



Green Entrepreneurship and Inclusive Innovation for Sustainable Creative Businesses: Evidence from the Borobudur Super-Priority Tourism Area

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ABSTRACT

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With increasing global awareness of environmental issues, green entrepreneurship has become a popular choice because it is not only profit-oriented but also considers social and environmental aspects. The creative industry in tourist destinations is increasingly dependent on a combination of technological innovation, social inclusiveness, and environmentally friendly practices. This study examines the role of green entrepreneurship, inclusive innovation ecosystems, and government support in driving the performance of sustainable creative businesses in the Borobudur super-priority tourist destination area. The data was sourced from a sample of respondents, namely creative entrepreneurs in the Borobudur tourism SPD area who have implemented green entrepreneurship. Data analysis was performed using modelling Smart PLS 4. Research findings show that green entrepreneurial intention has the greatest overall influence on the sustainability of creative businesses, both directly and indirectly. The path from green entrepreneurial intention to green entrepreneurial orientation is very strong, while the path from green entrepreneurial intention to marginalized communities is also significant. Marginalized communities and green entrepreneurial orientation emerge as the most influential drivers. The variables of access to technology and managerial capacity act as enablers. Meanwhile, stakeholder collaboration and government policy support do not have a statistically significant effect, indicating governance barriers.

1. INTRODUCTION

The green economy is seen as a middle ground between growth and environmental conservation, aiming to increase income and employment while reducing carbon emissions, improving resource efficiency, and restoring ecosystems [1]. The implementation of a green economy drives economic growth and employment by reducing carbon emissions, improving energy efficiency, and minimizing environmental degradation to achieve the Sustainable Development Goals (SDGs). Efforts to achieve the SDGs prioritize a green economy as an approach to promote environmentally friendly economic growth [2, 3]. Indonesia reaffirms its commitment through the 2022 G20 Presidency, themed “Recovery Together, Recovery Stronger” and a roadmap for the development of a green economy-based creative industry until 2030 [4].

The creative industry plays an important role in driving economic growth and job creation. The tourism and creative economy sectors contribute significantly to GDP (6.98%) and 14.66% of total employment in Indonesia [5]. The Indonesian

government has set a target to support green economy-based creative industries by 2030, aiming to create jobs and promote innovation in local products. This is achieved through the integration of creative industry development with Micro, Small, and Medium Enterprises (MSMEs), which play a vital role in the national economy. Economic growth through the tourism sector, supported by the expansion of MSMEs, has a positive impact on the economy and contributes to economic development (Bank Indonesia, 2023).

Development in the region to promote community welfare must be carried out using a sustainable development model. Competitiveness is one of the parameters in the concept of sustainable regional development [6]. The Borobudur tourist area in Magelang is one of Indonesia's super-priority tourist destinations (SPD), based on green tourism with a strong emphasis on cultural preservation. Optimizing creative economic activities in the Borobudur tourist area is a positive step in supporting green economy. Initiatives by creative sector actors contribute to sustainable development while preserving cultural heritage and promoting environmentally friendly practices [4]. Green economic activities in the

Borobudur tourism SPD area emphasize the optimization and preservation of natural resources, as well as local community assets through MSMEs. The majority of businesses in the Borobudur tourism area's MSME cluster support green tourism businesses, for example, by establishing the creative business *Kampung Borobudur* (Ministry of Tourism and Creative Economy, 2024). However, optimizing this potential faces two main challenges. First, there is limited adoption of green practices by creative businesses. Many businesses still rely on resource-intensive processes, without adequate waste management systems and energy efficiency measures. Second, there is a lack of social inclusivity. Marginalized groups—women, people with disabilities, and low-income households—have not been fully integrated into the creative value chain, resulting in economic and cultural benefits that are not distributed equitably.

Creative business activities that promote development and improve community welfare should be encouraged, while maintaining environmental sustainability and minimizing social impacts such as increased waste generation [7]. Green entrepreneurship, characterized by high green entrepreneurial intention (GEI) and green entrepreneurial orientation (GEO), is a key focus for developing a green economy in the creative industry sector. GEI measures an individual's intention to operate an environmentally friendly business; GEO reflects the strategic implementation of such intentions in product innovation, processes, and green marketing [8] and an inclusive innovation ecosystem, which emphasizes technology access, multi-stakeholder collaboration, and marginal involvement to ensure innovative solutions that are relevant to grassroots communities and socially just [9, 10].

The research gap arises because most studies separate GEI/GEO analysis from the dimension of inclusivity [11]; they focus on the context of manufacturing or technology industries rather than tourist destinations and rely on descriptive qualitative approaches. As a result, quantitative evidence regarding the social-ecological mediation mechanisms in green tourist destinations, particularly SPDs in developing countries, remains limited. This situation highlights the need for research that simultaneously examines green entrepreneurship practices, ecosystem inclusivity, and government support for sustainable creative enterprises in the Borobudur tourist SPD area.

2. LITERATURE REVIEW

2.1 Green economy

The United Nations Environment Programme (UNEP) states that a green economy is a way of managing the economy that improves human well-being and social equity while reducing risks to the environment and the scarcity of its resources [3]. The green economy has three main principles: low-carbon economic growth, efficient use of resources, and social justice. With this approach, economic growth is not only an important factor but also prioritizes sustainability for future generations. In the creative industry, the green economy is an important foundation that will enable businesses to combine creative innovation with environmentally friendly practices. Creative industries rooted in local wisdom and natural resources, such as handicrafts, local cuisine, and performing arts, can be developed using approaches that minimize waste, conserve energy, and support environmental preservation.

This model also strengthens social connections among businesses, consumers, and surrounding communities through sustainability values. Creative businesses involving marginalized groups can create broader social impacts and strengthen business social networks [12, 13].

The implementation of a green economy requires synergy between technological innovation, changes in consumption patterns, and policies that support the transition to a sustainable economic system. In the creative industry, this can be achieved through the adoption of clean technology, the use of renewable raw materials, and production systems based on recycling or the circular economy. Technology enables businesses to improve efficiency, reach broader markets, and reduce their carbon footprint through the digitalization of production and distribution processes. Digital platforms such as e-commerce, social media, and business management applications have helped MSMEs survive the crisis and expand their tourism markets. High levels of technology access also contribute to the creation of innovations that are adaptive to environmental challenges. The success of the green economy in this sector heavily depends on the awareness of businesses, as well as support from the government, academia, and consumers [14].

In Indonesia, the concept of green economy is gaining ground in national development policies, particularly in the context of tourism and the creative economy. Priority tourist areas such as Borobudur are encouraged to develop green and inclusive local economic ecosystems. Through this approach, the creative industry not only generates economic value but also serves as a social force for cultural preservation, community empowerment, and sustainable environmental protection. Government support is crucial to the success of programs aimed at transforming the creative industry into a more sustainable one. Policies that are not contextually appropriate or overly administrative can reduce their effectiveness, making the involvement of local stakeholders in policy formulation highly important. Additionally, businesses must have strong networks with stakeholders. Forms of collaboration can include training programs, business incubation, promotion of local products, and integration of business activities into the tourism ecosystem. The better the quality of collaboration among actors, the greater the likelihood of creating an inclusive and sustainable creative business ecosystem [15]. A broad network supported by good managerial skills encourages creative business actors to develop business models that are sensitive to social values and ecological sustainability.

