

Linking Green Intellectual Capital and Green Culture to Competitive Advantage through Green Innovation

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Abstract

Purpose: This study examines the mediating role of green innovation in the relationship between green intellectual capital and green culture on competitive advantage in the hotel industry in Bali, Indonesia.

Methodology: A causal-explanatory research design was employed, with data collected from 106 managers of three- to five-star hotels using purposive sampling technique. The study is grounded in the Natural Resource-Based View, and the data were analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS).

Results: The findings indicate that green intellectual capital and green culture have a positive and significant effect on green innovation. Green innovation has a strong, positive, and significant impact on competitive advantage. Green innovation also significantly mediates the relationship between green intellectual capital and green culture on competitive advantage, indicating a full mediation. Control variables such as gender and hotel classification had no significant effect on competitive advantage.

Conclusions: Green innovation functions as a crucial dynamic capability that converts intangible environmental resources, such as knowledge assets and cultural values, into tangible competitive advantages.

Limitations: This study is limited by its sample size of 106 respondents and its focus on three- to five-star hotels in Bali, which may restrict the generalizability of the findings to other regions or hotel types.

Contributions: This study contributes to the literature by extending the application of the Natural Resource-Based View in the hospitality sector. Practically, it highlights the importance of prioritizing green innovation as a key mechanism for leveraging intellectual capital and green culture to achieve sustainable competitive advantage.

Keywords: *Competitive Advantage, Green Culture, Green Innovation, Green Intellectual Capital, Sustainability*

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1. Introduction

The competitive paradigm of the global hospitality industry has undergone a fundamental shift over the last decade. Previously, competitive advantage was determined by tangible factors such as strategic location, star rating, and the completeness of physical facilities. However, the pressure for environmental sustainability has significantly altered the competitive landscape. The hospitality industry faces the critical challenge of transforming itself towards more environmentally friendly business practices without sacrificing service quality and profitability ([Gürlek & Tuna, 2018](#)).

This phenomenon is driven by the growing awareness of global consumers, stringent regulatory pressures, and stakeholder demands to internalize Environmental, Social, and Governance (ESG) principles in core business strategies ([K. A. K. Saputra, Laksmi, & Noordin, 2026](#)). Given that similar sustainability pressures and competitive dynamics are observed in other tourism-dependent economies, such as Thailand, Spain, and the Maldives, insights from the Balinese hospitality industry can offer transferable lessons and broader generalizability for hotel sectors worldwide facing the challenge of balancing environmental responsibility with market competitiveness.

Bali, a world-class tourism destination that serves as a benchmark for the recovery of Southeast Asia's hospitality industry, faces a paradox. The Balinese hospitality industry has reported remarkable post-pandemic resilience, with increasing occupancy rates and a rapid influx of new investments ([Xie, Abbass, & Li, 2024](#)). However, concerns regarding over tourism and environmental degradation remain undeniable. In this context, there is an urgent need to comprehensively understand how hotels in Bali can build a sustainable CA that is not focused on short-term profit. Pioneers such as Alila Villas Uluwatu, Potato Head Village, and Plataran Menjangan, with Earth Check Platinum certification, zero-waste philosophy, and a program in West Bali National Park, have proven that integrating sustainability and luxury is a significant competitive differentiator ([Dzhengiz & Niesten, 2020](#); [Mulatsih, 2025](#)).

The concept of sustainable competitive advantage in the hospitality industry cannot be separated from the role of intangible resources, which form the foundation of competitive advantages. In the expanded Resource-Based View (RBV) framework, an organization's ability to manage knowledge, culture, and innovative capabilities is a key determinant of value creation ([K. A. K. Saputra, Jayawarsa, & Laksmi, 2025](#)). Green Intellectual Capital (GIC) is a crucial construct that represents the accumulation of knowledge, experience, and organizational capabilities for managing environmental issues. GIC, comprising human, structural, and relational capital, serves as the foundation for hotels to develop coherent and effective environmental strategies ([Dzhengiz & Niesten, 2020](#)). Previous analyses have confirmed that GIC positively contributes to green CA in various contexts, including the hospitality industry in Spain and Pakistan ([El-Kassar & Singh, 2019](#)).

Green Culture (GC) plays a crucial role in transforming sustainability values into daily operational practices. A strong organizational culture in environmental aspects creates shared norms, value systems, and behavioral patterns that allow members of the organization to consistently prioritize ecological considerations ([García-Machado & Martínez-Ávila, 2019](#)). GC functions as a social control mechanism and catalyst that increases the adoption of innovative and environmentally friendly practices. In service industries such as hospitality, where the quality of interactions between employees and guests is a key determinant of satisfaction, internalizing environmental values through organizational culture is becoming increasingly important. This allows employees to take pro-environmental initiatives without waiting for formal instructions ([Abdullah et al., 2019](#)).

The mechanisms that transform the two resources require further exploration, even though GIC and GC are theoretically positioned as CA antecedents. Recent literature suggests that the relationship between organizational resources and performance is often indirect and mediated by the dynamic capabilities. In this context, Green Innovation (GI) is positioned as a dynamic capability that bridges knowledge resources and cultural values to achieve CA ([Chandra, Arafah, & Basri, 2021](#)). This variable includes developing environmentally friendly products and services and modifying operational processes to reduce ecological impacts. Empirical studies in various countries indicate that GI plays a significant mediating role, with the effect of GIC on CA becoming stronger when mediated by innovation capabilities ([Aulia, Siregar, & Aripin, 2024](#); [Gao, 2017](#)).

Intellectual capital and service innovation performance positively mediated the relationship between virtual human resource development practices and sustainable CA in Egyptian green hotels ([Aksoy, 2017](#)). Similar results were also reported in the context of the Pakistani hospitality industry, where green knowledge sharing strengthened the effect of GIC on green process innovation performance ([Özkan, Sarıışık, & Ulema, 2024](#)). The consistency across geographical contexts shows that the GI serves as a

crucial transmission mechanism. However, further testing in the specific context of Bali is needed because of the unique characteristics of the island's hospitality industry.

