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A CONCEPTUAL MODEL FOR ENHANCING SUSTAINABLE PERFORMANCE: THE SYNERGY OF GREEN INNOVATION BASED ON GREEN SKILLS AND GREEN CREATIVE SELF-EFFICACY IN METALCRAFT MSMES

[1*]Komang Dandy Andriadi, [2]Komang Tri Yasrawan, [3]Putu Eka Dianita Marvilianti Dewi, [4]Kadek Marlina Nalarreason, [5]Theresia Dirda Rosari Widyadara

[1,2,3,4]Bachelor of Accounting Study Program, Faculty of Economics, Universitas Pendidikan Ganesha
[5]Bachelor of Management Study Program, Faculty of Economics, Universitas Pendidikan Ganesha

*Corespondence Author: km.dandy.andriadi@undiksha.ac.id

ABSTRACT

Metalcraft micro, small, and medium enterprises (MSMEs) in Bali contribute to the island's craft economy, yet their transition to environmentally responsible production may be constrained by limited technical resources and uneven environmental capabilities. Although recent MSME studies associate green innovation with business performance, findings concerning environmental performance remain mixed, and previous studies rarely examine owners' green skills and green creative self-efficacy together in traditional metalcraft enterprises. This study tests the effects of Green Skill and Green Creative Self-Efficacy on Sustainable Performance, with Green Innovation as a mediator, and identifies managerial priorities through Importance-Performance Map Analysis (IPMA). Survey data were obtained from 259 owners of metalcraft MSMEs in Bali Province using proportionate stratified random sampling and analyzed with PLS-SEM in SmartPLS 4. The estimated relationships are positive and statistically significant, and Green Innovation partially mediates the relationships between both capability constructs and Sustainable Performance. Green Creative Self-Efficacy has numerically larger path coefficients than Green Skill for Green Innovation and Sustainable Performance; this coefficient ordering is interpreted descriptively because a formal between-coefficient difference test was not reported. IPMA identifies environmental awareness and pollution-control facility deployment as specific improvement priorities. The study extends MSME sustainability research by linking an individual-level cognitive capability with operational innovation in a traditional craft setting. For practice, the results support combining practical green-skills training with confidence-building problem-solving activities and affordable, context-appropriate pollution-control and waste-management measures.

Keywords: Green Skill, Green Creative Self-Efficacy, Green Innovation, Sustainable Performance, Metalcraft MSMEs.

ABSTRAK

UMKM kerajinan logam di Bali berperan dalam ekonomi kerajinan daerah, tetapi peralihan menuju produksi yang lebih ramah lingkungan dapat terkendala keterbatasan sumber daya teknis dan kemampuan lingkungan yang belum merata. Walaupun penelitian terbaru pada UMKM mengaitkan inovasi hijau dengan kinerja usaha, temuan terkait kinerja lingkungan masih beragam dan masih sedikit penelitian yang menguji keterampilan hijau pemilik serta efikasi diri kreatif hijau secara bersamaan pada UMKM kerajinan logam tradisional. Penelitian ini menguji pengaruh Green Skill dan Green Creative Self-Efficacy terhadap Sustainable Performance dengan Green Innovation sebagai variabel mediasi, serta menentukan prioritas manajerial melalui Importance-Performance Map Analysis (IPMA). Data survei diperoleh dari 259 pemilik UMKM kerajinan logam di Provinsi Bali melalui proportionate stratified random sampling dan dianalisis menggunakan PLS-SEM dengan SmartPLS 4. Hubungan yang diuji menunjukkan arah positif dan signifikan secara statistik, sedangkan Green Innovation memediasi

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secara parsial hubungan kedua konstruk kapabilitas dengan Sustainable Performance. Koefisien jalur Green Creative Self-Efficacy secara numerik lebih besar dibandingkan Green Skill untuk Green Innovation dan Sustainable Performance; urutan koefisien ini ditafsirkan secara deskriptif karena pengujian formal atas perbedaan antarkoefisien tidak dilaporkan. Hasil IPMA menunjukkan kesadaran lingkungan dan penerapan fasilitas pengendalian pencemaran sebagai prioritas perbaikan. Penelitian ini memperluas kajian keberlanjutan UMKM dengan mengaitkan kapabilitas kognitif individu dan inovasi operasional pada usaha kerajinan tradisional. Secara praktis, hasilnya mendukung pelatihan keterampilan hijau yang dipadukan dengan kegiatan pemecahan masalah untuk membangun kepercayaan diri, serta penerapan pengendalian pencemaran dan pengelolaan limbah yang terjangkau dan sesuai kondisi usaha.

Kata Kunci: Keterampilan Hijau, Efikasi Diri Kreatif Hijau, Inovasi Hijau, Kinerja Berkelanjutan, UMKM Kerajinan Logam

I. INTRODUCTION

Indonesia's manufacturing and advanced materials sectors face a severe shortage of technical human resources, driven by inconsistent competency standards and persistent brain drain (Kementerian Pendidikan Tinggi, Sains, 2025). This capacity deficit directly impacts Bali's metalcraft MSMEs, where artisans struggle with limited technical competencies that require targeted development (Artaya, 2023). Compounding the issue, the total number of metalcraft artisans in Bali continues to decline due to poor workforce regeneration and diminishing interest among younger generations (Warta Bali, 2024).

Without proper management, metal processing industries present severe environmental risks (Bali Ekbis, 2024). Ineffective waste handling in this sector frequently triggers hazardous contamination, particularly heavy metal pollution (Lin, Yishui, Feng, & Wenmin, 2024; Wang, Zhang, Wang, Zhao, & Yang, 2021). Concurrently, a shift in consumer behavior reveals a stronger preference for eco-conscious products (Girisaran & Khanna, 2025). Driven by these heightened public expectations, companies must prioritize sustainable performance to maintain stakeholder trust (Yasrawan et al., 2023). Sustainable performance fundamentally integrates economic, social, and environmental dimensions into core business activities (Yasrawan & Werastuti, 2022), While economic viability centers on solid financial outcomes (Yasrawan et al., 2025), the social dimension addresses workplace well-being and community relations (Cantele, Valcozzena, & Campedelli, 2024; Muthu, 2025; Wang, Yang, Park, Um, & Kang, 2022), Complementing both, environmental performance aims to mitigate ecological degradation caused by operational activities (Coronado et al., 2025; Jain & Kumar, 2025; Kumar et al., 2024).

According to official records from the Dinas Koperasi Usaha Kecil dan Menengah Provinsi Bali (2021), there are 733 micro, small, and medium-sized enterprises (MSMEs) in the metalcraft sector distributed across eight regencies and one city in the province of Bali. Environmental risks depend on the specific processes involved. Studies on non-ferrous metal processing have documented hazardous residues and pollution risks associated with metal production and waste management (Lin et al., 2024; Wang et al., 2021).

Despite possessing rich traditional skills, many metalcraft artisans still struggle to adopt environmentally friendly practices, largely slowed by the delayed implementation of green technologies (Kumar et al., 2025). Adopting clean technologies remains vital for reducing emissions and optimizing waste management. However, this transition is frequently hampered by a lack of skilled technical personnel capable of managing complex green operations (Dincbas et al., 2021). Consequently, strategic human resource management becomes the decisive factor in driving efficient resource utilization while boosting overall organizational productivity (Danish & Esteves, 2023).

