certification process.

B. Rules and Regulations

The interview response statements related to rules and regulations factors include availability of government regulations related to green building both at national and regional levels, convenience of green building certification and building permit submission, willingness of local governments to facilitate, convenience of information access, integration of available regulations and the strength of implementation of regulations at the technical level of construction services.

Regulation is the most frequently mentioned factor in discussions with informants, as it refers to the certification process that is mandatory or only recommended for building owners. What is meant by regulations and policies are related regulations that promote the certification process of a building as a green building so that it must meet the criteria for evaluating the performance of green buildings. In this aspect of regulation, about building design, in the province of Bali itself, there are regulations related to building requirements that are binding on how building design in Bali must reflect and apply the principles of traditional Balinese architecture.

The development of green buildings in Indonesia is currently increasing as it is supported by relevant regulations. Regulation of the Minister of Public Works and Public Housing No. 21 of 2021 on Performance Evaluation of Green Building Buildings is a regulation for evaluating the performance of green building buildings in Indonesia. For technical guidelines on building performance, Circular No. 1/SE/M/2022 on Technical Guidelines for Evaluating the Performance of Green Building Buildings has also been issued.

Based on the results of the interview, it can be concluded that the strength of this regulation needs to be integrated with local Balinese building regulations in order to have an impact. With regulations at the national level, such as this ministerial regulation, it will be more powerful. Furthermore, it is important that in the process of planning buildings, especially government buildings, the requirement for building certification is included in the terms of reference for their activities. This will make it mandatory for every building designer to design his building according to the principles of Green Building.

C. Socio culture

Sociocultural aspects are a component that is very much inherent in the context of community life in Bali and affects everything including environmental planning, building and how building users are involved in activities within it. In general, from the interviewees' responses, the factors mentioned are related to (1) culture and local wisdom of the Balinese community; (2) stakeholder awareness of certification; (3) green behaviour; and (4) green building trends.

Statements about culture and local wisdom, which are often mentioned, relate to the need to apply traditional architectural principles in today's buildings, a very specific social system influenced by the religious system and beliefs of Balinese society. The concept of sustainability and environmental friendliness is an inseparable part of social life. One of the fundamental principles is the Tri Hita Karana philosophy, which includes the principle of respect for nature and the environment. The principles of traditional Balinese architecture also gave rise to passive design strategies and the use of local materials as a sustainable form of traditional architectural identity.

The results of the interviews also often show that the presence of green building in Bali is seen as something new and is still not widely understood by the general public. The level of awareness of the importance of green building is still only understood by a few stakeholders who are directly involved and have sufficient understanding. There are also frequent statements about the need for socialisation and education to a wider audience. The importance of this socialisation starting at the educational level was also mentioned, as well as the need for cooperation with educational institutions and industrial sectors related to the construction world.

Green behavior is also widely conveyed as an important factor in socio-cultural aspects. A lack of understanding of green building certification leads to a lack of awareness among stakeholders of the importance of green behaviour in achieving green building performance. Human factors related to green behaviour and awareness of the importance of sustainable development are issues that are widely discussed in the interviews.

The trend of green building in Indonesia has started to move from green building to net zero building. This was evident in the interview as most of the speakers participated in socialisation and workshops related to green building, both organised by the government and the Green Building Council Indonesia. The benefits of buildings that are certified as Green Building, both in terms of technical and energy efficiency and in terms of ease of bank financing, are beginning to be understood. This is also an important factor in changing people's minds and cultures in the general and business sectors of the construction world in Bali.

From the identification of factors carried out by the content analysis method, groupings of main and derivative factors are formulated. These data are then compiled and coded to facilitate the stages of statistical analysis that will be carried out at the next stage, which can be seen in the Table 4 below.