Bali's hospitality industry has characteristics that distinguish it from other destinations. As an internationally renowned destination, Bali's hotels face intense competitive pressures with a vast array of accommodation options, from budget hostels to ultra-luxury resorts ([Weng, Chen, & Chen, 2015](#)). In this hypercompetitive environment, possessing environmental knowledge or green values is not sufficient to create meaningful differentiation. Innovative capabilities are required to transform this knowledge and these values into tangible solutions that benefit guests. GI in the Balinese hospitality industry includes passive architectural design that reduces energy consumption, recycled water management systems, farm-to-table culinary programs, and guest experiences integrated with nature conservation, such as Viceroy Bali's 30-year land lease scheme for the forest.

Furthermore, previous studies examining the relationship between GIC and GC on CA through the mediation of GI leave several gaps. First, most studies were conducted in the context of manufacturing or the general industry. Meanwhile, the service industry has very different characteristics and is more oriented towards service and experience innovation than physical products. Second, studies that simultaneously examine the role of GIC and GC as antecedents in an integrated model are limited ([K. Saputra, Subroto, Rahman, & Saraswati, 2023](#)). GC facilitates the accumulation of intellectual capital, which strengthens cultural internalization. Third, the mediating effect of GI in the context of the Balinese hospitality industry has not been systematically tested.

The significance of this study is strengthened by the presence of the control variables. Demographic and organizational characteristics moderate the relationships between constructs. For example, five-star hotels may have greater resources to invest in GI than three-star hotels. However, smaller hotels are often more agile in adopting innovations ([K. Saputra & Paranoan, 2024](#)). Gender perceptions of environmental issues vary and affect the effectiveness of GC implementation ([K. A. K. Saputra & Laksmi, 2024](#)). In this context, controlling for variables is crucial to obtain unbiased estimates. This study aims to empirically test the mediating role of GI in the relationship between GIC and GC on CA, considering the complexity of the phenomenon, practical urgency, and the identified gaps. A quantitative method using SmartPLS-based Structural Equation Modeling (SEM) was selected to test complex structural models with reflective and formative indicators simultaneously. The results contribute to the development of strategic management and sustainability literature and provide practical implications for hotel management, industry associations, and policymakers in formulating strategies to increase competitiveness.

2. Literature Review and Hypotheses Development

2.1 Resource-Based View (RBV) and Natural Resource-Based View (NRBV)

This study is based on the fundamental theory of strategic management, namely the RBV, first proposed by ([Barney, 1991](#)). RBV views a company as a collection of heterogeneous resources and capabilities, where sustainable CA can be achieved when the organization possesses resources that are valuable, rare, imperfectly imitable, and non-substitutable. In this perspective, resources include tangible (physical facilities and financial capital) and intangible assets (knowledge, reputation, organizational culture, and innovation capabilities).

The development of RBV thinking led to the introduction of the Natural Resource-Based View (NRBV) ([Hart, 1995](#)). The NRBV broadens the scope of the RBV by integrating environmental constraints into a corporate strategy framework. [Hart \(1995\)](#) argued that CA is determined by the ability to operate within ecological boundaries. The NRBV identifies three interrelated environmental strategies: pollution prevention, product stewardship, and sustainable development. These three strategies require distinct organizational capabilities and have the potential to generate sustainable CA. In the context of the hospitality industry, NRBV provides a solid theoretical foundation for explaining the integration of environmental aspects into core strategies ([Gyamfi, Onifade, Nwani, & Bekun, 2022](#)).

RBV and NRBV are closely related to these constructs. GIC represents the accumulation of environmental knowledge and capabilities that meet the VRIN criteria. GC reflects a system of shared values and norms that shape an organization's collective mindset about the environment. This variable is also a rare and difficult-to-replicate intangible resource ([Liu, Alharthi, Atil, Zafar, & Khan, 2022](#)). GI is positioned as a dynamic capability that transforms resources into actual CA. CA is the expected outcome of the strategic management of environmental resources and capabilities ([Gyamfi et al., 2022](#)).

2.2 Green Intellectual Capital (GIC)

GIC is defined as the accumulated knowledge, experience, information, intellectual property, and organizational capabilities related to environmental protection, held by individuals, organizations, and networks. [Chen \(2008\)](#) divided GIC into three main dimensions. First, Green Human Capital (GHC) refers to employees' knowledge, skills, abilities, attitudes, and commitment to environmental issues. Second, Green Structural Capital (GSC) includes non-human assets, such as environmental management systems, operational procedures, databases, and organizational culture that support environmentally friendly practices. Third, Green Relational Capital (GRC) refers to an organization's relationships with external stakeholders, namely customers, suppliers, partners, and regulators, related to environmental issues ([Ni, Cheng, & Huang, 2021](#); [Quintero, Blanco, & Garzón, 2021](#)).

In the hospitality industry, GIC plays a crucial role in building legitimacy and a green reputation for hotels. Hotels with high GHC employ workers who are not only skilled in daily operations but also possess ecological awareness, which is reflected in their interactions with guests. GSC is reflected in the existence of environmental certifications such as Green Globe, EarthCheck, and ASEAN Green Hotel Standard, which require comprehensive documentation of environmental management systems. GRC is achieved through collaboration with local communities on conservation programs, partnerships with local sustainable suppliers, and transparent communication of environmental initiatives to guests. Previous studies confirmed that GIC positively contributes to GI and CA across various industry contexts ([Bellucci, Marzi, Orlando, & Ciampi, 2021](#); [Salehi, Fahimi, Zimon, & Homayoun, 2022](#)).

2.3 Green Culture (GC)

GC is defined as a system of shared values, beliefs, assumptions, and symbols that shape an organization's perception of environmental issues. This subset of organizational culture emphasizes the importance of ecological sustainability in every aspect of business operations ([Abbas & Khan, 2023](#); [García-Machado & Martínez-Ávila, 2019](#)). When GC is strongly internalized, employees view environmentally friendly practices as an integral part of the organization's identity and professional pride. The characteristics of a GC within an organization include top management commitment to environmental issues. This reward system recognizes pro-environmental initiatives, consistent internal communication about sustainability values, and employee inclusion in environmental decision-making ([Gürlek & Tuna, 2018](#)). In the hospitality industry, a strong GC is reflected in practices such as consistently implemented energy and water conservation programs, rigorous waste management, guest education on sustainability, and active participation in community environmental initiatives. A previous study showed that organizations with strong GC proactively adopt environmental innovations and achieve better sustainability performance ([Sharma et al., 2021](#)).