2.2 Green entrepreneurship

Schumpeter's Innovation Theory highlights the important role of entrepreneurship and innovation in driving economic development and organizational success. When it comes to SMEs, this theory only serves to further demonstrate that firms need to innovate by introducing either new products, processes or business models in order to outdo their competition. SMEs often grow by exploiting niche markets and enhancing their ability to innovate quickly. SMEs are one of the preferred and numerous form factor organizations all set to contribute towards creating significant increase in economic activities and jobs [16]. Entrepreneurship, in its basic definition, is the act of creating value by bringing ideas to fruition through the application of an opportunity with some type of innovation and hoping for monetary gain. Entrepreneurship is an attribute of

a person that can recognize opportunity, encourage the risks of acting in dynamic environments through innovation and leadership as well as create value [17]. As a result of increasing international awareness in environmental and sustainability issues, this concept has evolved into green entrepreneurship, a form of entrepreneurship that is not only profit-oriented but also considers social and environmental aspects [11]. The approach is based on two central constructs namely green entrepreneurial intention (GEI) and green entrepreneurial orientation (GEO). They are equally important in informing us, as researchers who study the way how environmental values are internalized at the individual, and organizational level in the entrepreneurial process [18].

Specifically, based on the Theory of Planned Behavior [19], GEI refers to a person's intention to establish/expand an environmentally friendly business through the confirmation of attitudes, subjective norms, and perceived behavioral control. Recent longitudinal studies have shown that the stronger the components of the Theory of Planned Behavior, the more it will lead to a significant increase in changing green entrepreneurial behavior [20]. This study measures these intentions in terms of personal desire, anticipation of actual behavior, and readiness to act. Creative business people who have a lot of GEI, are more willing to make new environmentally friendly ideas. In addition, they are more likely to help local communities and create new ways to generate economic value that do not harm the environment [19, 20], which is part of environmentally friendly entrepreneurship, where good business is not only about making money, but also saving the earth, reducing carbon emissions, and treating everyone fairly. In this context, entrepreneurship must focus on issues such as global warming, business waste, or unfair treatment of people. The tendency to start a business is influenced by psychological factors such as beliefs, others' opinions, and how one perceives their ability to act. In the context of green entrepreneurship, this also means caring about sustainability [21]. GEI is affected by many factors as shown by many studies in different contexts: environmental education, personal experience with ecological issues; influence of pro-environmental communities; global exposure to climate change, social justice and environmental degradation [22, 23]. GEI can provide creative business opportunities in the Borobudur tourism area to start new ventures that are flexible, creative, and socially and environmentally beneficial. Business activities suitable for developing green business ideas include traditional food enterprises, local crafts, and community-based ecotourism. According to Rong et al. [8], these businesses are not only rooted in local culture and stories, but also help in the preservation of natural resources and promote the area as an all-round eco-friendly tourist destination.

GEO is a broader concept than the concept of Entrepreneurial Orientation (EO), but it focuses more on the environment. GEO is a way of managing or creating a business that is based on how much attention individuals or companies pay to new ideas, initiating new plans, and their willingness to take risks in environmentally friendly work. How well a company can develop new green innovations for products, ways of working, or jobs that reduce negative impacts on the environment is closely related to GEO. It also shows how ready entrepreneurs are to take risks when using new tools or doing other things that may not provide financial benefits, but have a great opportunity to do good things for society and the environment. The concept is to stop any work that can damage

air, water, soil, climate, and make people want to use or buy sustainable products. In green entrepreneurship, GEOs help companies enter the green economy, becoming more competitive, gaining a better reputation with buyers, and creating more sustainable outcomes. Other research also states that GEO is closely related to GEI and can help the development of green business [14]. GEO is proven to assist companies in achieving a better level of sustainability in corporate financial and environmental management [24]. The meta-analysis study of Asad et al. [24] shows that GEO helps in the aspect of corporate social performance so that it can function better and produce green innovation in the company. In the studies of Asad et al. [24] and Anwar et al. [25], stated that GEO is an approach consisting of several components, including willingness to take risks, act proactively, and be innovative. The existence of GEO shows how creative businesses are willing to promote new ideas, be active, and take risks by considering the social, economic, and environmental aspects of the business. In the Borobudur tourism SPD area, this orientation is important to ensure that creative entrepreneurs do not only focus on short-term profits but also build business practices relevant to global issues such as climate change and the preservation of local culture.

2.3 Inclusive innovation ecosystem

As an inclusive innovation ecosystem, it seeks more technology access, plus stakeholder cooperation along with including marginalized sectors so that grassroots-based needs are understood in the most appropriate manners. Yousaf et al. [26] said technology helps enterprises to enhance productivity and widen markets when the production and distribution processes become digitized, so that carbon emissions are minimized. Almtiri et al. [27], which Digital platforms and Social media, along with business management applications have aided to protect creative businesses from being eradicated by the crisis, ended up extending tourism markets and helping broadly in maintaining sustainable innovation in MSMEs. The work of Vashkevich et al. [28] also supports this view as their study on inclusive tourism destinations demonstrates that the involvement of vulnerable groups, for example, disabled people can be a success thanks to sustainable multi-stakeholder collaboration facilitated by digital technology. Moreover, research findings suggest that improved economic-environmental goal alignment of green tourism programs are associated with coordination among “double helix” actors (public-private sector) which leads to increased social legitimization within the green tourism plan [29].

Involvement of marginalized communities, representing engagement by people and at vulnerable groups, such as women, differently abled, low-income, in the creative business value chain. But as more othering goes on in an increasingly diverse society, inclusion also becomes a business strategy to promote social sustainability and community legitimacy [30]. Managerial capacity describes the ability of business actors to plan, organize, direct, and control resources to achieve business objectives effectively and efficiently. As Heubeck [31] and Roy et al. [32] said, managerial capacity is the capability that business actors have to plan, organize, direct and control resources to achieve business objectives effectively and efficiently. This capacity is interpreted within the framework of green entrepreneurship as a sustainable strategy, inclusive human resources and environmental risks

management, respectively. MSMEs internalize green principles via MSME opening up participation to vulnerable groups by the influence of Managers' competencies in planning, organizing and controlling. Quantitative evidence from 216 manufacturing MSMEs in Malaysia shows that dynamic managerial capabilities play a crucial role in mediating the influence of sustainable business practices on three-dimensional sustainability performance (economic, social, and environmental) [33]. Similar implications were found in the MSME strengthening index model at cultural heritage sites, where managerial skills mediate the relationship between green orientation and the adoption of resource efficiency practices [34].

2.4 Sustainability creative business (SCB), and government support (GS)

The performance of sustainable creative businesses in tourist areas is measured using economic indicators (profitability, job growth), environmental indicators (waste reduction, resource efficiency), and social indicators (inclusivity, cultural preservation). The positive relationship between GEO and sustainable creative business (SCB) has been confirmed through a cross-country meta-analysis [35], while the involvement of marginalized communities strengthens market legitimacy and product differentiation (handicrafts, cuisine) in historical tourist areas [36].