Table 4. Coding of identified factors

X	Green Building Performance
X1	Human Resources Competence
X2	Investment and Funding
X3	Green Building Technology
X4	Design Integration with local architecture
X5	Fulfillment of Green Building Performance Assessment
Y	Rules and Regulation
Y1	Rules and Regulations availability
Y2	permit and certification process difficulty level
Y3	Local Government Readiness
Y4	information accessibility
Y5	Regulation Integration
Y6	regulation implementation strength
Z	Socio-culture
Z1	Culture and Local Wisdom
Z2	Stakeholder Awareness of Certification
Z3	Green Behavior
Z4	Green Building Trend

5.3. Validity Test

In this study, the accuracy and reliability of measuring instruments are essential keys to ensuring the validity of the conclusions drawn. To achieve this goal, we conducted thorough validity and reliability tests on each item in the questionnaire designed to measure the relevant constructs in our research.

The use of Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity justifies the suitability of these data for factor analysis. KMO value indicates the suitability of the data for factor analysis, with values greater than 0.5 considered sufficient.

Bartlett's Test of Sphericity showed that the variables had sufficient correlation for factor analysis, with significance values less than 0.05. Communalities are used to measure the proportion of variance in each variable that can be explained by the factors extracted. The initial value of 1,000 adjusts based on extraction, with higher values indicating the variable closely matches the structure of the identified factor. It shows how well each item is correlated with the factors extracted

A. Validation Factor X (Green Building Performance)

The KMO value is 0.587 for Factor X, indicating that the data are moderately suitable for factor analysis. A KMO value greater than 0.5 indicates that the sample is sufficient for factor analysis. Bartlett's test of sphericity: A significant value (sig. < 0.05) confirms that the variables in the dataset are sufficiently correlated to perform factor analysis, thus validating the assumption that the data can be explained by fewer factors. The value of this commonality, which ranges from 0.479 to 0.766 for factor X, indicates that most of the variance in an item can be explained by the factor being extracted. The validation factor for Green Building Performance factors can be seen in Table 5.

Table 5. Validation Factor X (Green Building Performance)

Correlation Matrix (X)						
		X1	X2	X3	X4	X5
Correlation	X1	1.000	.108	.085	.156	.309
	X2	.108	1.000	.452	.296	.447
	X3	.085	.452	1.000	.258	.476
	X4	.156	.296	.258	1.000	.020
	X5	.309	.447	.476	.020	1.000

KMO and Bartlett's Test (X)		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.587
Bartlett's Test of Sphericity	Approx. Chi-Square	37.194
	Df	10
	Sig.	.000

Anti-image matrics (X)						
		X1	X2	X3	X4	X5
Anti-image Covariance	X1	.865	.049	.081	-.166	-.239
	X2	.049	.675	-.152	-.197	-.212
	X3	.081	-.152	.664	-.163	-.242
	X4	-.166	-.197	-.163	.826	.174
	X5	-.239	-.212	-.242	.174	.604
Anti-image Correlation	X1	.552a	.064	.107	-.197	-.331
	X2	.064	.681a	-.227	-.265	-.333
	X3	.107	-.227	.662a	-.220	-.382
	X4	-.197	-.265	-.220	.551a	.246
	X5	-.331	-.333	-.382	.246	.551a

Communalities (X)		
	Initial	Extraction
X1	1.000	.479
X2	1.000	.634
X3	1.000	.611
X4	1.000	.629
X5	1.000	.766

B. *Validation Factor Y (Rules and Regulations)*

The KMO value is 0.778 for Figure Y, demonstrating direct reasonableness of the information for figure examination. The value mentioned more than 0.5 shows that the test is adequate for calculate investigation. Bartlett's test of sphericity: sig. < 0.05) affirms that the factors within the dataset are adequately connected to perform figure investigation, hence approving the suspicion that the information can be portrayed in terms of less variables. Value extending from 0.476 to 0.831 for Calculate Y, shows that most of the change within the thing can be clarified by the extricated calculate. Coefficient for Validation factor within Rules and Regulations variables can be seen in Table 6.