At its core, a key challenge for metalcraft MSMEs is the need to strengthen business owners' green skills, particularly their environmental knowledge, awareness, social responsibility, and ability to integrate green policies and practices into daily business operations. Possessing these green competencies empowers individuals to design eco-friendly products and streamline cleaner production

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processes (Xie & Zhu, 2020). Beyond technical skills, green creative self-efficacy, defined as an artisan's confidence in generating novel environmental solutions (Saputra & Yasrawan, 2021), further drives green innovation by enabling the adaptation of sustainable business models (Abdelwahed et al., 2025). While such innovation naturally yields better sustainable performance (Rahman et al., 2025). the underlying mechanics remain intricate, as green skills and creative self-efficacy may also directly shape sustainability outcomes without intermediary paths (Amjad et al., 2024; Zainal et al., 2024).

The current literature extensively examines green innovation and sustainable performance in large-scale enterprises backed by robust financial and technological infrastructure, empirical focus on micro, small, and medium-sized enterprises (MSMEs) remains sparse. This omission creates a critical research gap, particularly regarding traditional craft industries deeply rooted in local wisdom and cultural heritage. Operating under severe resource constraints, these small-scale artisans face distinct, far more complex challenges when adopting environmentally friendly practices compared to their corporate counterparts.

Recent MSME evidence is not uniform: some studies associate green innovation with business or financial performance, whereas others find no significant effect on green performance. The unresolved issue is therefore not only whether innovation is beneficial, but how owners' technical green skills and confidence in solving environmental problems are translated into repeatable practices in traditional MSMEs craft (Ayu et al., 2025; Innayah et al., 2024; Wibowo et al., 2019).

To address these critical gaps, this study empirically examines the impact of green skills and green creative self-efficacy on sustainable performance, testing the mediating role of green innovation through Structural Equation Modeling–Partial Least Squares (SEM-PLS). Furthermore, using Importance-Performance Map Analysis (IPMA), this research evaluates the relative importance and performance levels of each construct to establish targeted strategic priorities for metalcraft MSMEs in Bali Province.

The findings are relevant to efforts to strengthen responsible production and consumption while supporting the livelihoods and local knowledge embedded in Bali's traditional craft economy. For resource-constrained MSMEs, the challenge is to make environmental improvements feasible alongside daily production requirements and business continuity (SDGs 9 and 12).

This study contributes in two main ways. First, by integrating Social Cognitive Theory (SCT) with the Natural Resource-Based View (NRBV), it links owners' individual capabilities—green skills and green creative self-efficacy to firm-level green innovation and sustainable performance. Second, it adds Importance-Performance Map Analysis (IPMA) to identify actionable priorities at both construct and indicator levels. In this sample, the clearest improvement priorities emerge at the indicator level, enabling resource-constrained MSMEs to target specific practices rather than treating every capability as equally urgent.

Finally, this study contextualizes macro-level sustainability metrics for micro-scale traditional enterprises. By tailoring broad reporting frameworks to the realities of local metal artisans, this work addresses unique cultural and environmental challenges, helping preserve Bali's ecological heritage while sustaining its creative economy. Ultimately, these insights advance both the theoretical understanding of green innovation and the practical design of targeted sustainability strategies for traditional craft industries.

II. LITERATURE REVIEW

Social Cognitive Theory

Social Cognitive Theory (SCT), pioneered by (Bandura, 1986) posits that human behavior emerges from triadic interaction among personal factors, behavioral patterns, and environmental influences. The framework underscores cognitive regulation, detailing how individuals acquire knowledge and adapt behaviors through observation, social exposure, and active environmental engagement (Alexander & Zafar, 2025; Schunk & DiBenedetto, 2022). Applied to this research, SCT clarifies how psychological beliefs and technical competencies jointly drive innovative work behavior.

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Individual innovation thrives when cognitive confidence intersects with hands-on skill mastery. Specifically, an artisan's green creative self-efficacy acts as the psychological engine motivating the pursuit of novel eco-friendly solutions. However, converting these environmental intentions into tangible green innovations requires pairing this creative confidence with practical technical expertise in the form of green skills. In green innovation contexts, SCT illustrates how self-efficacy beliefs interact with environmental conditions to influence sustainable behavior (Butt et al., 2025; Salama et al., 2025; Zhang et al., 2022). While green creative self-efficacy fosters the confidence needed to solve complex ecological problems, green skills—cultivated through technical education and professional development—provide the operational capability to execute green technology (Butt et al., 2025; Salama et al., 2025; Zhang et al., 2022). Equipping workforce talent with specialized environmental knowledge enables smoother adoption of cleaner production practices, directly curbing operational footprints (Boujedra & Jebli, 2025; Pavlova, 2017). Consequently, SCT confirms that green creative self-efficacy and green skills function as complementary drivers of green innovation. Creative self-efficacy supplies the cognitive motivation to envision sustainable ideas, whereas green skills deliver the technical proficiency needed to turn those ideas into functional innovations.

Natural Resource-Based View (NRBV)

The Natural Resource-Based View (NRBV) expands traditional Resource-Based View (RBV) logic by embedding environmental constraints directly into strategic management. Under this framework, ecologically oriented capabilities serve as primary drivers of long-term competitive advantage (McDougall et al., 2016, 2019). Specifically, NRBV asserts that organizations secure sustainable market positions by developing capabilities centered on pollution prevention, product stewardship, and clean technology deployment (McDougall et al., 2019). Through an NRBV lens, strategic assets extend beyond physical capital to include intangible human capabilities. Within this research, green skills, green creative self-efficacy, and green innovation embody critical sustainability capabilities that anchor eco-friendly operational practices. Green competencies and creative self-efficacy directly strengthen an enterprise's capacity to achieve sustainability milestones (Amjad et al., 2024). Consequently, investing in eco-conscious human capital transforms individual talent into a strategic asset that safeguards the long-term viability of MSMEs.

Furthermore, green innovation serves as the operational bridge converting these human capabilities into measurable organizational performance. Deploying green innovations yields competitive advantages by optimizing resource efficiency while generating eco-friendly products and processes. Empirical literature reinforces this relationship, establishing that green innovation consistently drives overall sustainable performance (Dinarjito & Purwoko, 2025; Rahman et al., 2025; Umair Anwar et al., 2025; Zafar et al., 2026). Thus, NRBV provides a robust theoretical foundation explaining how human-level sustainability capabilities enhance organizational performance—both directly and indirectly via green innovation.

Recent empirical research conducted specifically in MSMEs provides useful but not entirely consistent evidence. In Bali, a survey of 390 SMEs reported relationships among green innovation, sustainability practices, environmental policy, and financial performance (Ayu et al., 2025). In Thailand, evidence from 421 SMEs indicated that green innovation and sustainability readiness contributed to SME performance, while firm size moderated the relationship (Schrank & Kijkasiwat, 2024). Innayah et al. (2024), studying 105 Indonesian MSMEs, also found a positive effect of green process innovation on business performance. By contrast, Wibowo et al. (2019), using responses from 200 Indonesian SME owners and managers, did not find a significant effect of green innovation on green performance. The difference suggests that the consequences of green innovation may depend on the performance dimension assessed, the readiness and scale of the firm, and whether the outcome is environmental performance or broader business performance. These MSME studies strengthen the relevance of the present setting, but they do not directly test the combined role of green skills and green creative self-efficacy in traditional metalcraft MSMEs.