In the specific context of the hospitality industry, the link between green culture and green innovation operates through several distinct mechanisms. First, a strong green culture fosters employee environmental awareness and intrinsic motivation, which are critical for generating proactive eco-innovative ideas, such as reducing single-use plastics, designing zero-waste menus, or implementing guest-facing energy conservation systems. Second, green culture reduces organizational resistance to change by embedding sustainability as a shared norm, thereby accelerating the adoption of both incremental and radical green process innovations (graywater recycling and smart HVAC controls). Third, in hotels where green culture is deeply internalized, cross-departmental collaboration (between housekeeping, F&B, and engineering) becomes more fluid, enabling integrated innovations such as farm-to-table supply chains or waste heat recovery from kitchen equipment. Empirical evidence from hospitality studies confirms that green culture not only directly predicts green innovation but also amplifies the positive effects of other antecedents such as green intellectual capital ([Gürlek & Tuna,](#)

2018). Thus, green culture functions as a critical organizational enabler that transforms sustainability values into tangible innovative outputs, making it indispensable for hotels seeking competitive differentiation through environmental leadership and innovation.

2.4 Green Innovation (GI)

GI (eco-innovation or environmental innovation) refers to the development of new products, services, processes, or managerial practices that significantly reduce environmental impact. [Chen and Chang \(2013\)](#) categorized GI into two main types, namely green product and process innovation. In the hospitality context, green product innovation includes the development of environmentally friendly services such as on-demand linen changes, organic and biodegradable amenities, local organic cuisine, and tourism packages ([Szabo & Webster, 2021](#); [Zameer, Wang, & Yasmeen, 2020](#)). Green process innovation comprises operational process modifications that reduce energy and water consumption, advanced waste management systems, the use of renewable energy, and building designs. GI differs from conventional innovation because the concept has the characteristic of "double externality", generating positive knowledge spillover and reducing negative externalities on the environment ([Kam & Stanley, 2012](#); [Rusyani, Lavuri, & Gunardi, 2021](#)). These characteristics show that GI often requires stronger policy and organizational commitment than traditional innovations. From a dynamic capabilities' perspective, the variable represents an organization's ability to systematically respond to changes in the external environment by developing creative, sustainable solutions.

2.5 Competitive Advantage (CA)

CA is defined as the ability to create value for customers that exceeds the cost, leading to superior performance compared with competitors. According to [Ge, Chen, and Chen \(2018\)](#), CA is achieved when an organization implements a value-creating strategy that is not simultaneously implemented by competitors. In the context of sustainability, green CA refers to a superior competitive position achieved through implementing environmental strategies. Indicators can be measured across various dimensions, namely brand differentiation, customer loyalty, reputation, market share, profitability, as well as the ability to attract and retain top talent ([Cao, Tong, Chen, & Zhang, 2022](#); [Reed, Lemak, & Mero, 2000](#)). Hotels with a sustainable CA withstand market fluctuations and have stronger bargaining power with suppliers, better access to scarce resources, and greater strategic flexibility in facing changes in the business environment ([Marchi, Maria, & Micelli, 2013](#); [Pereira-Moliner et al., 2021](#)). In an era in which consumers are environmentally conscious, CA has become increasingly relevant and sustainable.

2.6 Hypotheses Formulation

Drawing on the Natural Resource-Based View ([Hart, 1995](#)) and the dynamic capabilities perspective, this study posits that intangible environmental resources alone are insufficient to generate sustainable competitive advantage. Green innovation, on the other hand, functions as a critical transformation mechanism. The literature confirms that green culture embeds pro-environmental norms that stimulate innovative behavior ([Gürlek & Tuna, 2018](#)), while green intellectual capital provides the knowledge base necessary for developing eco-innovations [Chen \(2008\)](#). However, the simultaneous mediating role of green innovation linking both antecedents to competitive advantage remains unexplored in the hospitality context. Therefore, based on theoretical reasoning and empirical gaps, the following hypotheses are proposed:

- H_1 : Green culture has a positive and significant effect on green innovation in the hospitality industry
- H_2 : Green intellectual capital has a positive and significant effect on green innovation in the hospitality industry
- H_3 : Green innovation has a positive and significant effect on competitive advantage in the hospitality industry
- H_4 : Green innovation mediates the relationship between green culture and competitive advantage
- H_5 : Green innovation mediates the relationship between green intellectual capital and competitive advantage

3. Methodology

This study used a quantitative method with a causal-explanatory design. This method was selected because the objective was to examine causal relationships and measure the effect between variables, particularly the mediating role of GI in the relationship between GIC and GC on CA. The relationships among variables can be measured using statistical procedures before generalizing the results to a wider population ([Hair Jr, Page, & Brunsveld, 2019](#)). Based on the time dimension, this study was cross-sectional, and data collection was conducted at a specific point in time. The cross-sectional design was selected because of its efficiency in terms of cost and time, as well as its suitability for the objective of describing the relationship between variables over the same observation period ([Mason, 2023](#)).

The population in this study includes all star-rated hotels operating in Bali Province. Based on data from the Bali Provincial Statistics Agency and the Bali Provincial Tourism Office, the number of three, four, and five-star hotels has reached 274 units spread across all regencies/cities, with the highest concentration in Badung Regency (Kuta, Seminyak, Nusa Dua), Denpasar City, and Gianyar Regency (Ubud). The selection is based on the consideration that hotels in this category have a more standardized management structure, adequate resources, and a greater capacity to systematically implement environmental management practices and GIs than those with lower stars or other types of accommodation. The sampling method used was purposive sampling, with certain considerations ([Montewka, Wróbel, Mąka, Nozdrzykowski, & Banaś, 2021](#)). The inclusion criteria for sample selection were as follows:

1. A minimum of three-star hotels operating in the Bali Province
2. The hotel has been operating for at least three years
3. The hotel has a program or initiative related to environmental sustainability (green practices)
4. Willingness to participate in the study

The determination of the minimum three-star hotel criteria is based on the assumption that hotels in this category have a more formal management structure, adequate resources, and the awareness and capacity to implement sustainable environmental management practices. The minimum three-year operating criterion aims to ensure that the hotel has passed the initial stages of operation and has experience managing operational issues, including environmental practices. The sample size determination follows the recommendations of [Hair, Risher, Sarstedt, and Ringle \(2019\)](#) for Structural Equation Modeling-Partial Least Squares (SEM-PLS) analysis. Hair et al. recommend a minimum sample size of ten times the number of paths leading to a construct in the structural model. In this model, the five paths leading to CA-GI, GC, GIC, gender, and hotel classification-were the largest. Therefore, the minimum sample size required was $10 \times 5 = 50$. A larger number of respondents were targeted to increase the generalizability of the results and reduce potential biases. Based on the data collection results, 106 hotels participated as respondents, meeting the minimum and sufficient criteria for the SEM-PLS analysis.