Table 6. Validation Factor Y (Rules and Regulation)

Correlation Matrix (Y)							
		Y1	Y2	Y3	Y4	Y5	Y6
Correlation	Y1	1.000	.526	.285	.067	.326	.595
	Y2	.526	1.000	.277	.330	.452	.645
	Y3	.285	.277	1.000	.242	.169	.324
	Y4	.067	.330	.242	1.000	.320	.254
	Y5	.326	.452	.169	.320	1.000	.388
	Y6	.595	.645	.324	.254	.388	1.000

KMO and Bartlett's Test (Y)		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.778
Bartlett's Test of Sphericity	69.172	37.194
	15	10
	.000	.000

Anti-image matrics (Y)							
		Y1	Y2	Y3	Y4	Y5	Y6
Anti-image Covariance	Y1	.577	-.121	-.094	.139	-.069	-.194
	Y2	-.121	.492	-.016	-.121	-.128	-.194
	Y3	-.094	-.016	.849	-.148	.017	-.080
	Y4	.139	-.121	-.148	.798	-.163	-.046
	Y5	-.069	-.128	.017	-.163	.741	-.049
	Y6	-.194	-.194	-.080	-.046	-.049	.475
Anti-image Correlation	Y1	.759a	-.228	-.135	.205	-.106	-.371
	Y2	-.228	.785a	-.024	-.194	-.213	-.401
	Y3	-.135	-.024	.839a	-.179	.021	-.126
	Y4	.205	-.194	-.179	.676a	-.212	-.075
	Y5	-.106	-.213	.021	-.212	.845a	-.082
	Y6	-.371	-.401	-.126	-.075	-.082	.770a

Communalities (Y)		
	Initial	Extraction
Y1	1.000	.727
Y2	1.000	.831
Y3	1.000	.51=3
Y4	1.000	.476
Y5	1.000	.647
Y6	1.000	.830

C. Z Factor Validation (Socio Culture)

The KMO value for Factor Z is 0.685, indicating that the data are moderately suitable for factor analysis. A KMO score exceeding 0.5 indicates that the sample size is adequate for factor analysis. Bartlett's Test of Sphericity was conducted to ascertain the suitability of the data for factor analysis. The significant value ($p < 0.05$) corroborates the assumption that the variables in the dataset are correlated sufficiently to justify the application of factor analysis. The commonality values, which range from 0.476 to 0.831 for Factor Z, indicate that the majority of the variance in an item can be explained by the extracted factor. The validation factor for socio-cultural factors can be seen in Table 7.

Table 7. Validation Factor Z (Socio-culture)

Correlation Matrix (Z)					
		Z1	Z2	Z3	Z4
Correlation	Z1	1.000	.318	.261	.289
	Z2	.318	1.000	.743	.520
	Z3	.261	.743	1.000	.430
	Z4	.289	.520	.430	1.000

KMO and Bartlett's Test (Z)		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.685
Bartlett's Test of Sphericity	Approx. Chi-Square	53.789
	Df	6
	Sig.	.000

Anti-image matrics (Z)					
		Z1	Z2	Z3	Z4
Anti-image Covariance	Z1	.877	-.079	-.017	-.118
	Z2	-.079	.391	-.277	-.160
	Z3	-.017	-.277	.445	-.040
	Z4	-.118	-.160	-.040	.709
Anti-image Correlation	Z1	.859a	-.135	-.027	-.150
	Z2	-.135	.626a	-.664	-.305
	Z3	-.027	-.664	.643a	-.071
	Z4	-.150	-.305	-.071	.817a

Communalities (Z)		
	Initial	Extraction
Z1	1.000	.538
Z2	1.000	.888
Z3	1.000	.841
Z4	1.000	.737

D. *Overall Factor Validation*

After presenting the results for each group of factors, the next step is to analyse the overall value of the three groups of factors. The KMO value for the overall factor validation is 0.585, which clearly indicates that the data is suitable for factor analysis. This value that is more than 0.5 also means the overall sample is sufficient for factor analysis. Bartlett's test of sphericity confirms that the variables in the dataset are sufficiently correlated to perform factor analysis. This validates the assumption that the data can be explained by fewer factors. This Table 8 shows the loading factors for each factor. The principle of exploratory factor analysis is that each item can correlate with all factors, but a good item only has a high *loading factor* on the factor it measures. Loading factors above 0.4 are considered high. The Table 9 below shows the measures of sampling adequacy (MSA) from anti image metrics. The value ranges from lowest .504 – .823 for the highest value. This value shows that this data valid enough to analysis in the next phase.