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Hypothesis Development

Taken together, previous MSME research supports a positive performance role for some green innovations but also shows that environmental outcomes are not uniformly improved. SCT therefore helps explain why the present model considers both the ability to implement environmentally oriented practices (green skills) and the belief that one can develop new environmental solutions (green creative self-efficacy). NRBV then explains how these individual capabilities may become firm-level green innovation and sustainability-related value. The hypotheses below test this proposed mechanism in a traditional craft context rather than assuming that findings from large or technology-intensive firms necessarily generalize to Bali's metalcraft MSMEs.

Social Cognitive Theory (SCT) explains human behavior as a dynamic interaction among personal, behavioral, and environmental factors (Bandura, 1986). Within this framework, innovative behavior is driven by the interplay between cognitive factors and the mastery of actual competencies. Green skills, acquired through environmental education and professional development, strengthen sustainable practices and the use of environmentally friendly technologies, which are essential for green innovation. Skilled workers equipped with green knowledge are therefore better able to adopt green innovation effectively (Boujedra & Jebli, 2025; Pavlova, 2017). Green skills also stimulate green innovation directly by enabling the development of environmentally friendly products and processes (Xie & Zhu, 2020). Accordingly, artisans with stronger green skills are expected to produce more green innovations. Thus, the following hypothesis is proposed:

H1: Green skill has a positive effect on green innovation.

SCT also emphasizes that individuals' beliefs in their own capabilities (self-efficacy) shape their sustainability-related practices (Butt et al., 2025; Salama et al., 2025; Zhang et al., 2022). Green creative self-efficacy refers to the belief in one's ability to generate creative solutions to environmental challenges, and it plays an important role in green innovation (Butt et al., 2025; Salama et al., 2025; Zhang et al., 2022). This belief has a positive effect on green innovation, particularly in adapting sustainable business models (Abdelwahed et al., 2025). Artisans who are confident in their ability to solve environmental problems are therefore more likely to design environmentally friendly solutions. Based on this reasoning, the following hypothesis is proposed:

H2: Green creative self-efficacy has a positive effect on green innovation.

The Natural Resource-Based View (NRBV) extends the Resource-Based View by integrating environmental sustainability into strategic management, and holds that firms gain a sustainable competitive advantage from resources and capabilities aligned with environmental sustainability (McDougall et al., 2019). Under this view, strategic resources are not limited to physical assets but also include intangible resources embedded in individuals, such as green skills. Developing green skills within an organization enhances its capacity to achieve sustainability goals (Amjad et al., 2024), and green skills have been linked to sustainability outcomes (Zainal et al., 2024). Sustainable performance integrates economic, social, and environmental aspects of firm activities (Yasrawan & Werastuti, 2022). Hence, the following hypothesis is proposed:

H3: Green skill has a positive effect on sustainable performance.

From the NRBV perspective, green creative self-efficacy is also an intangible resource that can support a sustainable competitive advantage (McDougall et al., 2019). Fostering green self-efficacy within organizations improves their ability to achieve sustainability goals (Amjad et al., 2024). Artisans who believe in their capacity to create environmental solutions are therefore expected to contribute to better economic, social, and environmental outcomes for their enterprises. Thus, the following hypothesis is proposed:

H4: Green creative self-efficacy has a positive effect on sustainable performance.

According to the NRBV, firms can achieve a sustainable competitive advantage by leveraging capabilities aligned with environmental sustainability, such as pollution prevention, product stewardship, and clean technology (McDougall et al., 2019). Green innovation is a driver of long-term competitive advantage, which is empirically reflected in improved sustainable performance (Dinarjito

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& Purwoko, 2025; Rahman et al., 2025; Umair Anwar et al., 2025; Zafar et al., 2026). Therefore, the following hypothesis is proposed:

H5: Green innovation has a positive effect on sustainable performance.

The relationship between green skills and sustainable performance is expected to operate through a sequential mechanism. From the SCT perspective, technical competence in the form of green skills is translated into concrete action in the form of green innovation (Bandura, 1986; Xie & Zhu, 2020). From the NRBV perspective, green innovation then serves as the mechanism that enhances sustainable performance (Dinarjito & Purwoko, 2025; Rahman et al., 2025). Green innovation thus bridges individual capability and the achievement of sustainable performance. Accordingly, the following hypothesis is proposed:

H6: Green innovation mediates the effect of green skill on sustainable performance.

From the SCT perspective, artisans' cognitive beliefs act as a primary motivation to design environmentally friendly solutions, thereby driving green innovation (Abdelwahed et al., 2025; Butt et al., 2025). From the NRBV perspective, green innovation subsequently enhances sustainable performance (Rahman et al., 2025; Umair Anwar et al., 2025; Zafar et al., 2026). Green innovation is therefore expected to channel the effect of green creative self-efficacy on sustainable performance. Based on this reasoning, the following hypothesis is proposed:

H7: Green innovation mediates the effect of green creative self-efficacy on sustainable performance

III. RESEARCH METHOD

This study adopts a quantitative, causal-explanatory research design complemented by descriptive and managerial analytical tools. The causal framework tests how green skills and green creative self-efficacy drive sustainable performance, specifically examining green innovation as a mediating mechanism. Subsequently, the study integrates Importance-Performance Map Analysis (IPMA) to evaluate the relative importance and performance of each construct. By converting statistical outputs into actionable importance-performance metrics, this dual-analytical approach establishes targeted managerial priorities to strengthen the sustainable performance of metalcraft MSMEs in Bali Province.

The study population comprised 733 metalcraft MSMEs distributed across eight regencies and one municipality in Bali Province, according to official records from the Bali Provincial Office of Cooperatives and SMEs (Dinas Koperasi Usaha Kecil dan Menengah Provinsi Bali, 2021). Applying Slovin's formula with a 5% margin of error yielded a minimum sample size of 259 respondents. The respondents were owners of metalcraft MSMEs in Bali Province. To ensure adequate geographic representation across Bali's diverse craft hubs, the respondents were selected using a proportionate stratified random sampling technique. This sampling strategy produced a proportional distribution comprising 108 respondents from Denpasar, 34 from Tabanan, 32 from Bangli, 30 from Buleleng, 28 from Jembrana, 15 from Karangasem, 7 from Badung, 3 from Klungkung, and 2 from Gianyar. The MSME owners served as key informants who provided information about the skills, environmental awareness, creative self-efficacy, green innovation practices, and sustainable performance of their respective businesses. Accordingly, the questionnaire responses reflected the owners' assessments of the relevant individual-level and business-level constructs.

Respondent eligibility followed the defined sampling frame: the respondent had to be the owner of a metalcraft MSME listed in the official Bali population register and located in one of the eight regencies or the municipality covered by the frame. Owners were selected as key informants because they could report on their own green capabilities and the operating practices of their businesses. The sampling design was proportionate by administrative area rather than by business age or firm-size category. Eligible respondents were owners of metalcraft MSMEs operating for at least one year and listed in the official population register used as the sampling frame. No additional restrictions were imposed based on business age or firm size. Consequently, the sample included micro, small, and

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medium enterprises. However, because the sampling procedure was not stratified by business age or firm-size category, the representation of these characteristics was not independently controlled. This approach ensured proportional representation across the selected administrative areas, while the distribution of respondents by business age and firm size was not separately established.