This study used primary data collected directly from respondents. Primary data were collected by distributing questionnaires to managers or parties with competence and authority in hotel management. The respondents in this study were General Managers, Operations Managers, Human Resources Managers, Environmental/Sustainability Managers, and Marketing Managers. The selection of respondents at the managerial level was based on a comprehensive understanding of hotel strategy, environmental policies, innovation practices, and competitive position ([Alsetoohy, Al-Abyadh, Döngül, Agina, & Elshaer, 2022](#)). The data collection procedure was conducted in the following stages:

1. Preparation Stage: A preliminary study was conducted to identify a list of star-rated hotels in Bali, collect contact information, and develop and validate a questionnaire. The instrument was developed based on indicators tested in a previous study and was adapted to the context of the Balinese hospitality industry.
2. Permit Stage: Studies permit applications and cover letters were submitted to academic institutions and hotel management.
3. Questionnaire Distribution Stage: Questionnaires were distributed through several methods: (1) in-person visits to the target hotels, (2) emailing a link to the online questionnaire (Google Form), and

- (3) collaborating with hotel associations such as the Indonesian Hotel and Restaurant Association (PHRI) Bali and Bali Hotel Association to facilitate questionnaire distribution.
4. Collection and Verification Stage: The collected questionnaires were checked for completeness. Incomplete or straight-lined questionnaires were excluded from the analysis to maintain the data quality.

This study upholds the principles of ethics, which are realized by (1) explaining the objectives to respondents, (2) guaranteeing the confidentiality of identities and information, (3) using data only for academic purposes, and (4) possessing the freedom to participate or refuse without negative consequences (Ibrahim et al., 2022). The variables consist of independent (exogenous), mediating, dependent (endogenous), and control variables. All latent variables were measured using a five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree), while the control variables were measured using a nominal scale.

GIC is measured through managers' perceptions of the overall knowledge assets and capabilities, including employee knowledge and commitment, environmental management systems, and relationships with external stakeholders related to issues. GIC is measured using eight indicators and three dimensions: green human, structural, and relational capital ([C. H. Wang & Juo, 2021](#); [J. Wang, 2022](#)). All indicators were subjected to validity and reliability testing with an outer loading value of >0.70 ([Hair et al., 2019](#)). GC is measured through managers' perceptions of the extent to which environmental sustainability values, norms, and practices are internalized within the organizational culture, as reflected in management commitment, reward systems, internal communication, and employee engagement. GC was measured using seven indicators after meeting the validity and reliability criteria ([Abbas & Khan, 2023](#); [García-Machado & Martínez-Ávila, 2019](#)).

GI is measured through managers' perceptions of the level of environmental innovation undertaken by hotels in developing environmentally friendly services and modifying operational processes. GI was measured using nine indicators that met the validity and reliability criteria ([Huong et al., 2021](#); [Meneto & Siedschlag, 2020](#)). CA is obtained through managers' perceptions of the competitive position compared to the main competitors in terms of differentiation, reputation, customer loyalty, and market performance. CA was measured using six indicators ([Cao et al., 2022](#); [Ge et al., 2018](#)). This study uses two control variables to analyze the influence of demographic factors and organizational characteristics on the competitive advantage. The rationale for including these variables was twofold.

First, gender is controlled because prior studies suggest that male and female managers may differ in environmental attitudes, risk preferences, and leadership styles, which could potentially influence strategic decisions related to green innovation and competitive positioning ([K. Saputra & Paranoan, 2024](#)). However, empirical evidence remains mixed; some studies find no significant gender effects, while others report that female managers exhibit stronger pro-environmental behavior. By controlling for gender, this study isolates the net effects of green intellectual capital, green culture, and green innovation from potential demographic biases. Second, hotel classification (star rating) is included because higher-rated hotels typically possess greater financial and organizational resources to invest in environmental management and green innovation ([K. Saputra & Paranoan, 2024](#)). Conversely, lower-rated hotels may be more agile in adopting certain innovations because of less bureaucratic inertia. Controlling for classification ensures that the observed relationships are not spurious artifacts of differential resource endowments. Both control variables are measured using nominal (gender) and ordinal (hotel classification) scales. The data analysis uses SEM-PLS with the help of SmartPLS 4.0 software ([Hair et al., 2019](#)).

SEM-PLS was selected to test the complex structural models with reflective indicators. The assumption of data normality is not required, but the method is suitable for studies that need to develop theories with relatively small to medium sample sizes ([Hair et al., 2019](#)). Hypothesis testing includes 1) Direct Effects, which test the direct relationship between variables, namely GC on GI, GIC on GI, GI on CA, and the effect of control variables on CA. 2) Indirect Effects (Mediation): testing the mediating effect of GI on the relationship between GC and GIC on CA.

4. Results and Discussions

4.1 Descriptive Statistical Analysis

Descriptive statistical analysis was used to provide a general overview of the characteristics of the respondents and the distribution of answers. The descriptive statistics presented include: (1) mean (average) to determine the tendency of answers; (2) median to determine the middle value; (3) standard deviation to determine the variation in answers; and (4) minimum and maximum values to determine the range of answers (Hair et al., 2019). The overall descriptive statistics show that hotel managers' perceptions ranged from high to very high. The average score was above 3.80, with most indicators being above 4.20. This indicates that hotels in Bali have developed GIC, internalized GC, implemented GI, and achieved CA at satisfactory levels. Several interesting patterns were identified in the descriptive analysis as shown in Table 1.