Government support plays a role in creating a business climate that supports green economy principles and inclusive innovation [37]. This support can take the form of regulations, fiscal incentives, provision of green infrastructure, facilitation of training, and access to markets and financing [38]. It is expected that different fiscal incentive schemes, green certification, and government technical assistance are helping the speed of this leverages towards the acceleration of green creative industries. Small green industries also benefit from the location of Borobudur tourist area with the program "Green Industry Concept" to improve energy efficiency and market access through digital marketing at all layers of MSMEs (initially increased by 18% within one year) [39]. But other research warns that innovation intentions could be dampened in the presence of too many bureaucratic regulations if it is not complemented with service ease.

2.5 Theory of Planned Behavior (TPB)

Theory of Planned Behavior (TPB) is a theoretical model proposed for explaining how human intentions are formed documenting that behavior following from these intentions can be predicted. The TPB suggests that an individual intention to engage in a behavior is based on three main components: attitude towards the behavior, subjective norms, and perceived behavioral control. All three of these operate at the same time to influence whether an individual acts or does not act in a given situation [11, 40]. Recently, TPB has been used in the green entrepreneurship literature to study the intention of business actors to engage with sustainable (environmentally friendly) practices. Environmental sustainability attitude are the dominant key factor for increasing willingness among business actors to perform green innovation, where subjective norms such as community social pressure or demand from consumers turning into an individual postulated construct at performing and actualizing adherence in behaving based on sustainability principles. Meanwhile, perceived behavioral control: the power of an individual to

execute their intentions in practice as a consequence of capacity and resources [11, 40].

The appropriateness of the TPB in how green entrepreneurship behavior can be explained is well documented by some extant studies. Which means that TPB also has potential to predict entrepreneurial intention in situations of sustainability-driven sectors, especially MSMEs actors in developing countries. In the creative industry, the TPB model is very useful for understanding the motivations of business actors in implementing environmentally friendly production, recycling-based innovation, and the adoption of green technology [1]. Implications TPB provides a strong theoretical foundation for designing interventions or behavior-change policies. Effective green entrepreneurship training must foster positive attitudes, strengthen supportive social norms, and enhance entrepreneurs' confidence in their ability to manage sustainable businesses. By understanding the psychological and social factors that shape such intentions, policymakers and facilitators can develop more targeted and impactful strategies for the development of the green creative industry [16, 41].

3. HYPOTHESIS

Digital transformation in the tourism sector promotes resource efficiency, product innovation, and platform-based business models that reduce carbon footprints. Comparative studies in Europe have shown that "smart solutions" improve destination sustainability scores through real-time energy and waste management [42]. In Indonesia, a survey of creative SMEs shows that technology adoption before, during, and after the pandemic positively correlates with increased green revenue and business resilience [43]. Similar findings among global SMEs confirm that digital competencies strengthen resilience readiness and sustainability orientation [44]. This evidence reinforces the expectation of a significant positive relationship, leading to the hypothesis that access to technology-digitalization (AT) positively influences SCB: AT → SCB.

The quadruple-helix model (government–industry–academia–community) has been proven to accelerate the green creative transition. An analysis of the determinants of creative tourism reveals that cross-actor collaboration enhances product diversification, joint marketing, and the achievement of destination environmental indicators [45]. Research in Tana Toraja found that collaboration significantly increases visits and cultural-environmental conservation initiatives [46]. A quantitative study in 137 tourist villages in Bali confirmed collaboration and inclusive governance as predictors of sustainability performance [47]. Given the consistent positive evidence, the hypothesis that stakeholder collaboration (SC) positively influences SCB; SC → SCB is deemed relevant.

Fiscal incentives, green certification, and technical assistance increase the adoption of environmentally friendly innovations in MSMEs. A cross-country survey found that subsidies and tax breaks accelerate green innovation and the net profits of SMEs [48]. A panel study in China demonstrates that official government "green-identity certificates" increase a company's market value and environmental reputation [38]. A panel analysis in Europe shows that "green identity" certificates enhance the reputation and market value of creative companies [49]. Furthermore, Wang and Feng [50] add that government support moderates the influence of green orientation on sustainability performance. Thus, government

policy support (GPS) has a significant positive effect on SCB; GPS → SCB.

The ability to plan, organize, and provide inclusive leadership enables business actors to include vulnerable groups in the value chain. Micro-foundational research on digital transformation in SMEs confirms that managerial cognition determines the success of integrating local talent and green practices [51]. Case studies on Base-of-the-Pyramid (BoP) inclusion demonstrate how SME leaders structure co-creation processes to ensure economic benefits reach marginalized communities [52]. Therefore, it is hypothesized that managerial capability (MC) positively influences marginal inclusion (MI): MC → MI.

GEI not only encourages green entrepreneurial behavior but also promotes pro-social values. An analysis of 407 Chilean students showed that GEI is positively correlated with community-based green entrepreneurial behavior [53]. Global GEI bibliometrics highlight research trends on the role of green intentions in addressing socio-ecological issues [54]. Salamzadeh and Kesim [55] reported a positive correlation between GEI and community involvement in green startups in Iran. Escobar [56] confirmed that green entrepreneurial intent drives inclusive business practices in Latin America. The concept of “intentions-behaviour gap” in eco-entrepreneurship (GEI) positive and significant manifest themselves in the actions of MI in the context of Borobudur tourism SPD. Hypothesis: GEI → MI.

Several recent studies view GEI as an antecedent to the formation of GEO. A PLS study on SMEs confirms that GEI and knowledge management processes directly enhance GEO [57]. Muangmee et al. [34] found that GEI combined with knowledge management processes enhances innovation, proactivity, and green risk-taking in Thai SMEs. Erdogan et al. [58] also demonstrated the pathways of GEI and GEO in New Zealand's tourism services sector. A theoretical review positions GEI as a cognitive input toward organizational behavior based on proactivity, innovation, and green risk-taking [59]. Therefore, the significant positive relationship between GEI → GEO is worth testing.

The participation of marginalized communities enhances the legitimacy, product differentiation, and social sustainability of destinations. Factor analysis in tourist villages shows that community involvement improves competitiveness, empowerment, and destination performance [60]. Moise et al. [61] in Rumania tourist villages found that community involvement improves the economic and social performance of destinations. Maziliauske [62] asserts that co-creation between SMEs and local residents strengthens social-cultural sustainability in world heritage areas. Co-creation between SMEs and local residents has been proven to strengthen socio-cultural benefits in rural areas [62]. This evidence supports the hypothesis: MI → SCB positive.

A meta-analysis of 72 studies found a strong correlation between GEO and companies' financial, environmental, social, and green innovation performance [35]. Research on the manufacturing-service industry in emerging economies confirms that GEO improves business success by enhancing green innovation capabilities [8]. Momayez et al. [63] demonstrate that GEO enhances sustainability by strengthening green innovation capabilities in Malaysia's tourism sector. Similar findings in the tourism sector identify GEO as the primary determinant of sustainability performance [64]. With this literature, the GEO → SCB hypothesis is

considered strong both theoretically and empirically.

4. RESEARCH METHOD

Methods- Sampling Frame, Inclusion Criteria, and Procedure.

Sampling Frame.