Slovin's formula was used to establish a population-based sample target, but it should not be treated as the sole evidence of adequacy for PLS-SEM. As a supplementary benchmark, the most complex endogenous equation in this model has three incoming predictors; a conventional multiple-regression power calculation using a medium effect size ($f^2 = 0.15$), $\alpha = 0.05$, and power = 0.95 gives an estimated minimum of 119 observations (Faul et al., 2009; Hair et al., 2022). The 259 respondents exceed this benchmark. Because the manuscript does not document a prospective power calculation at the design stage, this is presented as a supplementary adequacy check rather than a claim that G*Power originally determined the sample size. Methodological guidance likewise recommends more robust approaches to sample-size justification than relying on the ten-times rule alone (Kock & Hadaya, 2018).

Primary data were gathered through a structured questionnaire featuring closed-ended items evaluated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Variable measurements were operationalized using validated indicators adapted from recent empirical studies. A detailed summary of the operational definitions, measurement indicators, and evaluation scales for each variable is presented in Table 1.

Table 1. Operational Definitions of Variables

Variable	Operational Definition	Indicators	Scale
X_1	The owners' technical and operational capabilities, encompassing environmental knowledge, awareness, social responsibility, and adaptive competence in integrating green policies and practices into daily business operations.	Environmental technical skills (X1.1); environmental awareness (X1.2); social responsibility (X1.3); adaptive competence in integrating green policies into work practices (X1.4) (Irawan et al., 2025)	Likert 1-5
X_2	The owners' confidence in their ability to generate novel environmental ideas, solve ecological problems, and develop those ideas into actionable sustainability solutions.	Novel green idea generation (X2.1); environmental problem-solving efficacy (X2.2); further green idea development (X2.3) (Meirun et al., 2024)	Likert 1-5
Y1	The extent of adopting and executing eco-friendly practices and innovations within business operations, encompassing sustainable material usage, environmental technology adoption, pollution-control facility deployment, and eco-friendly project implementation.	Encompassing sustainable material usage (Y1.1); environmental technology adoption (Y1.2); pollution-control facility deployment (Y1.3); eco-friendly project implementation (Y1.4) (Al Koliby et al., 2025)	Likert 1-5
Y2	The holistic performance and sustainability outcomes of MSMEs, integrating three core dimensions: economic performance (market share growth), environmental protection (minimization of natural resource damage), and social contribution (support for local communities).	Market share growth (Y2.1); minimization of natural resource damage (Y2.2); support for local communities (Y2.3) (Al-Abbadi & Abu Rumman, 2023)	Likert 1-5

Source: Synthesized from previous literature (2026).

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Data analysis was conducted via Structural Equation Modeling–Partial Least Squares (SEM-PLS) utilizing SmartPLS version 4. Executed in two sequential phases, the procedure first evaluated the measurement model (outer model) to verify construct validity and reliability, followed by the structural model (inner model) to assess explanatory power and test the hypothesized direct and indirect relationships (Hair et al., 2019, 2022). To translate these empirical findings into actionable managerial strategies, the evaluation was extended using Importance-Performance Map Analysis (IPMA). IPMA maps construct importance against performance scores across four priority quadrants, helping establish targeted interventions for MSMEs (Mathew et al., 2017; Ringle & Sarstedt, 2016). Specifically, this approach identifies key drivers that exert substantial influence on the target outcome but currently demonstrate lower performance levels, signaling urgent operational priorities (Ringle & Sarstedt, 2016; Teeluckdharry et al., 2024).

IV. RESULTS AND DISCUSSION

Data Analysis Results

The PLS-SEM analysis evaluates the measurement model (outer model), structural model (inner model), and hypotheses. The measurement model assesses validity and reliability through convergent validity, composite reliability, and discriminant validity, with an ideal factor loading criterion of greater than 0.70 (Abdillah & Hartono, 2015). The convergent validity assessment for this study is presented in Table 2 below.

Table 2. Initial Outer Loadings of Research Variable Indicators

	Green Creative Self-Efficacy (X_2)	Green Innovation (Y1)	Green Skill (X_1)	Sustainable Performance (Y2)
X1.1			0.741	
X1.2			0.842	
X1.3			0.742	
X1.4			0.738	
X2.1	0.916			
X2.2	0.903			
X2.3	0.920			
Y1.1		0.852		
Y1.2		0.851		
Y1.3		0.797		
Y1.4		0.660		
Y2.1				0.884
Y2.2				0.869
Y2.3				0.883

Source: SmartPLS Output (2026).

As detailed in Table 2, indicator Y1.4 was excluded from further analysis because its outer loading failed to meet the established threshold of 0.70. Table 3 illustrates the recalculated outer loadings following the removal of this item.

An outer loading of 0.660 falls in the range where removal should be considered alongside reliability, convergent validity, and content coverage rather than applied automatically. A diagnostic calculation from the rounded initial loadings in Table 2 gives an approximate AVE of 0.630 and composite reliability of 0.871 for Green Innovation before removal; recalculating from the final loadings in Table 3 gives an approximate AVE of 0.732 and composite reliability of 0.891. Thus, the remaining indicators retain acceptable measurement properties and the recalculated reliability improves.

Table 3. Final Outer Loadings of Research Variable Indicators

	Green Creative Self-Efficacy (X^2)	Green Innovation (Y1)	Green Skill (X^1)	Sustainable Performance (Y2)
X1.1			0.743	

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X1.2			0.842	
X1.3			0.740	
X1.4			0.737	
X2.1	0.915			
X2.2	0.903			
X2.3	0.920			
Y1.1		0.876		
Y1.2		0.870		
Y1.3		0.819		
Y2.1				0.884
Y2.2				0.870
Y2.3				0.881

Source: SmartPLS Output (2026).

The data in Table 3 confirm the validity of all remaining indicators, as each outer loading surpassed the 0.70 threshold. Discriminant validity was then evaluated through the Heterotrait-Monotrait (HTMT) ratio, with the empirical findings displayed in Table 4.

Table 4. Heterotrait-Monotrait Ratio of Correlations

	Green Creative Self-Efficacy (X2)	**Green Innovation (Y1)**	**Green Skill (X1)**
Green Innovation (Y1)	0.669		
Green Skill (X_1)	0.846	0.711	
Sustainable Performance (Y2)	0.821	0.854	0.865

Source: SmartPLS Output (2026).

Based on Table 4, the requirement for discriminant validity has been met, as all HTMT values are below the threshold of 0.90.

Subsequently, construct reliability was evaluated using composite reliability, and the results are presented in Table 5 below.

Table 5. Composite Reliability Test Results

	Composite Reliability
Green Creative Self-Efficacy (X_2)	0.937
Green Innovation (Y1)	0.891
Green Skill (X_1)	0.850
Sustainable Performance (Y2)	0.910

Source: SmartPLS Output (2026).

According to the results in Table 5, every construct exhibited adequate internal consistency, as composite reliability values comfortably exceeded 0.70.

The subsequent stage involves the inner model analysis to illustrate the relationships among the latent variables based on a robust substantive theoretical foundation. The structural model was evaluated based on the coefficient of determination (R^2) and predictive relevance (Q^2), while model fit was assessed using the Standardized Root Mean Square Residual (SRMR). The strength of the structural model is determined by the R^2 criteria, where values of 0.75, 0.50, and 0.25 indicate strong, moderate, and weak models, respectively (Ghozali & Latan, 2020). The results of the R^2 testing are presented in Table 6 below:

Table 6. R-Square Test Results

	R-square
Green Innovation (Y1)	0.382

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Sustainable Performance (Y2)	0.685

Source: SmartPLS Output (2026).