Table 1. Descriptive statistical analysis

Name	Mean	Median	Min	Max	Standard Deviation
GIC 1	4.321	4.000	3.000	5.000	0.542
GIC 2	4.189	4.000	3.000	5.000	0.551
GIC 3	4.283	4.000	3.000	5.000	0.491
GIC 4	3.811	4.000	2.000	6.000	0.848
GIC 5	4.491	4.000	4.000	5.000	0.500
GIC 6	4.132	4.000	2.000	5.000	0.701
GIC 7	4.226	4.000	3.000	5.000	0.537
GIC 8	4.113	4.000	3.000	5.000	0.572
GC 1	4.660	5.000	4.000	5.000	0.474
GC 2	4.623	5.000	4.000	5.000	0.485
GC 3	4.623	5.000	4.000	5.000	0.485
GC 4	4.642	5.000	4.000	5.000	0.480
GC 5	4.377	4.000	3.000	5.000	0.522
GC 6	4.528	5.000	4.000	5.000	0.499
GC 7	4.377	4.000	4.000	5.000	0.485
GI 1	4.208	4.000	3.000	5.000	0.562
GI 2	4.396	4.000	3.000	5.000	0.526
GI 3	4.321	4.000	3.000	5.000	0.506
GI 4	4.434	5.000	3.000	5.000	0.630
GI 5	4.604	5.000	4.000	5.000	0.489
GI 6	4.264	4.000	3.000	5.000	0.677
GI 7	4.358	4.000	3.000	5.000	0.647
GI 8	4.283	4.000	4.000	5.000	0.450
GI 9	4.321	4.000	3.000	5.000	0.506
CA 1	4.151	4.000	1.000	5.000	0.737
CA 2	4.245	4.000	1.000	5.000	0.698
CA 3	4.302	4.000	3.000	5.000	0.498
CA 4	4.283	4.000	3.000	5.000	0.528
CA 5	4.396	4.000	3.000	5.000	0.526
CA 6	4.189	4.000	1.000	5.000	0.675

First, GC consistently showed the highest average scores across all indicators. This indicates that GC has become a strong foundation for hotel organizations. The internalization of environmental values through top management support, reward systems, and cross-departmental participation has been well established. Second, the GIC showed significant variation across indicators, with the GRC being an aspect that needs improvement. This implies that hotels need to expand their focus from developing internal resources to external networks that support sustainability. Third, GI shows strong implementation across all aspects, with waste management being the most advanced area. This is consistent with regulatory pressures regarding waste management and the widespread zero waste

movement. Fourth, the low minimum values for some indicators indicate that not all hotels experience the same competitive benefits, even though CA presents a high average. This is due to differences in implementation effectiveness, communication strategies, or other external factors.

Standard deviations below 1.00 indicate that the variation among respondents is relatively low to moderate, indicating good consistency in perceptions. This strengthens the reliability of the data collected and provides confidence that the results accurately reflect the hotel industry's actual conditions. Descriptive statistics provide a solid foundation for further analysis of the relationships between variables. The high level of respondents' perceptions across all variables shows that the Balinese hotel industry adopts sustainable practices as an appropriate context for testing the relationship model.

4.2 Convergent Validity

Convergent validity was assessed by examining item reliability, as indicated by the loading factor value. A loading factor is a number that reports the correlation between the score of a question and the construct indicators. The analysis shows that all items making up the latent variables have outer loading values > 0.70 . This indicates the accuracy of the variable measurements used to construct each of the indicators. The results identified the consistency and reliability of the measurements used to assess the variables. Therefore, convergent validity provides confidence in the quality of the variable measurements. The results of the validity test can be seen in Table 2.

Table 2. Validity test using outer loading

Hypotheses	Outer Loadings
CA 1 $\leftarrow$ Competitive Advantage	0.929
CA 2 $\leftarrow$ Competitive Advantage	0.930
CA 3 $\leftarrow$ Competitive Advantage	0.887
CA 4 $\leftarrow$ Competitive Advantage	0.875
CA 5 $\leftarrow$ Competitive Advantage	0.797
CA 6 $\leftarrow$ Competitive Advantage	0.917
GC 1 $\leftarrow$ Green Culture	0.862
GC 2 $\leftarrow$ Green Culture	0.928
GC 3 $\leftarrow$ Green Culture	0.869
GC 4 $\leftarrow$ Green Culture	0.939
GC 5 $\leftarrow$ Green Culture	0.859
GC 6 $\leftarrow$ Green Culture	0.926
GC 7 $\leftarrow$ Green Culture	0.912
GI 1 $\leftarrow$ Green Innovation	0.790
GI 2 $\leftarrow$ Green Innovation	0.811
GI 3 $\leftarrow$ Green Innovation	0.827
GI 4 $\leftarrow$ Green Innovation	0.816
GI 5 $\leftarrow$ Green Innovation	0.889
GI 6 $\leftarrow$ Green Innovation	0.868
GI 7 $\leftarrow$ Green Innovation	0.850
GI 8 $\leftarrow$ Green Innovation	0.922
GI 9 $\leftarrow$ Green Innovation	0.855
GIC 1 $\leftarrow$ Green Intellectual Capital	0.889
GIC 2 $\leftarrow$ Green Intellectual Capital	0.781
GIC 3 $\leftarrow$ Green Intellectual Capital	0.795
GIC 4 $\leftarrow$ Green Intellectual Capital	0.885
GIC 5 $\leftarrow$ Green Intellectual Capital	0.939
GIC 6 $\leftarrow$ Green Intellectual Capital	0.757
GIC 7 $\leftarrow$ Green Intellectual Capital	0.813
GIC 8 $\leftarrow$ Green Intellectual Capital	0.722

Gender ← Gender	1.000
Hotel Classification ← Hotel Classification	1.000

4.3 Discriminant Validity

Discriminant validity measures the extent to which a construct is truly distinct from the others. A high discriminant validity value provides evidence that a construct is unique and capable of capturing measured phenomena. The AVE value is used to determine the validity of a construct with a criterion above 0.50. Based on Table 3, the validity through the AVE indicator on all variables is classified as valid at a value of > 0.50.