The study targeted 120 creative enterprises located within the Borobudur Super-Priority Destination (crafts, culinary, fashion, and creative services). Inclusion Criteria (purposive). (i) operating within the DSP Borobudur area; (ii) having current or planned green practices (e.g., waste management, eco-friendly materials, energy efficiency); (iii) at least one year of operation; (iv) respondent is the owner or key decision-maker. Pre-survey ‘Green’ Screening. We applied three screener items capturing minimum green practice. Units that did not meet the threshold were not invited to the main survey. The percentage of screened-out non-green units was not documented quantitatively at the time of data collection. To enhance transparency, we provide the sampling flow in Table A1 and explicitly report the final analytical sample ($n = 65$, $\approx 54\%$ of the 120-unit frame).

Sample Adequacy for PLS-SEM (ISR/GE Summary)

We evaluated the adequacy of $n = 65$ using the inverse square root and gamma-exponential approaches based on the smallest absolute path coefficient ($\alpha = 0.05$; power = 0.80). Effects that are near-zero would require large N ; our realized $n = 65$ is sufficient for the small-to-moderate focal effects that were significant in the bootstrap. Detailed computations are provided in Appendix A-1. Although the final response rate was moderate, the achieved sample met both statistical power and theoretical representativeness requirements for PLS-SEM analyses.

The green economy is a new paradigm in development that balances economic growth with environmental preservation and social justice. This study examines the implementation of inclusive innovation ecosystems, the role of green entrepreneurs, and government commitment to green creative enterprises in the Borobudur tourist SPD area. The study is quantitative in nature with a cross-sectional approach. The testing framework uses Structural Equation Modeling-Partial Least Squares (SEM-PLS) because: (a) the model is predictive-exploratory, (b) the sample size is limited, and (c) the constructs contain reflective and formative indicators [65]. The analysis was conducted using Smart PLS 4.0.

The population includes all green economy-based creative industry players in the Borobudur tourist SPD area (120 business units, source: Tourism Office 2024). The sampling technique used purposive sampling with the following inclusion criteria: (a) businesses that have been active for at least two years; (b) produce products/services based on local cultural heritage; (c). Implementing at least one environmentally friendly business practice (such as sustainable materials or waste management). The next criterion is: (a). The $10 \times$ indicator rule-the largest construct (GEO) has six indicators, so ≥ 60 observations are required [65]; (b). Power analysis via GPower 3.1 ($\alpha = 0.05$; power = 0.80; $f^2 = 0.15$; five main predictors) recommends ≥ 55 samples [66].

Using purposive sampling and predetermined sampling criteria, a sample of 65 sustainable creative entrepreneurs was obtained. The functional relationship between exogenous variables and endogenous variables is as follows: exogenous

variables include: (a) green entrepreneurship (GEO, GEI, managerial capacity), (b) inclusive innovation ecosystem (access to technology-digitalization, involvement of marginalized communities, stakeholder collaboration), and (c) GPS. The endogenous variable is SCB in the Borobudur

tourism SPD area. To address the research objectives and hypotheses, a quantitative approach (SEM-PLS) was used. The empirical research model is shown in Figure 1 and Figure 2.

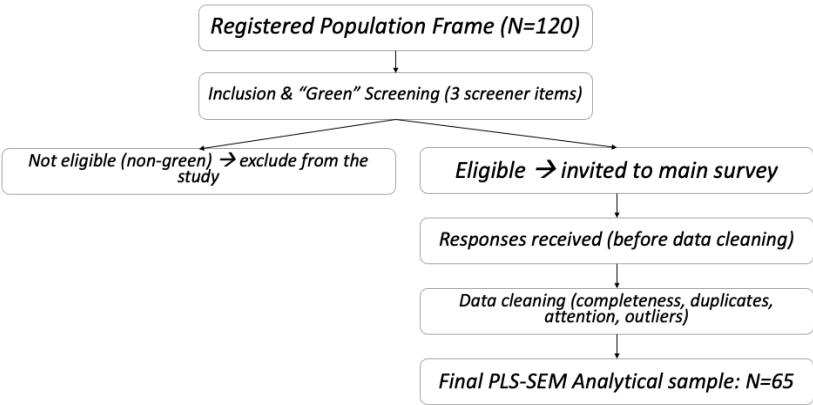


Figure 1. Sampling flow

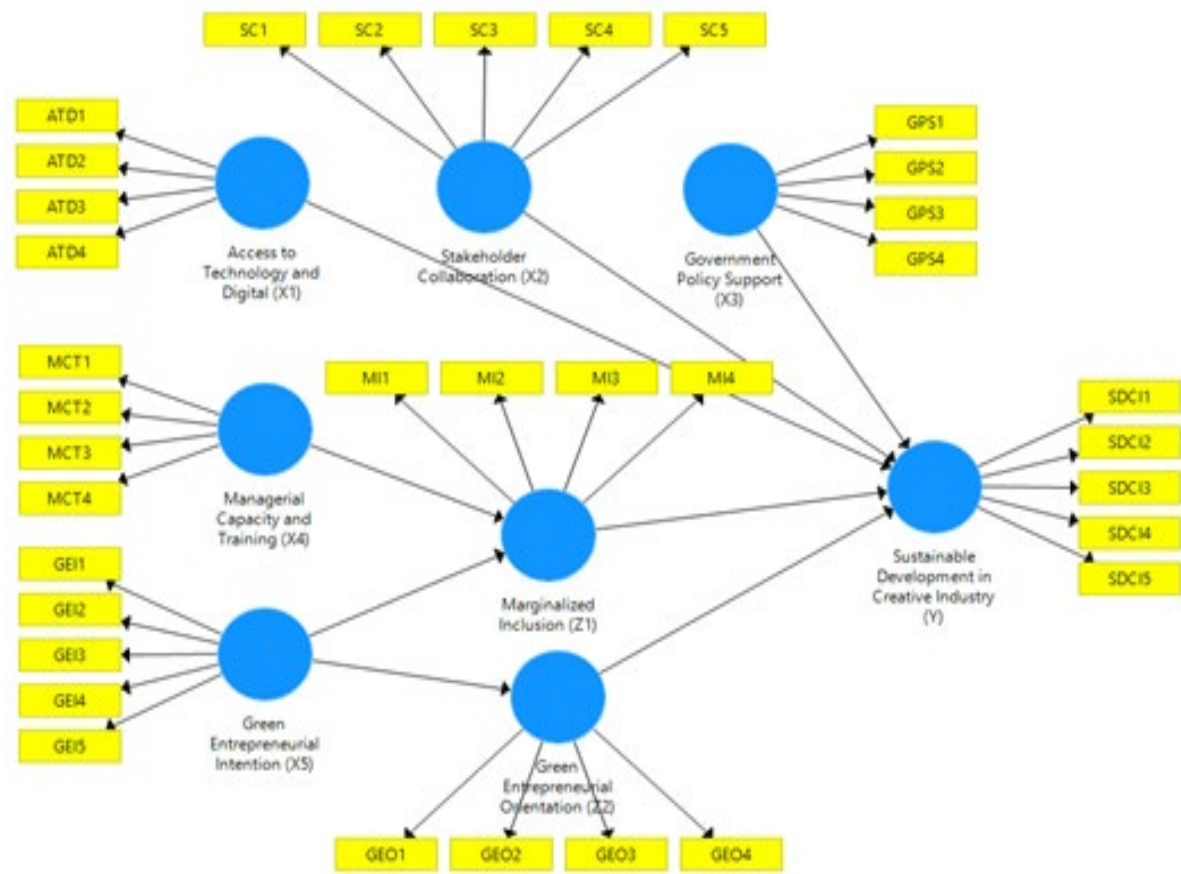


Figure 2. Empirical model of research

5. RESULTS AND DISCUSSION

The research objects were creative industry entrepreneurs who had implemented environmentally friendly practices within the Borobudur Super-Priority Destination (SPD). Respondent characteristics are summarized by age, education, years in operation, and business type (Table 1). Most owners are aged 30–60 (≈ 72.3%), the majority hold a Senior High School degree (≈ 38.5%), and over five years in operation (≈

76.9%).