As detailed in Table 6, Green Innovation (Y1) yielded an R^2 value of 0.382, indicating that Green Skill (X^1) and Green Creative Self-Efficacy (X^2) jointly account for 38.2% of its variance, with the remaining 61.8% driven by exogenous factors beyond the scope of this model. According to the criteria established by Ghozali and Latan (2020), this value falls into the weak category. Meanwhile, Sustainable Performance (Y2) yields an R^2 value of 0.685, indicating that 68.5% of its variance is jointly explained by Green Skill (X1), Green Creative Self-Efficacy (X2), and Green Innovation (Y1), with the remaining 31.5% accounted for by unexamined variables. Based on the benchmark criteria, the structural strength for the Sustainable Performance construct is categorized as moderate.

For MSME management, the R^2 values show where capability-building is likely to help and where support beyond the owner is still needed. The model accounts for 38.2% of variation in Green Innovation, so improving owners' green skills and creative confidence is relevant but leaves a substantial share of innovation differences associated with factors outside the model, such as access to equipment, finance, suppliers, buyers, or external technical advice. The 68.5% explained variance in Sustainable Performance indicates that the combined capabilities and green innovation offer a comparatively comprehensive explanation of differences in the economic, environmental, and social outcomes captured by this survey. It does not mean that any single intervention will increase performance by 68.5%; rather, it suggests that management and support programs should work on capabilities and their translation into operational practices together.

The evaluation of the PLS structural model can also be assessed using the Q^2 (Q-Square) test, which represents the goodness of fit of the observed values generated by the model along with its parameter estimates. A Q^2 value greater than zero ($Q^2 > 0$) indicates that the model possesses predictive relevance, whereas a value below zero ($Q^2 < 0$) signifies a limitation in predictive relevance. More specifically, the degree of predictive relevance is classified into three structural thresholds: 0.02 (weak), 0.15 (moderate), and 0.35 (strong) (Ghozali & Latan, 2020). The Q^2 values are presented in Table 7 below:

Table 7. Q^2 Test Results

	SSO	SSE	Q^2 (=1-SSE/SSO)
Green Creative Self-Efficacy (X^2)	777.000	777.000	0.000
Green Innovation (Y1)	777.000	564.579	0.273
Green Skill (X^1)	1036.000	1036.000	0.000
Sustainable Performance (Y2)	777.000	372.262	0.521

Source: SmartPLS Output (2026).

The Q^2 results indicate predictive relevance for both endogenous constructs. Green Innovation yielded a Q^2 value of 0.273, while Sustainable Performance yielded a Q^2 value of 0.521. These positive values indicate that the model demonstrates predictive relevance for both target constructs under the applied assessment procedure. The results should be interpreted as evidence of predictive relevance rather than as a comprehensive measure of overall model fit.

From a practical perspective, the positive Q^2 values suggest that the model has predictive relevance for the two outcomes under the applied procedure, with stronger predictive relevance for Sustainable Performance (0.521) than for Green Innovation (0.273). Managers can use this as support for prioritizing the measured drivers, but should not interpret Q^2 as a forecast of a specific percentage increase in sales, pollution reduction, or employment; those outcomes were not directly measured as objective changes in this study.

The model fit assessment using the Standardized Root Mean Square Residual (SRMR) is presented in Table 8. An SRMR value below 0.08 is generally considered to indicate an acceptable model fit (Ghozali & Latan, 2020).

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Table 8. Goodness of Fit

	Estimated model
SRMR	0.059

Source: SmartPLS Output (2026).

Table 8 presents an SRMR value of 0.059. This value is below the 0.08 threshold, indicating that the model demonstrates an acceptable fit based on the SRMR criterion.

For practice, SRMR is a diagnostic of the discrepancy between the observed correlations and those implied by the model, not a business-performance indicator. Its acceptable value supports interpreting the estimated paths and IPMA priorities, but it does not prove that the model includes every relevant business constraint or that the proposed practices will have identical effects across all enterprise sizes.

Explanatory research typically applies the Partial Least Squares Structural Equation Modeling (PLS-SEM) method as its primary analytical instrument. To evaluate the statistical significance of relationships among variables, a bootstrapping procedure is required. This bootstrapping process operates through repeated resampling generated entirely from the original dataset. Methodological guidelines generally recommend a parameter of 5,000 bootstrap samples, provided the subsample size exceeds the initial sample size. Nevertheless, relevant literature indicates that 200 to 1,000 replications are sufficient to accurately estimate standard errors in PLS modeling (Ghozali & Latan, 2020).

The structural model resulting from the hypothesis testing of this study is presented in Figure 1 below.

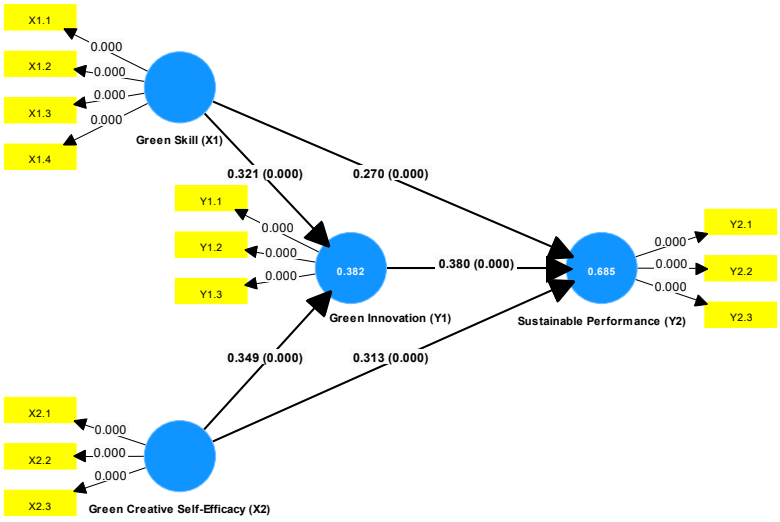

Figure 1. Structural Model for Hypothesis Testing

Source: SmartPLS Output (2026).

Figure 1 illustrates the structural model evaluated for hypothesis testing, while the corresponding empirical results are presented in Table 9 below:

Table 9. Hypothesis Testing Results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Green Skill (X_1) -> Green Innovation (Y1)	0.321	0.325	0.058	5.582	0.000
Green Creative Self-Efficacy (X_2) -> Green Innovation (Y1)	0.349	0.346	0.056	6.239	0.000

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Green Skill (X_1) -> Sustainable Performance (Y2)	0.270	0.268	0.055	4.922	0.000
Green Creative Self-Efficacy (X_2) -> Sustainable Performance (Y2)	0.313	0.314	0.056	5.619	0.000
Green Innovation (Y1) -> Sustainable Performance (Y2)	0.380	0.380	0.049	7.738	0.000
Green Skill (X_1) -> Green Innovation (Y1) -> Sustainable Performance (Y2)	0.122	0.123	0.026	4.609	0.000
Green Creative Self-Efficacy (X_2) -> Green Innovation (Y1) -> Sustainable Performance (Y2)	0.133	0.131	0.027	4.868	0.000

Source: SmartPLS Output (2026).