Table 8. Overall Factor Validation

KMO and Bartlett's Test (overall)						
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.				.585		
Bartlett's Test of Sphericity	Approx. Chi-Square			278.321		
	Df			105		
	Sig.			.000		
Component Matrix (overall)						
	1	2	3	4	5	6
X1	-.007	.496	.361	.631	-.108	.063
X2	.693	.313	.127	-.041	.064	.087
X3	.401	.610	.105	-.249	.453	-.104
X4	.298	.206	.441	-.122	.025	.722
X5	.523	.603	-.108	.253	.060	-.303
Y1	.497	.157	-.674	.111	-.112	.284
Y2	.717	-.018	-.404	.036	-.088	-.056
Y3	.464	-.346	-.117	.143	.410	.402
Y4	.464	-.326	.171	.540	.043	-.067
Y5	.665	-.179	.085	-.070	-.557	.117
Y6	.748	.046	-.432	-.088	-.021	-.013
Z1	.472	.218	.300	-.439	-.462	-.104
Z2	.799	-.317	.294	.162	-.016	-.140
Z3	.679	-.320	.276	.117	.111	-.236
Z4	.556	-.242	.180	-.453	.329	-.140

Table 9. Anti metric validation for overall factor

Anti-image Matrices																
		Z1	Z2	Z3	Z41	X1	X2	X3	X4	X5	Y1	Y2	Y3	Y4	Y5	Y6
Anti-image Covariance	Z1	.493	-.042	.057	-.057	.006	.094	.012	-.163	-.141	.173	-.066	.056	.201	-.175	-.115
	Z2	-.042	.147	-.134	-.106	-.107	-.123	.046	.114	.051	-.025	.067	-.073	-.108	-.075	-.014
	Z3	.057	-.134	.280	.009	.110	.142	.013	-.155	-.130	.106	-.113	-.006	.064	.024	-.020
	Z41	-.057	-.106	.009	.520	.168	.045	-.172	-.038	.053	-.024	-.013	.001	.054	.059	.003
	X1	.006	-.107	.110	.168	.619	.061	-.002	-.176	-.164	.019	-.046	.065	.002	.088	.106
	X2	.094	-.123	.142	.045	.061	.323	-.092	-.171	-.130	.094	-.121	-.007	.143	-.046	-.024
	X3	.012	.046	.013	-.172	-.002	-.092	.497	-.117	-.153	.088	-.064	.018	.010	.051	-.044
	X4	-.163	.114	-.155	-.038	-.176	-.171	-.117	.553	.187	-.135	.164	-.096	-.156	-.055	.024
	X5	-.141	.051	-.130	.053	-.164	-.130	-.153	.187	.344	-.170	.099	.039	-.106	.049	-.012
	Y1	.173	-.025	.106	-.024	.019	.094	.088	-.135	-.170	.348	-.136	-.082	.139	-.106	-.148
	Y2	-.066	.067	-.113	-.013	-.046	-.121	-.064	.164	.099	-.136	.382	-.019	-.138	-.057	-.088
	Y3	.056	-.073	-.006	.001	.065	-.007	.018	-.096	.039	-.082	-.019	.680	-.005	.100	-.028
	Y4	.201	-.108	.064	.054	.002	.143	.010	-.156	-.106	.139	-.138	-.005	.521	-.069	-.060
	Y5	-.175	-.075	.024	.059	.088	-.046	.051	-.055	.049	-.106	-.057	.100	-.069	.402	.051
	Y6	-.115	-.014	-.020	.003	.106	-.024	-.044	.024	-.012	-.148	-.088	-.028	-.060	.051	.369
Anti-image Correlation	Z1	.588[a]	-.156	.155	-.112	.012	.234	.025	-.312	-.343	.418	-.151	.097	.396	-.393	-.270
	Z2	-.156	.596[a]	-.661	-.382	-.354	-.564	.171	.398	.227	-.111	.282	-.232	-.392	-.308	-.060
	Z3	.155	-.661	.562[a]	.024	.264	.472	.035	-.395	-.421	.339	-.344	-.014	.167	.073	-.063
	Z41	-.112	-.382	.024	.734[a]	.297	.109	-.338	-.070	.126	-.056	-.030	.002	.103	.130	.006
	X1	.012	-.354	.264	.297	.568[a]	.136	-.004	-.301	-.355	.041	-.094	.100	.004	.176	.223
	X2	.234	-.564	.472	.109	.136	.567[a]	-.230	-.406	-.392	.279	-.344	-.015	.349	-.128	-.069
	X3	.025	.171	.035	-.338	-.004	-.230	.634[a]	-.223	-.370	.211	-.146	.031	.019	.115	-.102
	X4	-.312	.398	-.395	-.070	-.301	-.406	-.223	.521[a]	.429	-.309	.358	-.156	-.290	-.117	.054
	X5	-.343	.227	-.421	.126	-.355	-.392	-.370	.429	.511[a]	-.493	.274	.081	-.251	.133	-.034
	Y1	.418	-.111	.339	-.056	.041	.279	.211	-.309	-.493	.521[a]	-.372	-.169	.326	-.283	-.413
	Y2	-.151	.282	-.344	-.030	-.094	-.344	-.146	.358	.274	-.372	.680[a]	-.037	-.309	-.144	-.235
	Y3	.097	-.232	-.014	.002	.100	-.015	.031	-.156	.081	-.169	-.037	.823[a]	-.008	.191	-.057
	Y4	.396	-.392	.167	.103	.004	.349	.019	-.290	-.251	.326	-.309	-.008	.504[a]	-.152	-.136
	Y5	-.393	-.308	.073	.130	.176	-.128	.115	-.117	.133	-.283	-.144	.191	-.152	.751[a]	.133
	Y6	-.270	-.060	-.063	.006	.223	-.069	-.102	.054	-.034	-.413	-.235	-.057	-.136	.133	.834[a]