In terms of business type, handicrafts and souvenirs combined account for 46.2% (30/65), followed by others (e.g., tourism services, accommodation, travel agencies, ornamental plants) at 32.3% (21/65). These distributions indicate substantial heterogeneity across firms—consistent with the inclusion of control variables (firm age, education, and, where available, firm size) and with the robustness checks reported in Table 1.

Table 1. Characteristics of sample respondents

Sample Respondent Criteria							
Age (years)	Number (people)	Type of Education	Number (people)	Duration (years)	Number (people)	Type of Business	Number (people)
< 30	6	Elementary School	11	< 1	1	Handicrafts	17
30–39	15	Junior High School	15	1–3	4	Souvenirs	13
40–49	17	Senior High School	25	3–5	10	Culinary	9
50–60	15	Diploma	8	5–7	15	Batik	5
> 60	12	Bachelor's Degree	6	> 7	35	Others	21
Total	65		65		65		65

Table 1 presents the criteria of respondents in this study, totaling 65 participants. Based on age, the majority of respondents are between 40–49 years old (26.2%), followed by those aged 50–60 years (23.1%), 30–39 years (23.1%), over 60 years (18.5%), and under 30 years (9.2%). In terms of education, most respondents completed senior high school (38.5%), while others graduated from junior high school (23.1%), elementary school (16.9%), diploma (12.3%), and bachelor's degree (9.2%). Regarding business experience, the majority have been operating for more than 7 years (53.8%), followed by 5–7 years (23.1%), 3–5 years (15.4%), 1–3 years (6.2%), and less than 1 year (1.5%). Based on the type of business, most respondents are engaged in handicrafts (26.2%), souvenirs (20.0%), culinary (13.8%), batik (7.7%), and others (32.3%). This distribution indicates that most business actors are middle-aged individuals with moderate to long business experience and secondary-level education.

6. OUTER MODEL ANALYSIS

6.1 Convergent validity

Convergent validity measures the extent to which indicators of a construct are highly correlated with each other and consistently represent the latent variable being measured. One of the main criteria for assessing convergent validity is the loading factor value, where an indicator is considered valid if it has a loading factor > 0.50 [67]. The loading factor data is shown in Table 2 (Appendix Table A1).

Based on the results of the convergent validity analysis, all loadings were ≥ 0.70 except for KMP1 (0.589) and PBIK5 (0.655). Both indicators were still above the minimum exploratory threshold of 0.50. Therefore, all constructs in the model met the criteria for convergent validity. These two indicators were retained because their factor loadings were still within the acceptable tolerance range for exploratory research. According to Hair et al. [67], factor loadings above 0.50 can be considered adequate when supported by strong theoretical justification and acceptable overall model validity. Moreover, both KMP1 and PBIK5 demonstrated satisfactory cross-loading values, indicating that each indicator loaded higher on its respective construct than on others. Thus, their inclusion was maintained to preserve the comprehensiveness and theoretical consistency of the measurement model.

6.2 Common method bias (CMB) diagnostics

Harman's single-factor (unrotated) did not indicate a dominant common factor; the Common Latent Factor (CLF) test produced average Δ -loading < 0.20 ; the marker-variable correction did not alter the significance of focal paths; and construct-level collinearity is acceptable with all inner VIF

values < 3.0 (see Table 3).

We minimized CMB by ensuring anonymity, clarifying there were no right/wrong answers, randomizing items across constructs, and using neutral wording. An unrotated EFA across all indicators showed that no single factor accounted for a majority of variance (Table 2).

Table 2. Validity test results

Variable	Indicator	Loading Factor	Validity Result
Access to Technology (X1)	ATD1	0.917	Valid
	ATD2	0.831	Valid
	ATD3	0.907	Valid
	ATD4	0.826	Valid
	KDS1	0.911	Valid
Stakeholder Collaboration (X2)	KDS2	0.818	Valid
	KDS3	0.813	Valid
	KDS4	0.815	Valid
	KDS5	0.837	Valid
	DKP1	0.837	Valid
Government Support (X3)	DKP3	0.874	Valid
	DKP4	0.877	Valid
	DKP5	0.827	Valid
Managerial Capacity (X4)	KMP2	0.866	Valid
	KMP3	0.721	Valid
	KMP4	0.901	Valid
	KMP5	0.881	Valid
	GEI1	0.770	Valid
Green Entrepreneurial Intention (X5)	GEI2	0.907	Valid
	GEI3	0.782	Valid
	GEI4	0.842	Valid
	GEI5	0.807	Valid
	KMM1	0.928	Valid
Marginal Inclusion (Z1)	KMM2	0.908	Valid
	KMM4	0.865	Valid
	KMM5	0.811	Valid
	KMP1 (X4)	0.589	Valid
	GEO1	0.849	Valid
Green Entrepreneurial Orientation (Z2)	GEO2	0.724	Valid
	GEO3	0.749	Valid
	GEO4	0.745	Valid
	GEO5	0.724	Valid
	PBIK1	0.749	Valid
Sustainable Creative Businesses (Y)	PBIK2	0.709	Valid
	PBIK3	0.815	Valid
	PBIK4	0.752	Valid
	PBIK5	0.655	Valid

Adding a common latent factor to the measurement model yielded an average indicator loading difference < 0.20 (Table 2), indicating negligible CMB. Marker Variable Approach. Using a theoretically unrelated marker to adjust correlations left the significance of focal paths unchanged (Table 3). All full collinearity VIF values per latent construct were below 3.3 (Table 3). Together, these diagnostics suggest CMB is not material in our data.

Table 3. Construct-level collinearity (Inner VIF)

Construct	Inner VIF
AT (X1)	1.859
SC (X2)	2.129
GS (X3)	2.153
MC (X4)	1.075
GEI (X5)	1.000
MI (Z1)	1.948
GEO (Z2)	1.519

6.3 Construct reliability and validity

Construct validity can be seen from the Average Variance Extracted (AVE) value, with a minimum limit of 0.50, which indicates that the latent variable is able to explain more than 50% of the variance of its indicators. Construct reliability is evaluated using three main measures: Cronbach's Alpha, rho_A, and Composite Reliability, all of which must be above 0.70 to meet the criteria for internal reliability [68-70] (Table 4).