Based on the hypothesis testing results presented in Table 9, Green Skill (X_1) has a positive and significant effect on Green Innovation (Y1), with a path coefficient of 0.321, a T-statistic of 5.582, and a p-value of 0.000 ($p < 0.05$). Likewise, Green Creative Self-Efficacy (X_2) has a positive and significant effect on Green Innovation (Y1), with a path coefficient of 0.349, a T-statistic of 6.239, and a p-value of 0.000 ($p < 0.05$). With respect to Sustainable Performance (Y2), Green Skill (X_1) has a positive and significant direct effect, with a path coefficient of 0.270, a T-statistic of 4.922, and a p-value of 0.000. Green Creative Self-Efficacy (X_2) also has a positive and significant direct effect, with a path coefficient of 0.313, a T-statistic of 5.619, and a p-value of 0.000. Green Innovation (Y1) has a positive and significant direct effect on Sustainable Performance (Y2), with a path coefficient of 0.380, a T-statistic of 7.738, and a p-value of 0.000. Thus, all direct effects reported in Table 9 are statistically significant at the 5% significance level. Furthermore, the indirect effects are also statistically significant. Green Skill (X1) affects Sustainable Performance (Y2) through Green Innovation (Y1), with an indirect path coefficient of 0.122, a T-statistic of 4.609, and a p-value of 0.000. Green Creative Self-Efficacy (X2) also affects Sustainable Performance (Y2) through Green Innovation (Y1), with an indirect path coefficient of 0.133, a T-statistic of 4.868, and a p-value of 0.000. Because the direct effects of Green Skill (X1) and Green Creative Self-Efficacy (X2) on Sustainable Performance (Y2) remain statistically significant while their indirect effects through Green Innovation (Y1) are also significant, Green Innovation (Y1) partially mediates the effects of both variables on Sustainable Performance (Y2). Among the direct effects on Sustainable Performance (Y2), Green Innovation (Y1) has the largest path coefficient at 0.380, followed by Green Creative Self-Efficacy (X2) at 0.313 and Green Skill (X1) at 0.270. Based on the results in Table 9, all proposed relationships are statistically significant at the 5% significance level. Therefore, the hypotheses corresponding to these relationships are supported.

Following the confirmation of the structural model relationships and hypotheses, an Importance-Performance Map Analysis (IPMA) was performed for Green Innovation (Y1), as presented in Table 10. While the PLS-SEM path coefficients highlight the statistical significance of the variables, IPMA extends these findings by contrasting construct importance with performance levels to identify key target areas for improvement.

Table 10. IPMA for Green Innovation (Y1)

Construct	Importance	Performance	Quadrant
Green Creative Self-Efficacy (X^2)	0.349	48.49	High importance – High performance
Green Skill (X^1)	0.321	44.96	Low importance – Low performance
Mean construct importance = 0.335; mean construct performance = 46.73.			

Source: SmartPLS Output (2026).

Table 10 presents the construct-level IPMA results for Green Innovation (Y1). Green Creative Self-Efficacy (X^2) has an importance value of 0.349 and a performance value of 48.49, placing it in the high-importance–high-performance quadrant. This suggests that its current performance should be

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maintained. In contrast, Green Skill (X^1) has an importance value of 0.321 and a performance value of 44.96, placing it in the low-importance–low-performance quadrant because its importance is below the construct-level mean of 0.335. Thus, Green Skill is not identified as a high-importance–low-performance priority at the construct level. Nevertheless, the indicator-level analysis provides a more specific perspective: X1.2 is classified as high importance–low performance for Green Innovation. This distinction demonstrates why construct-level and indicator-level IPMA should be interpreted together: the overall construct may not fall within the priority-improvement quadrant, while a specific indicator within that construct may still warrant managerial attention.

Based on the empirical results summarized in Table 10, the indicator-level results for Green Innovation (Y1) are presented in Table 11 below.

Table 11. IPMA Indicator Analysis for Green Innovation (Y1)

Indicator	Importance	Performance	Quadrant
X1.1	0.102	45.66	Low importance – Low performance
X1.2	0.123	44.21	High importance – Low performance
X1.3	0.097	44.50	Low importance – Low performance
X1.4	0.094	45.56	Low importance – Low performance
X2.1	0.127	48.46	High importance – High performance
X2.2	0.123	48.26	High importance – High performance
X2.3	0.133	48.75	High importance – High performance
Mean indicator importance = 0.114; mean indicator performance = 46.48.			

Source: SmartPLS Output (2026).

At the indicator level, X1.2 (environmental awareness) is positioned in the high-importance–low-performance quadrant and represents the main indicator-level improvement priority for Green Innovation (Y1). This result indicates that environmental awareness warrants particular attention because its relative importance is high while its performance remains comparatively low. Meanwhile, X2.1, X2.2, and X2.3 are positioned in the high-importance–high-performance quadrant and should be maintained. X1.1, X1.3, and X1.4 fall into the low-importance–low-performance quadrant and may be considered for gradual improvement according to the operational needs and resources of the MSMEs. Taken together with the construct-level results in Table 10, these findings show that indicator-level IPMA can reveal a specific improvement priority that is not apparent from the overall construct classification alone.

Next, to identify the performance and importance priorities for the primary outcome variable, the IPMA was performed for Sustainable Performance (Y2), as summarized in Table 12.

Table 12. IPMA for Sustainable Performance (Y2)

Construct	Importance	Performance	Quadrant
Green Creative Self-Efficacy (X^2)	0.446	48.49	High importance – High performance
Green Innovation (Y1)	0.380	46.55	Low importance – Low performance
Green Skill (X^1)	0.391	44.96	Low importance – Low performance
Mean construct importance = 0.406; mean construct performance = 46.67.			

Source: SmartPLS Output (2026).

Table 12 presents the construct-level IPMA results for Sustainable Performance (Y2). Green Creative Self-Efficacy (X^2) falls into the high-importance–high-performance quadrant, indicating that its current performance should be maintained. In contrast, Green Skill (X^1) and Green Innovation (Y1) fall into the low-importance–low-performance quadrant based on the construct-level mean values. Accordingly, neither construct is classified as a high-importance–low-performance priority for Sustainable Performance at the construct level. However, this overall classification does not preclude

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the existence of specific indicators requiring improvement. The indicator-level analysis in Table 13 is therefore used to identify more targeted priorities for Sustainable Performance.

Because no construct was classified as high importance–low performance at the construct level, the analysis was further extended to the indicator level to identify more specific areas requiring managerial attention.

Table 13. IPMA Indicator Analysis for Sustainable Performance (Y2)

Indicator	Importance	Performance	Quadrant
X1.1	0.125	45.66	Low importance – Low performance
X1.2	0.150	44.21	High importance – Low performance
X1.3	0.119	44.50	Low importance – Low performance
X1.4	0.115	45.56	Low importance – Low performance
X2.1	0.162	48.46	High importance – High performance
X2.2	0.157	48.26	High importance – High performance
X2.3	0.170	48.75	High importance – High performance
Y1.1	0.147	48.07	High importance – High performance
Y1.2	0.150	47.97	High importance – High performance
Y1.3	0.147	43.44	High importance – Low performance
Mean indicator importance = 0.144; mean indicator performance = 46.49.			