5.4. Factor Analysis

Factor analysis in the study suggests that the items of the questionnaire can be grouped into larger factors, each of which represents a specific construct. Using the Principal Component Analysis (PCA) method, it successfully identifies the key components that represent the critical dimensions of this data.

A. Interpretation of research results

This study describes the process of factor analysis, from data conformity testing to factor extraction and interpretation of loadings. Highlight how the results of factor analysis support the grouping of questionnaire items into factors that represent the intended construct. Discuss the relevance of such factors to the aims of the study and how they help to understand the constructs being measured.

- Factors X, Y, and Z: Each factor represents a collection of closely interrelated variables. For example, if Factor X relates to 'Performance', then high-loading variables on this factor might measure performance-related aspects.
- Loading Factor: A variable with high loading on a particular factor is considered to have a significant contribution to the construct that that factor represents. This allows to name factors based on the characteristics measured by those variables.

For example, if Factor X reflects 'Performance', interpret the loading values for each item in this factor and discuss how each item contributes to the measurement of the 'Performance' construct. Explain how the identified factors help in conceptualizing the variables of this study and provide new insights into the data.

B. Conclusion of factor analysis

In this study, factor analysis was applied to test the conceptual structure of the measurement instruments used. The results of this analysis reveal the grouping of variables into factors consistent with the theoretical framework underlying the study, indicating the existence of a logical and theoretical structure in the data obtained. Through the Principal Component Analysis method, it succeeded in identifying the main factors that represent hypothesized constructs, with Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity confirming the suitability of the data for factor analysis.

First, an adequate KMO value indicates that the correlation pattern between survey items is strong enough for factor analysis. This, along with significant results from Bartlett's Test of Sphericity, reinforces the assumption that the variables in the questionnaire are interrelated and suitable for extraction into fewer factors. Furthermore, high communalities indicate that most variables have a strong correlation with the extracted factor, confirming that each item in the questionnaire contributes significantly to the construct it measures. This suggests that survey items effectively measure certain aspects of the phenomenon under study, according to the underlying theoretical concepts.

Analysis of the variance described by each factor shows that these factors collectively account for a significant proportion of the total variance in the data, suggesting that the factors hold strong explanatory forces against the construct being measured. This provides additional evidence of the construct validity of the measurement instrument.