Table 4. Construct validity and reliability

Variable	Cronbach's Alpha	Composite Reliability	AVE	Evaluation Results
AT (X1)	0.894	0.926	0.759	Valid and Reliable
SC (X2)	0.895	0.923	0.705	Valid and Reliable
GS (X3)	0.876	0.915	0.729	Valid and Reliable
MC (X4)	0.873	0.909	0.715	Valid and Reliable
GEI (X5)	0.880	0.913	0.677	Valid and Reliable
MI (Z1)	0.901	0.931	0.773	Valid and Reliable
GEO (Z2)	0.769	0.852	0.590	Valid and Reliable
SCB (Y)	0.790	0.856	0.544	Valid and Reliable

Based on the test results, both construct validity and construct reliability have been fulfilled, so that the instruments used in this model are valid and reliable [68-70].

6.4 Discriminant validity

GEO Specification (Reflective) and Robustness. We modeled GEO as reflective because indicators (innovativeness, proactiveness, risk-taking) are manifestations of the underlying strategic posture; changes in the latent trait should affect all indicators in the same direction and indicators are

interchangeable. Support comes from high outer loadings, CR/pA/a above thresholds, AVE > 0.50, and outer VIF < 5. As a robustness check, we also estimated a second-order reflective-reflective GEO (INNO, PROAC, RISK) and found that key structural conclusions remain unchanged (Table 4 and Appendix Table A2).

Discriminant Validity (GEI-GEO). HTMT_GE I-GEO = 0.983 (> 0.90) reflects close conceptual relatedness (intention vs. orientation) among MSMEs where intention-to-practice translation is rapid. We retain both constructs due to their non-redundant roles (GEI as intention; GEO as strategic posture) and provide robustness via the second-order GEO, cross-loading inspection, and VIF checks; we acknowledge this as a limitation and suggest more distinctive indicators or longitudinal designs (Appendix Table A3).

MI Indicator Allocation. We removed item KMP1 (managerial) from MI, as it reflects managerial capacity rather than inclusion. Retained MI indicators focus on access to information/markets, network participation, and benefit sharing. Post-adjustment reliability and validity remain adequate (see revised Table 2 and Appendix Table A2).

According to Henseler et al. [71], a good Heterotrait-Monotrait Ratio of Correlations (HTMT) value should be below 0.90 to ensure that the constructs in the model do not overlap and measure different concepts (Table 5 and Appendix Table A4).

Based on the HTMT test results in Table 5, all construct pairs met the recommended threshold of < 0.90 for discriminant validity, except for the GEI and GEO pairs, which reached 0.983. This value can be explained by the high conceptual fit between "intent" and "orientation" toward green practices in creative business activities at Borobudur. Previous studies have confirmed that, at the micro and small scales, GEIs are often directly manifested in operational behavior without a long time lag, leading respondents to view the two as a single entity [72, 73]. A meta-analysis by Schlaegel and Koenig [74], also shows a high correlation-even above 0.70-between entrepreneurial intention and subsequent behavior, particularly in the context of sustainability-oriented entrepreneurship. Thus, the high GEI-GEO correlation reflects the reality in the field rather than a weakness of the instrument.

6.5 Inner model analysis

The R Square (R^2) value is used to measure the predictive ability of the structural model in explaining the variance of the dependent (endogenous) variable. According to Chin [75], an R^2 value of ≥ 0.67 is considered strong, around 0.33 - < 0.67 is considered moderate, and < 0.33 is considered weak.

Table 5. Heterotrait-monotrait ratio (HTMT)

Construct	(ATD)	(GPS)	(GEI)	(GEO)	(MC)	(IMC)	(SC)	(SD)
Access to Technology	—	0.520	0.625	0.602	0.476	0.623	0.605	0.750
Government Policy Support		—	0.641	0.518	0.336	0.679	0.756	0.585
Green Entrep. Intention			—	0.983	0.296	0.576	0.453	0.772
Green Entrep. Orientation				—	0.281	0.555	0.473	0.855
Managerial Capacity					—	0.680	0.591	0.571
Marginal Inclusion						—	0.619	0.871
Stakeholder Collaboration							—	0.568
Sustainable Develop. in CI								—

Table 6. R² values

Endogenous Variables	R ²	Category [75]
GEO (Z2)	0.687	Strong
MI (Z1)	0.584	Moderate
SCB (Y)	0.727	Strong

The results of the analysis in Table 6, show that the model has good predictability for endogenous variables. This research model is also able to estimate and explain the sustainability performance of creative MSMEs in the Borobudur Tourism SPD area. This is evidenced by the values of 0.635 (GEO), 0.549 (MI), and 0.543 (SCB) in Stone-Geisser Q² obtained through the benchmark test. All these Q² values exceed the high predictive relevance threshold of 0.35 [67]. Through PLS-Predict, it shows positive Q²predict values and smaller RMSE-PLS than the reference linear model, so out-of sample data can be predicted in this model (Table 7) [76].

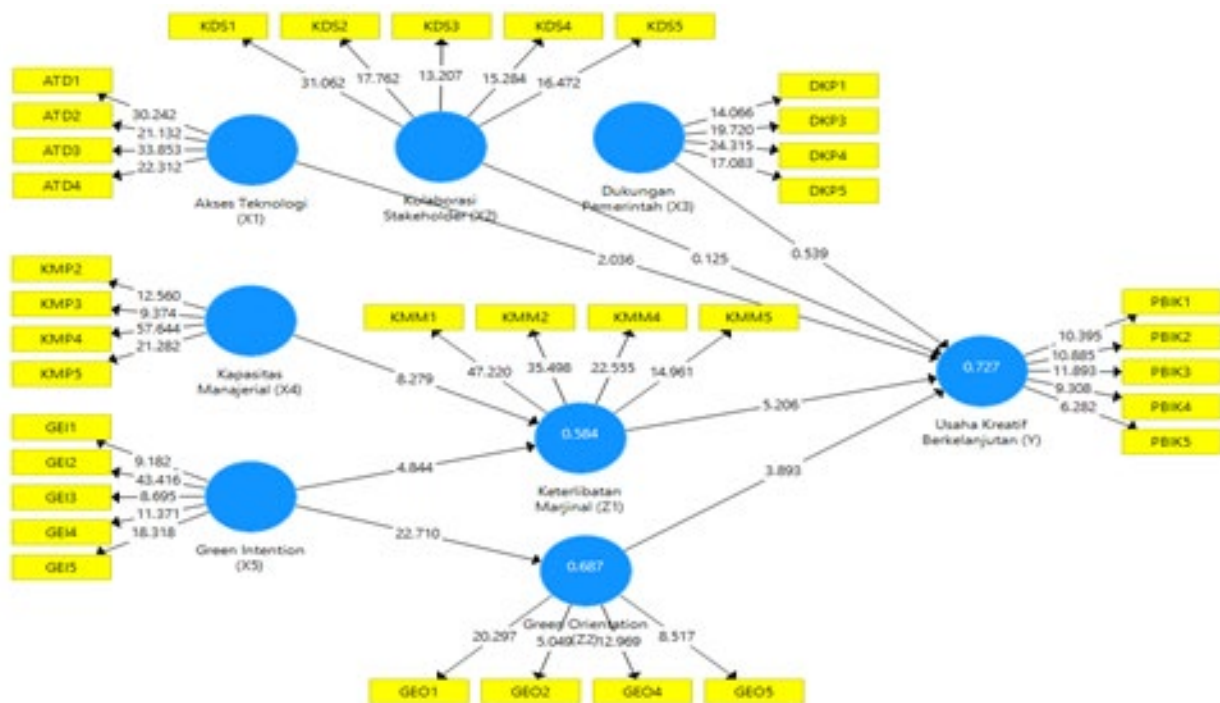
6.6 Path coefficient analysis

Interpretation of research results is important in determining the relative contribution of each construct in explaining the phenomenon under study and evaluating hypotheses. Through path coefficient analysis, the direction and strength of the

relationship between the independent and dependent variables in the study can be determined. In addition, a significant effect is obtained through the T statistical significance test and the p value, provided that the p value must be less than 0.05 (Figure 3).