Table 3. Average variance extracted

	Average Variance Extracted (AVE)
Competitive Advantage	0.793
Green Culture	0.810
Green Innovation	0.720
Green Intellectual Capital	0.682

4.4 Reliability Estimate

A reliability estimate was used to evaluate the consistency and reliability of the measurement instrument. This analysis examined the composite reliability value. The criterion used was that the composite reliability value should be greater than 0.70 to indicate an adequate level. The following analysis results can be obtained using the framework in Table 4.

Table 4. Reliability estimate

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
Competitive Advantage	0.947	0.948	0.958
Green Culture	0.961	0.971	0.967
Green Innovation	0.954	0.978	0.958
Green Intellectual Capital	0.934	0.981	0.944

4.5 Coefficient of Determination

The coefficient of determination is an important metric for evaluating how well a regression model fits the observed data. The criteria used to assess model strength were that the R-square value should be between 0.25 and 0.50 to indicate a moderate model fit, and above 0.50 to indicate a strong model fit. This can be observed from the following analysis results. Furthermore, the coefficients of determination (R-squared) for CA and GI were 0.786 and 0.340, respectively.

Table 5. Coefficient of determination

	R-square	R-square adjusted
Competitive Advantage	0.786	0.772
Green Innovation	0.340	0.313

Table 5 shows practical significance of R² values: The R² value of 0.786 for competitive advantage indicates that the model explains 78.6% of the variance in the competitive advantage. From a practical standpoint, this high explanatory power means that green innovation, together with the controlled demographic and organizational factors, accounts for nearly four-fifths of the differences in competitive performance among hotels in Bali. For hotel managers, this implies that improving green innovation capabilities can translate into substantial and measurable gains in market positioning, brand differentiation, and customer loyalty. The remaining 21.4% of the variance suggests that other unexamined factors, such as location-specific advantages, seasonality, or external partnerships, also play a role.

The R^2 value of 0.340 for green innovation, while lower, is practically meaningful in social science research, especially for exploratory models. This indicates that collectively, green culture and green intellectual capital account for 34% of the variance in green innovation. For practitioners, this finding suggests that while culture and intellectual capital are important drivers of eco-innovation, nearly two-thirds of innovation outcomes depend on other organizational and external factors not captured in this model, such as regulatory pressure, technological infrastructure and guest demand for sustainability. Therefore, managers should view green culture and intellectual capital as necessary but not sufficient conditions; complementary investments in R&D, technology adoption, and external collaborations are equally critical for fostering green innovation.

4.6 F-Square

Before discussing the results, the concept of effect size used to evaluate the influence of an independent variable on a dependent variable in a regression model should be understood. Table 6 presents the F-square values for the variables. The criteria used to assess the effect size were that an F-square value of 0.02, 0.15, and 0.35 indicated a small, moderate, and strong effect, respectively. The analysis results can be explained using the following framework.

Table 6. F-square

	F-square
Green Culture → Green Innovation	0.308
Green Innovation → Competitive Advantage	3.477
Green Intellectual Capital → Green Innovation	0.130
Gender → Competitive Advantage	0.026
Hotel Classification → Competitive Advantage	0.018

Table 6 shows GI had a large effect size on CA (F-square = 3.477), confirming its position as a key variable in the model. This implies that efforts to improve hotel competitiveness should focus on developing tangible and measurable GI. GC shows a medium to large effect size on GI (F-square = 0.308), indicating that building a strong variable is an important prerequisite for promoting innovation in the construction industry. Investing in developing green cultural values, norms, and practices provides significant returns in the form of increased innovation capabilities. The substantive contribution of GIC to GI was statistically significant but relatively small (F-square = 0.130). This is because environmental knowledge and systems are inadequate. Gender and hotel classification have very small effect sizes approaching zero since the variables are not substantively relevant in explaining CA. This result strengthens the validity of the main model, which focuses on strategic factors such as GIC, GC, and GI.

4.7 VIF (Variance Inflation Factor)

According to Hair et al. (2014), a VIF value above 10 indicates collinearity. Table 7 shows that all indicator variables have VIF values < 10, since the study is free of collinearity.

Table 7. Collinearity statistics (inner VIF values)

	VIF
Green Culture → Green Innovation	1.026
Green Innovation → Competitive Advantage	1.017
Green Intellectual Capital → Green Innovation	1.026
Gender → Competitive Advantage	1.017
Hotel Classification → Competitive Advantage	1.000

The VIF value of 1.026 for the relationship between GC and GI indicates that there is no significant correlation between GC and the other predictors. This value, approaching 1, shows that there is almost no variance inflation due to multicollinearity. Furthermore, GC explains variations in GI independently of GIC. The VIF value for the relationship between GIC and GI was 1.026, since the correlation was very low. These relatively orthogonal independent variables were used to explain the GI without overlap.

The VIF value of 1.017 for the relationship between GI and CA suggests that there is no significant correlation with gender or hotel classification. Therefore, GI is a predictor independent of respondent demographics and hotel organizational characteristics. The VIF value for gender (1.017) showed no significant correlation with other predictors. This demographic variable did not share significant variance with GI or hotel classification in explaining CA. A value of 1.000 for hotel classification is the standard, indicating no correlation with other predictors. In this context, the variances of hotel classification are completely independent, and there is no inflation due to multicollinearity. Hotel classification is a categorical variable that is not conceptually correlated with GI or the respondent's sex.

4.8 Q-Square

Based on Table 8, the Q-square values are 0.606 and 0.210 for CA and GI, respectively. The subsequent step is to conduct a Q^2 (predictive relevance) test using the blindfolding method to provide evidence that a particular variable has a predictive relationship (predictive relevance) with others, with a measurement threshold value above zero. The threshold value for Q^2 (predictive relevance) test is 0.02, 0.15, and 0.35 for a small, medium, and large effect, respectively.

Table 8. Q-square test results

	SSO	SSE	$Q^2 (=1-SSE/SSO)$
Competitive Advantage	318.000	125.746	0.606
Green Culture	371.000	371.000	0.000
Green Innovation	477.000	376.995	0.210
Green Intellectual Capital	424.000	424.000	0.000

4.9 Hypothesis Testing Using Bootstrapping

Hypothesis testing was conducted after confirming that the measurement model satisfied the validity and reliability criteria and that the structural model was free from multicollinearity. The procedure was carried out using a bootstrapping procedure, a resampling method with repeated sampling from the original dataset to generate standard errors and t-statistic estimates. The bootstrapping method does not require the assumption of normality and can provide stable estimates with relatively small-to-medium sample sizes. In this study, bootstrapping was performed with 5,000 subsamples to ensure stable estimation.