Furthermore, an in-depth understanding of the structure of factors generated through the Component Matrix and Rotated Component Matrix allows for a clearer interpretation of how variables relate to the constructs being measured. High loadings on certain factors confirm a strong relationship between items and the constructs they represent, demonstrating reliability in the measurement of those constructs.

In conclusion, the results of the factor analysis provide convincing evidence that the measurement instruments we used in this study have strong construct validity. The factor structure consistent with the theoretical framework confirms that the instrument is capable of measuring desired constructs in a logical and theoretical way, reinforcing confidence in research findings and making important contributions to the literature in this field.

5.5. Influence Analysis

Influence analysis in the context of this study involves assessing the impact of independent variables (Y and Z) on dependent variables (X) through the use of simple linear regression and multiple linear regression. In this study, we investigated the influence of independent variables Y and Z on dependent variable X to understand the dynamics underlying the phenomenon under study. The analysis was conducted through two approaches: simple linear regression for each of the independent variables and multiple linear regression to assess the combined influence.

A. Simple Linear Regression

- **Effect of Y on X:** The regression model reveals a significant relationship between Y and X, with a coefficient of determination (R^2) of 0.158. This shows that about 15.8% variability in X can be explained by variability in Y. The regression model is formulated as $X = 49.598 + 0.247Y$, indicating that each increase of one unit in Y is associated with an increase of 0.247 units in X. The statistical significance of this model ($p < 0.006$) confirms that Y has a significant influence on X. The simple linear regression for factor Y on X can be seen in Table 10 below.

Table 10. Simple Linear Regression Analysis for Factor Y on X

Descriptive Statistics (Y → X)					
	Mean	Std. Deviation	N		
X	67.11	5.056	46		
Y	70.87	8.123	46		
Correlations (Y → X)					
		X	Y		
Pearson Correlation	X	1.000	.397		
	Y	.397	1.000		
Sig. (1-tailed)	X	.	.003		
	Y	.003	.		
N	X	46	46		
	Y	46	46		
Model Summary (Y → X)					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.397a	.158	.138	4.693	1.991
a. Predictors : (Constant), Y b. Dependent variable : X					

ANOVAa (Y → X)						
Model		Sum of squares	Df	Mean Square	F	Sig.
1	Regression	181.275	1	181.275	8.230	.006b
	Residual	969.181	44	22.027		
	Total	1150.457	45			
a. Dependent Variable: X b. Predictors: (Constant), Y						

- **Effect of Z on X:** A similar analysis shows that Z also has a significant effect on X, with a higher coefficient of determination (R^2 = 0.209). This signifies that 20.9% variability in X can be explained by Z. The regression equation X = 52.105 + 0.357Z shows the positive influence of Z on X, with strong significance ($p < 0.001$). The simple linear regression for factor Z on X can be seen in Table 11 below.

Table 11. Simple Linear Regression Analysis for Factor Z on X

Descriptive Statistics (Z → X)					
	Mean	Std. Deviation	N		
X	67.11	5.056	46		
Y	42.07	6.479	46		
Correlations (Z → X)					
		X	Y		
Pearson Correlation	X	1.000	.397		
	Z	.457	1.000		
Sig. (1-tailed)	X	.	.003		
	Z	.003	.		
N	X	46	46		
	Z				
Model Summary (Z → X)					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.457a	.209	.191	4.548	2.195
a. Predictors : (Constant), Z b. Dependent variable : X					

ANOVAa (Z → X)						
Model		Sum of squares	Df	Mean Square	F	Sig.
1	Regression	240.277	1	240.277	11.616	.001b
	Residual	910.179	44	20.686		
	Total	1150.457	45			
a. Dependent Variable: X b. Predictors: (Constant), Z						

The simple linear regression for factor Y and Z on X separately can be seen in Table 12 below.