The estimation results show that most of the paths in the model have a significant effect on the dependent variable. The path GEI (X5) → GEO (Z2) has the strongest and most significant influence with a coefficient of 0.829 ($p < 0.001$), followed by MI (Z1) → SCB (Y) at 0.506, and MC (X4) → MI (Z1) at 0.589. Meanwhile, the effect of AT (X1) on SCB (Y) is significant with a coefficient of 0.211 ($p = 0.042$). However, there are two statistically insignificant relationships, namely between GPS (X3) and SC (X2) on SCB (Y) with p-values of 0.590 and 0.900, respectively.

These findings indicate that most constructs contribute to the model, but not all relationships statistically provide a significant direct effect. The Q² values obtained from blindfolding confirm substantial predictive power for all three endogenous constructs ($Q^2 = 0.308\text{--}0.486$). The PLSpredict evaluation shows that all indicators have a lower RMSE-PLS than the linear model, indicating strong out-of-sample predictive power. Effect-size analysis (f^2) reveals the greatest influence is on the GEI → GEO path ($f^2 = 0.87$; large) and MI → SCB ($f^2 = 0.38$; large), while AT → SCB is only small-medium ($f^2 = 0.05$) (Appendix Table A5).

**Figure 3.** Results of path coefficient analysis**Table 7.** Path coefficients

Relationship Between Variables	Path Coefficient (β)	T Statistic	P Value	Description
AT (X1) → SCB(Y)	0.211	2.036	0.042	Supported (H1)
SC (X2) → SCB(Y)	-0.016	0.125	0.900	Not supported (H2)
GPS (X3) → SCB(Y)	-0.055	0.539	0.590	Not supported (H3)
MC (X4) → MI(Z1)	0.589	8.279	<0.001	Supported (H4)
GEI(X5) → MI(Z1)	0.356	4.844	<0.001	Supported (H5)
GEI(X5) → GEO(Z2)	0.829	22.710	<0.001	Supported (H6)
MI (Z1) → SCB(Y)	0.506	5.206	<0.001	Supported (H7)
GEO(Z2) → SCB(Y)	0.357	3.893	<0.001	Supported (H8)

These findings also confirm the dominance of cognitive-strategic mechanisms and social inclusion over mere access to technology. Bootstrap mediation tests show that GEI enhances SCB through two channels: (a) the social channel $GEI \rightarrow MI \rightarrow SCB$ ($\beta = 0.180$; $p < 0.001$); and (b) the strategic channel $GEI \rightarrow GEO \rightarrow SCB$ ($\beta = 0.296$; $p < 0.001$). Since the direct path $GEI \rightarrow SCB$ is not significant, these two paths indicate full-partial mediation that validates the “green-inclusive entrepreneurship” framework (Appendix Table A6).

The f^2 analysis reveals varying levels of effect size among the studied constructs. Green Entrepreneurial Intention (X5) shows a very large effect ($f^2 = 0.829$) on Green Entrepreneurial Orientation (Z2), indicating that entrepreneurs’ green intentions strongly influence their orientation toward sustainable practices. Similarly, Managerial Capacity and Training (X4) and Marginalized Inclusion (Z1) exert large effects ($f^2 = 0.589$ and 0.506 , respectively) on Sustainable Development in the Creative Industry (Y), highlighting the critical roles of managerial competence and inclusive participation. Green Entrepreneurial Orientation (Z2) also demonstrates a large effect ($f^2 = 0.357$) on sustainability outcomes, while Access to Technology and Digitalization (X1) contributes a moderate effect ($f^2 = 0.211$). Conversely, Government Policy Support (X3) and Stakeholder Collaboration (X2) show minimal or negative effects ($f^2 = -0.055$ and -0.016), suggesting that policy frameworks and partnerships have yet to translate into substantial sustainability impacts within the creative industry context (Appendix Table A7).

7. DISCUSSION

7.1 The role of access to technology on sustainable creative businesses

The path estimation results indicate that AT significantly increases SCB, albeit moderately ($\beta = 0.211$; $p = 0.042$). These findings support the logic of technology-enabled sustainability, where digital infrastructure cuts process inefficiencies and reduces the carbon footprint of destinations [77]. At the micro level, a meta-review of European SMEs establishes ICT adoption as a driver of green innovation [78]. The moderate effect reinforces the capability-based view: technology is merely an enabler without managerial literacy, its impact is blunted [79].

In the Borobudur SPD area, social media penetration is widespread, but the integration of the Internet of Things (IoT) into the green supply chain is still minimal. Digital supply chain training and green digital voucher schemes for MSMEs are priorities in order to leverage AT growth. Implications: For creative businesses in tourist areas like Borobudur, this includes improving digital literacy and ensuring equitable access to technology, which are key factors in driving the adoption of sustainability principles. This also underscores that the development of an inclusive innovation ecosystem cannot be separated from strengthening the digital infrastructure and capabilities of businesses.

7.2 The impact of stakeholder collaboration on sustainable creative businesses

Stakeholder collaboration pathways for SCB: $SC \rightarrow SCB$ is not significant ($\beta = -0.016$; $p = 0.900$). Substantively, this

finding is quite interesting, because theoretically cross-sector collaboration should strengthen the adaptive and innovative capacity of business actors, challenging the assumptions of the Quadruple-Helix model [80]. Qualitative explanations indicate that collaboration between creative businesses in Borobudur and other communities (government, local communities, academia, private sector) tends to be ceremonial, limited to promotional events without an operational coordination platform. Information asymmetry and a lack of trust among actors mean that direct contributions to sustainability performance are not yet felt, thus no longer providing a significant additional effect on business sustainability.

This finding is in line with the findings of Koiwanit and Filimon [81], which show that in local contexts (such as tourist destinations), multi-stakeholder collaboration is often ineffective due to the lack of direct benefits felt by business actors and weak collaborative structures. They emphasize that collaboration will fail to create added value if it is not based on trust, equal contribution, and a clear shared purpose [81]. Meanwhile, research in Toraja shows that cross-actor collaboration increases product diversification Suparjo et al. [46] and Asian heritage records similar positive effects [82]. Governments and tourist destination managers need to form cross-actor working groups, with key performance indicators (such as collective waste reduction, joint green certification) to ensure that collaboration has a real impact. Based on field observations and informal interviews, stakeholder collaboration in the creative industry development programs around Borobudur often takes a ceremonial form, focusing on attendance and formality rather than joint planning or implementation.