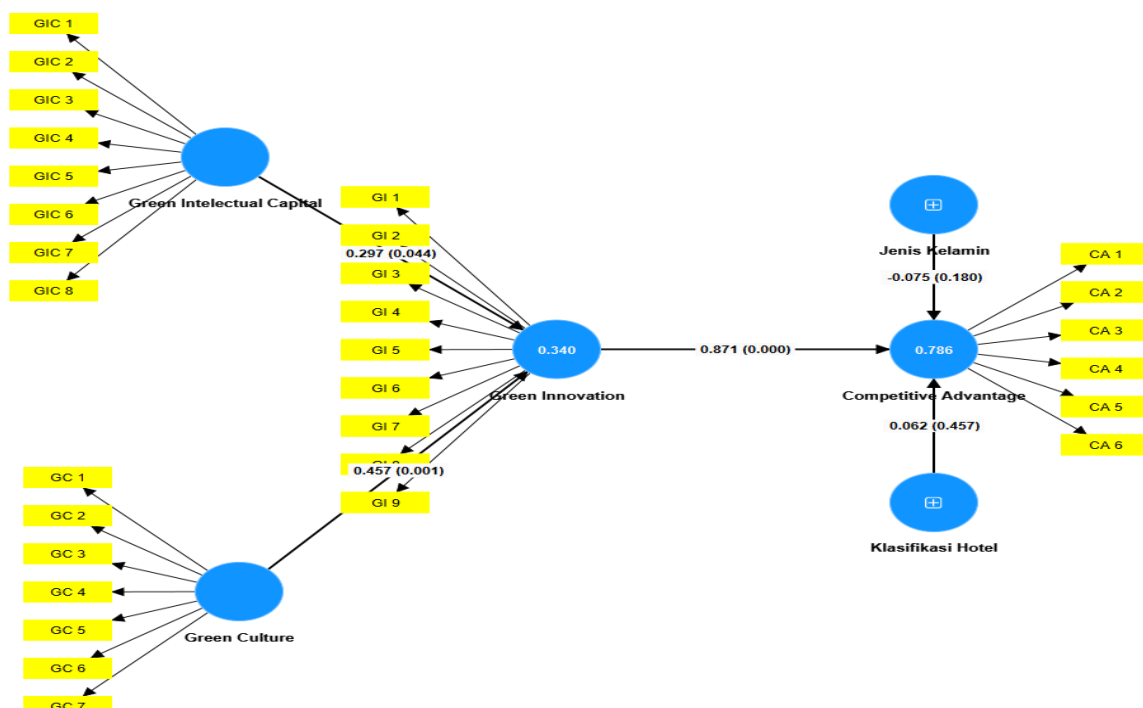


Figure 1. Hypothesis testing using bootstrapping

Figure 1 confirms the strong explanatory power of the proposed model. The high R-squared value for CA (0.786) indicates that the model variables explain most of the variation in CA. The dominant effect of GI is clear, confirming its central role as a mechanism used to transform organizational resources into actual CA. This visual result provides initial confirmation of the GI's mediating role. GC and GIC are not directly connected to CA, as their effects are fully mediated by GI. This is consistent with the theoretical framework grounded in the NRBV, which positions dynamic capabilities as a bridge between organizational resources and CA. The statistical results show that hotels in Bali can build a sustainable CA through the development of GIC and GC.

Table 9. Summary of bootstrapping results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Green Culture → Green Innovation	0.457	0.461	0.139	3.290	0.001
Green Innovation → Competitive Advantage	0.871	0.881	0.035	25.062	0.000
Green Intellectual Capital → Green Innovation	0.297	0.318	0.147	2.015	0.044
Gender → Competitive Advantage	-0.075	-0.072	0.056	1.342	0.180
Hotel Classification → Competitive Advantage	0.062	0.061	0.083	0.744	0.457
Green Intellectual Capital → Green Innovation → Competitive Advantage	0.398	0.406	0.124	3.200	0.001
Green Intellectual Capital → Green Innovation → Competitive Advantage	0.259	0.281	0.131	1.976	0.048

Based on Figure 1 and Table 9, several patterns were identified. The t-statistic of 3.290 (> 1.96) and p-value of 0.001 (< 0.05) show that the effect is both positive and significant. Therefore, the stronger the GC, the greater the increase in the GI. The original sample (O) value of 0.871 indicates a very strong positive effect. The t-statistic of 25.062 and p-value of 0.000 (< 0.05) suggest a highly significant effect on the dependent variable. Therefore, GI strongly increases CA levels. The original sample (O) value of 0.297 indicates a positive effect. The t-statistic of 2.015 (> 1.96) and p-value of 0.044 (< 0.05) indicate that the effect is positive and significant, respectively. Furthermore, the original sample (O) value of 0.398 suggests a positive mediating effect.

The t-statistic of 3.200 and p-value of 0.001 (< 0.05) show that GI significantly mediates the effect of GC on CA. The original sample (O) value of 0.259 indicates a positive indirect effect. The t-statistic of 1.976 (> 1.96) and p-value of 0.048 (< 0.05) suggest that the mediation effect is significant at the 5% significance level. The original sample (O) value of -0.075 shows a very weak, negative relationship. The t-statistic of 1.342 and p-value of 0.180 (> 0.05) indicate that the effect of gender on CA is insignificant. Therefore, sex did not affect CA in this model. The original sample (O) value of 0.062 suggests a very small, positive effect. The t-statistic of 0.744 and p-value of 0.457 (> 0.05) indicate that the effect of hotel classification on CA is not significant. Therefore, hotel classification does not significantly contribute to the CA.

4.10 Discussion

The results provide an in-depth understanding of the mechanisms underlying the creation of sustainable CA in the Balinese hotel sector. In this context, GI mediates the relationship between GIC and GC with CA (Gürlek & Tuna, 2018; K. A. K. Saputra et al., 2026). The significance of the mediating role shows that possessing environmental knowledge resources and green values is insufficient to create CA. Innovative capabilities are needed to transform the resources into tangible solutions for market advantage (Hooi, Liu, & Lin, 2022). These results reinforce Hart's NRBV argument that organizations require dynamic capabilities in responding to environmental pressures and creating important value (Aslam, Zain, Qasim, Leghari, & Abbas, 2024).