Table 12. Simple Linear Regression coefficients for Math Model

Model		Unstandardized coefficients		Standardized Coefficient	t	Sig.	95,0% Confidence Interval for B		Collinearity Statistics	
		B	Std. error	Beta			Lower bound	Upper bound	tolerance	VIF
1	(constant)	49.598	6.143		8.074	.000	37.217	61.987		
	Y	.247	.086	.397	2.869	.006	.074	.421	1.000	1.000

a. Dependent Variable : X

Math Model : X = Math Model: X = 49,5 + 0,247 Y +e

Model		Unstandardized coefficients		Standardized Coefficient	t	Sig.	95,0% Confidence Interval for B		Collinearity Statistics	
		B	Std. error	Beta			Lower bound	Upper bound	tolerance	VIF
1	(constant)	52.105	4.453		11.701	.000	43.131	61.080		
	Z	.357	.105	.457	3.408	.001	.146	.568	1.000	1.000

b. Dependent Variable : X

Math Model : X = Math Model: X = 52,1 + 0,357 Z +e

B. Multiple Linear Regression

When considering the combined effect of Y and Z on X through multiple linear regression, the model becomes more complex. The combined coefficient of determination (R^2 = 0.239) shows that about 23.9% of the variability in X can be explained by a combination of Y and Z. However, in the context of the combined model, only Z shows a significant effect on X ($p < 0.038$), while Y shows no statistical significance ($p = 0.202$). This suggests that, although Y has an influence when analyzed separately, its influence becomes insignificant when analyzed in conjunction with Z. The multiple linear regression analysis for factors X, Y and Z can be seen in Table 13.

The results in Table 14 show that when simultaneously only Z has a significant effect on X. The final value (X) can be described by Y and Z in the regression equation X = 46.7 + 0.129 Y + 0.267 Z + e.

The coefficient of determination is 20.3%. The remaining 79.7% is explained by factors other than the variables in the regression equation.

The result of the influence analysis in this study underlines several key aspects that are important to understand in the context of the variables of the factors studied. The following is a more detailed explanation of the result that can be drawn from the analysis of the influence of Y (rules and regulation factors) and Z (socio-culture factors) on X (green building performance), based on simple and multiple linear regression:

Significant effects of independent variables separately

- Y on X: A simple linear regression analysis shows that Y has a significant positive influence on X. This means that changes in the variable Y are associated with unidirectional changes in X. In other words, as the value of Y increases, the value of X also tends to increase. The coefficient of determination (R^2) shows that approximately 15.8% of the variability in X can be explained by the variability in Y. This suggests a significant, though not dominant, relationship between Y and X.
- Z on X: Z has a stronger influence on X than Y, with a higher coefficient of determination (R^2 = 0.209). This indicates that Z is a better predictor of X and makes a more significant contribution to the variability in X. The presence of Z has a positive effect on the value of X, and an increase in Z will increase X. The Combined Effect of Y and Z on X.
- When Y and Z are analyzed together in a multiple linear regression model, the combined coefficient of determination shows an increase in the model's ability to explain variability X (R^2 = 0.239). However, this combined influence reveals a more complex dynamic in which only Z is statistically significant in influencing X, while Y's influence becomes insignificant.

From the above, the results of this research can be formulated theoretically and practically. Theoretically, the conclusions from the influence analysis strengthen our understanding of the factors that influence X (green building performance). In a theoretical context, these results support a theory or model that proposes Z (socio-culture) as a more critical factor in influencing X (green building performance) than Y (rules and regulations). These findings challenge or reinforce existing conceptual models of the relationships between these variables. From a practical perspective, the finding that Z (socio-culture) has a more significant influence on X (green building performance) may lead stakeholders or practitioners to focus more resources or interventions on factors related to socio-cultural factors in Bali that affect green building certification. This confirms the importance of Z as an independent variable that has a significant effect on X, either separately or in combination with Y. Although Y also affects X separately, its effect becomes insignificant when analysed in combination with Z. These conclusions not only provide important insights for the theory underlying the relationships between variables but also offer practical direction for enhancement or intervention that Targeted.