Source: SmartPLS Output (2026).

At the indicator level, X1.2 (environmental awareness) falls into the high-importance–low-performance quadrant for both Green Innovation and Sustainable Performance, making it a shared improvement priority. In addition, Y1.3 (pollution-control facility deployment) is classified as high importance–low performance specifically for Sustainable Performance. These findings indicate that environmental awareness and the deployment of pollution-control facilities warrant particular managerial attention. Metalcraft MSMEs should strengthen environmental awareness and translate it into production practices, while reviewing the implementation and use of pollution-control facilities where relevant to their operations. Meanwhile, X2.1, X2.2, X2.3, Y1.1, and Y1.2 fall into the high-importance–high-performance quadrant and should be maintained. X1.1, X1.3, and X1.4 fall into the low-importance–low-performance quadrant and may be considered for longer-term improvement.

Overall, the IPMA results indicate that, at the construct level, no variable is classified as high importance–low performance for the Green Innovation (Y1) target. However, at the indicator level, X1.2 is identified as a high-importance and low-performance indicator and therefore represents the main improvement priority for Green Innovation. For Sustainable Performance (Y2), no construct falls into the high-importance–low-performance quadrant. However, at the indicator level, X1.2 and Y1.3 are classified as high importance–low performance, indicating that these specific indicators should receive greater managerial attention. Managerial efforts should prioritize strengthening environmental awareness (X1.2), an indicator of Green Skill, and improving the deployment of pollution-control facilities (Y1.3), an indicator of Green Innovation, to support Sustainable Performance. At the same time, MSMEs should maintain the strong performance of Green Creative Self-Efficacy and the other indicators classified in the high-importance–high-performance quadrant.

DISCUSSION

Green Skill and Green Innovation

The results of this study indicate that green skills has a positive effect on green innovation among metal craft MSMEs in Bali Province. Social Cognitive Theory (SCT) explains human behavior as a dynamic interaction among personal, behavioral, and environmental factors (Bandura, 1986). Within this framework, innovative behavior is driven by the interplay between cognitive factors and the mastery of actual competencies. Green skills, acquired through environmental education and professional development, strengthen sustainable practices and the use of environmentally friendly

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technologies, which are essential for green innovation. Skilled workers equipped with green knowledge are therefore better able to adopt green innovation effectively (Boujedra & Jebli, 2025; Pavlova, 2017). Investments in employee training, particularly in green skills, are shown to positively influence the development and implementation of green innovations that lead to environmental benefits such as reduced energy consumption and emissions (Mach, 2026). Green training increases the likelihood of firms achieving sustainability performance through green innovation, emphasizing the importance of organizational learning and skill development (Xie & Zhu, 2020). Green skills also stimulate green innovation directly by enabling the development of environmentally friendly products and processes (Xie & Zhu, 2020). Accordingly, artisans with stronger green skills are expected to produce more green innovations.

In a Metalcraft MSMEs, green skills become useful when owners and artisans can identify where material is lost, sort reusable offcuts, handle process residues appropriately, reduce avoidable rework, or choose a less wasteful operating method. These are incremental changes that may be more feasible for small metalcraft MSMEs than large capital-intensive technologies. The indicator-level IPMA result for environmental awareness (X1.2) is consistent with this interpretation: technical skill alone is unlikely to generate sustained innovation unless owners recognize why a practice matters and can connect it to daily production decisions. At the same time, access to suitable equipment, finance, or technical support may still constrain whether knowledge is converted into practice.

Green Creative Self-Efficacy and Green Innovation

The results of this study indicate that green creative self-efficacy has a positive effect on green innovation among metal craft MSMEs in Bali Province. SCT also emphasizes that individuals' beliefs in their own capabilities (self-efficacy) shape their sustainability-related practices (Butt et al., 2025; Salama et al., 2025; Zhang et al., 2022). Green self-efficacy, defined as employees' belief in their ability to drive green change, is shown to positively influence green innovative behavior and green innovation in organizational contexts. Employees with higher green self-efficacy are more likely to engage in green innovation activities, especially when supported by behavioral interventions and a conducive learning climate (Guo, 2022; Li et al., 2026; Senbeto, 2025). Green creative self-efficacy refers to the belief in one's ability to generate creative solutions to environmental challenges, and it plays an important role in green innovation (Butt et al., 2025; Salama et al., 2025; Zhang et al., 2022). This belief has a positive effect on green innovation, particularly in adapting sustainable business models (Abdelwahed et al., 2025). Artisans who are confident in their ability to solve environmental problems are therefore more likely to design environmentally friendly solutions.

The numerically larger coefficient for Green Creative Self-Efficacy (0.349) than for Green Skill (0.321) may reflect the owner-led character of many small metalcraft MSMEs: confidence in generating and adapting solutions can help an owner initiate small trials, learn from unsuccessful attempts, and persist when a standard solution is unaffordable or unavailable. Skills provide the know-how, whereas creative self-efficacy can encourage owners to apply that know-how flexibly to their own materials, tools, and customer requirements. The difference between the two coefficients was not formally tested, however; it is therefore an interpretive ordering, not evidence that Green Creative Self-Efficacy is statistically stronger than Green Skill. The high-importance/high-performance IPMA classification for the three self-efficacy indicators suggests that these strengths should be maintained and channelled into concrete shop-floor improvements.

Green Skill and Sustainable Performance

The results of this study indicate that green skills has a positive effect on sustainability performance among metal craft MSMEs in Bali Province.The Natural Resource-Based View (NRBV) extends the Resource-Based View by integrating environmental sustainability into strategic management, and holds that firms gain a sustainable competitive advantage from resources and capabilities aligned with environmental sustainability (McDougall et al., 2019). Under this view, strategic resources are not limited to physical assets but also include intangible resources embedded in individuals, such as green skills. Developing green skills within an organization enhances its capacity

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to achieve sustainability goals (Amjad et al., 2024), and green skills have been linked to sustainability outcomes (Zainal et al., 2024). Sustainable performance integrates economic, social, and environmental aspects of firm activities (Yasrawan & Werastuti, 2022). Green competencies and values, especially those related to carbon footprint reduction, directly enhance sustainable performance. This effect is further strengthened when individuals are motivated to mitigate carbon emissions, indicating that both skills and willingness are crucial for sustainability outcomes (Abdelkareem et al., 2024).

This direct relationship is plausible because routine competence can affect performance even when a business has not introduced a formally labelled green innovation. More careful material handling can lower avoidable input costs and scrap; environmental awareness can encourage safer handling and more consistent waste separation; and social responsibility can help preserve relationships with workers and the surrounding community. These mechanisms connect the three dimensions of Sustainable Performance without assuming that every metalcraft MSMEs has the capital to install advanced technology. The IPMA result also cautions against treating Green Skill as a single uniform capability: environmental awareness is the specific underperforming indicator that warrants priority attention.

Green Creative Self-Efficacy and Sustainable Performance

The results of this study indicate that green creative self-efficacy has a positive effect on sustainability performance among metal craft MSMEs in Bali Province. From the NRBV perspective, green creative self-efficacy is also an intangible resource that can support a sustainable competitive advantage (McDougall et al., 2019). Fostering green self-efficacy within organizations improves their ability to achieve sustainability goals (Amjad et al., 2024). Green creative self-efficacy boosts green creativity, which is directly linked to sustainable performance and environmental outcomes in organizations (Aeknarajindawat & Jermsittiparsert, 2019; Rafiq et al., 2026). The relationship between green creativity and sustainable performance is strengthened when employees feel confident in their ability to generate and implement eco-friendly ideas (Aeknarajindawat & Jermsittiparsert, 2019; Rafiq et al., 2026). Artisans who believe in their capacity to create environmental solutions are therefore expected to contribute to better economic, social, and environmental outcomes for their enterprises.