The effect of GC on GI reflects the creation of a climate conducive to developing innovative, environmentally friendly ideas ([C.-H. Wang, 2019](#)). When green values are strongly internalized within organizations, employees view environmental practices as an opportunity for creativity and professional pride. A strong culture creates social norms that promote pro-environmental behavior while providing employees with the discretion to take innovative initiatives without waiting for formal instructions ([S. Wang, Abbas, Sial, Álvarez-Otero, & Cioca, 2022](#)). From the RBV perspective, GC is a rare, intangible resource that is difficult to replicate because of the unique historical accumulation process. Hotels in Bali have a greater capacity to develop environmentally friendly services and process innovations ([Al-Mesaiadeen, Mili, & AL-Soud, 2023](#)).

GIC has been shown to positively contribute to GI but to a lesser extent than GC. These results indicate that the accumulation of environmental knowledge embedded in human resources, organizational systems, and networks provides a cognitive and structural foundation for innovation development ([Roespinoedji, Saudi, Hardika, & Rashid, 2019](#)). Employee knowledge of environmental issues, a documented management system, and relationships with external partners create a reservoir of capabilities that enables organizations to identify innovative opportunities ([Sugiharto & Alhazami, 2023](#)). However, the smaller contribution relative to GC suggests that knowledge without values tends to remain unrealized.

This is consistent with the dynamic capabilities perspective, which emphasizes the importance of resource integration and configuration mechanisms ([Fraj, Martínez, & Matute, 2011](#)). The powerful mediating role of GI shows its central position as a transmission mechanism within the NRBV framework. GI represents a dynamic capability that transforms static resources into actual CA ([Aulia et al., 2024](#)). Furthermore, hotels in Bali create meaningful differentiation amid hypercompetition by offering unique experiences for guests. Innovations such as passive architectural design, recycled-water management systems, farm-to-table culinary programs, and nature-conservation experiences create value that is difficult for competitors to replicate because of the requirement of a unique combination of knowledge, cultural commitment, and technical capabilities.

The results that control variables such as respondent gender and hotel classification do not significantly affect CA, offer interesting theoretical implications. This insignificance suggests that CA grounded in sustainability is universal and independent of demographic characteristics or hotel star ratings ([Huong et al., 2021](#)). A three-star hotel with limited resources can achieve CA through creative and targeted GI. Meanwhile, a five-star hotel does not automatically excel because of its classification. This reinforces the RBV argument that CA is determined by unique resources and capabilities rather than structural attributes ([Meneto & Siedschlag, 2020](#)). In the context of Bali, these results provide optimism that every hotel has an equal opportunity to build sustainable CA, provided the concept manages GIC, cultivates green values, and develops relevant innovations ([García-Machado & Martínez-Ávila, 2019](#)). The three environmental strategies outlined in the NRBV, namely pollution prevention, product stewardship, and sustainable development, can be realized through GI, which is supported by intellectual capital and organizational culture. Hotels in Bali that successfully integrate the three elements have the capacity to withstand competitive pressures and create a sustainable market position.

5. Conclusions

5.1 Conclusion

Sustainable competitive advantage (CA) in the hotel industry cannot be achieved solely through environmental knowledge and values but requires green innovation capability to transform these resources into tangible innovations. The findings confirm that green innovation (GI) mediates the relationship between green intellectual capital (GIC), green culture (GC), and CA, supporting the Natural Resource-Based View (NRBV) by highlighting the role of dynamic capabilities in converting strategic resources into sustainable advantages. Therefore, hotels in Bali should strengthen green values, manage environmental knowledge, and develop eco-friendly innovations to enhance competitiveness.

Hotel managers are encouraged to embed green culture through sustainability training, performance evaluation, and reward systems, while systematically developing green intellectual capital by managing employee capabilities, environmental systems, and sustainable partnerships. Future research should extend this model to other sectors, conduct longitudinal and cross-cultural studies, and examine moderating factors such as market turbulence, competitive intensity, and government support to better understand the conditions that enhance the effectiveness of green innovation in creating competitive advantage.

5.2 Research Limitations

This study had several limitations. First, the sample is limited to 106 three- to five-star hotels in Bali, which restricts the generalizability of the findings to other regions, hotel categories (e.g., budget or one-star hotels), and tourism destinations with different environmental regulations and cultural contexts. Second, the cross-sectional design captured relationships at a single point in time, preventing causal inferences. Longitudinal studies are required to confirm the directionality of these effects. Third, data were collected solely from managerial perspectives, which may have introduced self-report and social desirability biases, particularly regarding green practices and competitive positioning. Fourth, this study focused only on green innovation as a mediator; other potential mechanisms (e.g., green absorptive capacity and environmental management systems) were not examined. Finally, the control variables were limited to gender and hotel classification, leaving other relevant factors (e.g., hotel age, size, and ownership structure) unexplored.

5.3 Suggestions and Directions for Future Research

Future research should address several issues. First, the model should be replicated in other geographical settings (e.g., Thailand, Mediterranean, or Caribbean) and across different hotel categories (including budget and eco-lodges) to enhance generalizability. Second, longitudinal designs are needed to establish causal relationships and examine how the mediating role of green innovation evolves. Third, comparative studies across other service sectors, such as healthcare, education, retail, and tourism destinations, would test the external validity of the NRBV framework beyond hospitality. Fourth, future models should incorporate additional mediators (e.g., green dynamic capabilities and environmental management systems) and moderators (e.g., competitive intensity, regulatory pressure, and top management support). Fifth, mixed-method approaches combining surveys with in-depth interviews or case studies could enrich the understanding of how green culture and intellectual capital translate into specific innovation outcomes. Finally, cross-cultural research comparing developed and developing economies would reveal the contextual boundary conditions of the proposed relationships.

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Author Contributions

All authors contributed equally to this study. AAD and KAKS jointly developed the conceptual framework and designed the research methodology. AAD was responsible for performing the SEM-PLS analysis, while KAKS conducted the data collection and validation process. All authors contributed to the writing, review, and editing of the manuscript. In addition, all authors have read and approved the final version of the manuscript.

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