Table 13. Multiple Linear Regression Analysis for Factors X,Y and Z

Descriptive Statistics (Y and Z → X)

	Mean	Std. Deviation	N
X	67.11	5.056	46
Y	70.87	8.123	46
Z	42.07	6.479	46

Correlations (Y and Z → X)

		X	Y	Z
Pearson Correlation	X	1.000	.397	.457
	Y	.397	1.000	.555
	Z	.457	.555	1.000
Sig. (1-tailed)	X	.	.003	.001
	Y	.003	.	.000
	Z	.001	.000	.
N	X	46	46	46
	Y	46	46	46
	Z	46	46	46

Model Summary(b) (Y and Z → X)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.488a	.239	.203	4.513	2.108

a. Predictors : (Constant), Z, Y
b. Dependent variable : X

ANOVAa (Y and Z → X)

Model		Sum of squares	Df	Mean Square	F	Sig.
1	Regression	274.488	2	137.244	6.737	.003b
	Residual	875.968	43	20.371		
	Total	1150.457	45			

a. Dependent Variable: X
b. Predictors: (Constant), Z, Y

Table 14. Multiple Linear Regression Coefficient for Factors X,Y and Z

Model		Unstandardized coefficients		Standardized Coefficient	t	Sig.	95,0% Confidence Interval for B		Collinearity Statistics	
		B	Std. error	Beta			Lower bound	Upper bound	tolerance	VIF
1	(constant)	46.737	6.057		7.716	.000	34.521	58.952		
	Y	.129	.100	.207	1.296	.202	-.072	.330	.692	1.444
	Z	.267	.125	.342	2.139	.038	.015	.519	.692	1.444

a. Dependent Variable : X
b. Independent Variable : Y,Z
Math Model : X = 46.7 + 0.129 Y + 0.267 Z + e

5.6. Limitation of the Research

Some initial assumptions and limitations in the conduct of the research will affect the results. The projects that have been certified as green buildings in Bali are government buildings and are managed by the government or related institutions in small numbers. This research will under-represent the diversity of functions that can be designed into green buildings. The involvement of private stakeholders cannot be described in the context of this research.

This limitation also leads to a limited number of respondents representing stakeholders involved in the planning and development of green buildings in Bali. This condition will bring this research to the starting point of green building development in Bali, which will show the existing paradigm so that it can be a benchmark for its dynamics in the future. Research on green building still has a considerable opportunity to be followed up for future research. Qualitative and quantitative issues are still open for exploration. The characteristics of green building in Bali, which are strongly influenced by local cultural forces, will bring dynamics to the architectural design and construction of green buildings.

6. Conclusions

This research conclusion, based on the influence analysis, shows that Z (socio-cultural factors) is a stronger predictor of X (green building performance) than Y (regulatory factors), especially when analysed simultaneously. This provides important insights into the underlying dynamics of these variables and helps to identify the factors that most influence X. In the context of research, it is important to recognise the complexity of the relationships between variables and how certain factors may play a more dominant role in certain contexts. By understanding the influence of the independent variable on the dependent variable, the study makes a valuable contribution to the literature, strengthens the underlying theoretical model, and provides practical insights for evidence-based interventions or decisions in related areas.

The results of this study show that sustainable development, and specifically green building certification, must take into account contextual factors, in this case factors related to socio-cultural aspects. One of the particularities is the existence of socio-cultural factors and Balinese architectural philosophy that need to be applied to green buildings in Bali. Although the rating tools do not include this criterion in their specific assessment, the exterior design of buildings in Bali must apply the principles of traditional Balinese architecture. From these results, it may be possible in the future to develop a green building rating approach that is more contextual to the local values and culture where these green buildings are being constructed. Harmonisation of this assessment will be needed in areas where there is a cultural identity that needs to be maintained in the midst of more contemporary development.

This research with the results of the factors and scope of issues in green building certification in Bali opens opportunities for further research with more specific topics and also with different research methods. At the regulatory level, for example, research opportunities related to the effectiveness of regulations and their influence on increasing the number of green buildings in Bali are interesting topics in an effort to find strategies to encourage building owners' interest in certifying their buildings. In the field of architectural planning, especially Balinese architecture today, it is interesting if green building research is directed at how these two approaches are integrated in one or more buildings in Bali Province. Cross-disciplinary research is also possible to develop green building research in Bali, considering that the concept of sustainability can be seen from other perspectives such as green economy, sustainable materials, green consumption and environmental sustainability in green buildings.

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