Creative self-efficacy may also shape performance directly by influencing the decisions owners are willing to make before an innovation project is fully implemented for example, engaging workers in waste-reduction ideas, discussing material alternatives with suppliers, or responding to customer expectations for responsible production. In resource-constrained enterprises, perceived ability to solve a problem may help owners mobilize people and existing resources before committing to expensive equipment. The estimated coefficient is numerically larger than the Green Skill coefficient (0.313 versus 0.270), but, as with the Green Innovation equation, no formal test comparing these two coefficients was reported. The result should therefore be read as evidence that both capability dimensions matter, with a descriptive coefficient ordering rather than a statistically verified difference in their relative magnitudes.

Green Innovation and Sustainable Performance

The results of this study indicate that green innovation has a positive effect on sustainability performance among metal craft MSMEs in Bali Province. According to the NRBV, firms can achieve a sustainable competitive advantage by leveraging capabilities aligned with environmental sustainability, such as pollution prevention, product stewardship, and clean technology (McDougall et al., 2019). Green innovation is a driver of long-term competitive advantage, which is empirically reflected in improved sustainable performance (Dinarjito & Purwoko, 2025; Rahman et al., 2025; Umair Anwar et al., 2025; Zafar et al., 2026). Green innovation directly enhances environmental performance by reducing waste, emissions, and resource consumption, leading to cleaner production and improved sustainability metrics (Nasrollahi et al., 2020; Rahman et al., 2025; Zainuddin et al., 2026). Adoption of renewable energy and eco-innovation further boosts environmental outcomes and supports international trade, reinforcing sustainable performance (Liu et al., 2022).

The result can be understood through relatively practical mechanisms: better use of materials and environmental technology may reduce input losses; pollution-control facilities may improve the handling of process residues; and credible environmental practices can help protect customer trust and

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market position. This interpretation is consistent with the positive performance relationships reported for Bali SMEs by Ayu et al. (2025), for Thai SMEs by Schrank & Kijkasiwat (2024), and for Indonesian MSMEs by Innayah et al. (2024). However, the finding should not be generalized as universal. Wibowo et al. (2019) found that green innovation did not significantly affect green performance among Indonesian SMEs, even though it related to competitive advantage and non-green performance. One plausible explanation is that improvements in broad business performance may appear sooner than measurable environmental outcomes, or that environmental benefits depend on readiness, firm size, and the substantive quality of the innovation. Because the current study uses owner-reported survey indicators rather than direct pollutant measurements, it supports a relationship with perceived sustainable performance, not a quantified reduction in contamination.

The Mediating Role of Green Innovation in the Green Skill–Sustainable Performance Relationship

The results of this study indicate that green innovation mediates the effect of green skill on sustainable performance among metal craft MSMEs in Bali Province. The relationship between green skills and sustainable performance is expected to operate through a sequential mechanism. From the SCT perspective, technical competence in the form of green skills is translated into concrete action in the form of green innovation (Bandura, 1986; Xie & Zhu, 2020). From the NRBV perspective, green innovation then serves as the mechanism that enhances sustainable performance (Dinarjito & Purwoko, 2025; Rahman et al., 2025). Studies show that green HRM and green human capital directly enhance sustainable performance, but their effect is significantly strengthened when mediated by green innovation. Employees with green skills are more likely to generate and implement green innovations, which in turn drive sustainable performance (Bindeeba et al., 2025; Haryono & Kusumawati, 2026). Green innovation thus bridges individual capability and the achievement of sustainable performance.

The partial mediation indicates that green skills can be associated with Sustainable Performance through two routes: owners may improve routine resource handling directly, and they may use their skills to introduce green innovations that further support performance. For management, this means that training should not stop at awareness or technical instruction; it should include guided application in the MSMEs, such as reviewing material losses, trialling waste-segregation procedures, or checking whether an adopted technology is actually used. Because the direct route remains relevant, such implementation support should complement rather than replace foundational skills training.

The Mediating Role of Green Innovation in the Green Creative Self-Efficacy–Sustainable Performance Relationship

The results of this study indicate that green innovation mediates the effect of green creative self-efficacy on sustainable performance among metal craft MSMEs in Bali Province. From the SCT perspective, artisans' cognitive beliefs act as a primary motivation to design environmentally friendly solutions, thereby driving green innovation (Abdelwahed et al., 2025; Butt et al., 2025). From the NRBV perspective, green innovation subsequently enhances sustainable performance (Rahman et al., 2025; Umair Anwar et al., 2025; Zafar et al., 2026). Individuals or organizations with high green creative self-efficacy are more likely to engage in green innovation activities because they feel confident in their creative abilities to address environmental issues (Mankgele, 2023). Green innovation acts as a bridge, translating the confidence and creativity (self-efficacy) into tangible actions and outcomes that improve sustainable performance. In other words, self-efficacy alone does not guarantee sustainable performance; it is the implementation of innovative green ideas that leads to measurable improvements (Mankgele, 2023). Green innovation is therefore expected to channel the effect of green creative self-efficacy on sustainable performance.

The second mediation pathway suggests that confidence becomes more consequential when it leads to implemented changes. An owner may believe that a cleaner process is possible, but the expected sustainability benefit depends on turning that belief into a workable product or process adjustment. The practical implication is to provide low-risk opportunities to propose, test, and review green ideas, supported by technical advice and peer learning. This is especially relevant when financial or equipment

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constraints make a full technology upgrade impractical. The mediation remains partial, so creative self-efficacy may also influence direct owner decisions and staff engagement outside the measured green-innovation pathway.

V. CONCLUSION

The main contribution of this study is to show how owner-level environmental capabilities can be connected to operational innovation and the wider sustainability of traditional metalcraft MSMEs. Integrating Social Cognitive Theory with the Natural Resource-Based View provides a multi-level explanation: green skills supply practical know-how, green creative self-efficacy supports the initiative to develop solutions, and green innovation is one mechanism through which these capabilities can become business practices. The IPMA adds managerial value by distinguishing broad capability strengths from specific improvement needs, particularly environmental awareness and pollution-control facility deployment.

For practice, training and support should combine applied environmental-skills development with opportunities for owners and artisans to propose, test, and review affordable green solutions. Local government, industry associations, and support institutions can complement these efforts through technical assistance, peer demonstrations, and access to suitable waste-management or pollution-control options. The findings should be interpreted in light of several limitations: the cross-sectional, owner-reported survey cannot establish changes over time or verify actual pollutant reductions; the sample is limited to metalcraft MSMEs in Bali; business age and size-category distributions were not reported in the analyzed manuscript; and the Green Innovation construct excludes the eco-friendly project implementation indicator (Y1.4). Future studies should collect enterprise-age and scale profiles, combine survey responses with objective economic and environmental measures, use longitudinal or multi-source data, and test whether the relative effects of green skills and creative self-efficacy differ formally across enterprise types and support conditions.

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