7.3 The role of government policy support on sustainable creative businesses

GPS on SCB is not significant ($\beta = -0.055$; $p = 0.590$). This gap is consistent with criticism of the implementation gap of green fiscal incentives, which often fail downstream [83]. A Chinese panel study demonstrates that subsidies are effective only if the procedures are simple [84]; in Borobudur, respondents complained about the high cost and lengthy process of green certification. The “one-stop service + performance-based incentives” approach is recommended so that GPS functions as a condition of effectiveness [85], not merely as administrative regulation. A study by Andriansyah et al. [86], on tourism MSMEs in Indonesia shows a similar pattern: government interventions that are not contextually appropriate tend to fail to stimulate improvements in marketing performance and innovation, due to a lack of adaptation to on-the-ground conditions and coordination across government levels.

7.4 The impact of managerial capacity on marginal inclusion

Managerial capacity (MC) has a significant effect on MI ($\beta = 0.589$; $p < 0.001$; $f^2 = 0.35$). The concept of dynamic managerial capability suggests that coordination knowledge enables inclusive work design, such as dividing household production tasks among women or the elderly [87]. Cardeal et al. [88] add that managerial human capital mediates the social inclusion of MSMEs. Creative entrepreneurs in Borobudur have extensive business experience (>5 years), routinely

divide production processes among households of women and the elderly, and enhance the social legitimacy of the destination. Participatory leadership training and performance-based incentive systems should be prioritized.

Good managerial skills can create an inclusive and participatory environment. This enables groups that have traditionally been marginalized (women, people with disabilities, low-income households) to participate in the creative business value chain in a structured and sustainable manner, and to be more actively involved and contribute, particularly in the Borobudur area. The findings of this study align with the conceptualization of entrepreneurial competencies by Man et al. [89], which emphasizes that managerial capacity, encompassing conceptual, relational, and organizational competencies, serves as a catalyst for building organizational capabilities that not only drive internal efficiency but also create opportunities for the empowerment of non-traditional workforce. When business owners can manage resources strategically, decisions regarding work assignments, training allocation, and operational process design tend to be inclusive, enabling marginalized groups to access more meaningful roles in the value creation process. Furthermore, Urban [90] views managerial literacy as the foundation of social value-based entrepreneurship, where innovation creation is inseparable from the goal of community empowerment.

7.5 The role of green entrepreneurial intention on marginal inclusion

GEI has a significant positive effect on MI ($\beta = 0.356$; $p < 0.001$). This finding confirms that green intention is pro-social [91, 92]. Environmentally oriented businesses tend to open up employment opportunities for marginalized groups as part of the sustainability ethos. In the Borobudur area, cultural spiritual motives (*gotong-royong*) reinforce this preference. Green entrepreneurship acceleration programs should include social inclusion capital, so that GEI values are reflected in practice. The stronger the intention of creative businesses in Borobudur to implement environmentally friendly practices, the higher the proportion of marginalized: vulnerable groups—women, people with disabilities, low-income households—included in their business value chain.

Conceptually, this finding confirms that sustainability orientation does not stop at ecological innovation, but also expands the ethical horizons of business actors towards social inclusiveness. Kuckertz and Wagner [72] show that individuals with a high sustainability orientation combine entrepreneurial drive and sensitivity to distributive justice, so that green business intentions are often accompanied by aspirations to reduce asymmetries of economic opportunity. Meanwhile, Meek et al. [93] elaborate that internalized environmental norms can change the institutional structure of the market. Green entrepreneurs act as institutional agents that normalize public-oriented business practices, through the creation of internal work mechanisms and policies that deliberately include marginalized groups as part of the business value proposition. More than just a positive side effect, the involvement of marginalized groups becomes a strategic concept. The participation of vulnerable groups strengthens their social legitimacy, adds to the authentic narrative of Borobudur tourist destination, and creates consumer preferences that are willing to pay a green premium. Thus, increasing green intention has the potential to become

an institutional transformation tool that combines ecological dimensions and social justice—realizing a creative industry ecosystem that is not only environmentally sustainable, but also economically equitable for the most vulnerable communities in the region.

7.6 The role of entrepreneurial intention (GEI) on green entrepreneurial orientation (GEO)

The GEI $\rightarrow$ GEO pathway is the strongest ($\beta = 0.829$; $p < 0.001$), extending Daellenbach and Zhu [94], evidence that green intention transforms into green innovation-activity-risk strategy [19]. The value of $\beta > 0.8$ indicates that the conversion gap between intention and implementation is relatively small in the Borobudur area, due to business experience > 5 years, and tourism market awareness of green products. This finding highlights the importance of nurturing green intentions from the start (through SDGs-based business incubation), so that the company's orientation is firmly established. This finding indicates that the intention of business actors to run environmentally friendly businesses actually materializes in the form of orientation, or business practices that focus on sustainability aspects. This orientation can take the form of using more environmentally friendly raw materials, energy efficiency, waste reduction, and green marketing strategies. Thus, the intention towards sustainability does not just stop at the level of discourse or attitude, but is actually implemented in the form of real operational practices.

Substantially, the positive relationship GEI on GEO indicates consistency between internal values (intention) and real behavior (orientation). Business actors who have the awareness and intention to protect the environment will tend to apply these principles throughout their business processes, from the selection of environmentally friendly raw materials, energy efficiency, waste management, to marketing approaches that emphasize green values. Green entrepreneurship is not a passive concept, but transformative and applicable. This finding is in line with the Theory of Planned Behavior [19], which states that intention is the main predictor of actual behavior. In this context, GEIs encourage the formation of green orientation practices. Research by Leonidou et al. [95], also supports this result by stating that green intentions directly influence their strategic decisions to adopt environmentally friendly operations.

7.7 The role of marginal inclusion (MI) on sustainable creative businesses (SCB)

MI was the largest predictor of SCB ($\beta = 0.506$; $p < 0.001$), consistent with the study of Lawelai et al. [96], which showed community involvement increases socio-cultural legitimacy in Wakatobi. In Borobudur, visitors tend to value products that feature local empowerment narratives. Thus, a branding strategy based on storytelling about marginalized workers can increase perceived value and economic sustainability.

The involvement of marginalized communities is proven to have a positive and significant influence on SCB in the Borobudur tourism area. The higher the involvement of community groups that have been less accommodated such as women, people with disabilities, or underprivileged communities, the greater the contribution to the sustainability of the creative businesses being run. This finding emphasizes that the social inclusiveness dimension is not only morally important, but also has a direct impact on business

performance. When businesses actively involve marginalized groups in the production process, decision-making, or distribution of benefits, it creates added value in the form of social legitimacy, community loyalty, and stronger socio-economic sustainability. This finding is in line with the concept of inclusive innovation [10], which emphasizes that innovations that involve marginalized groups will produce solutions that are more relevant and sustainable, because they touch real needs at the grassroots level. In addition, Hall et al. [97] also stated that business sustainability cannot be achieved only by internal strategies, but requires a strong connection with the surrounding community.

7.8 The role of green entrepreneurial orientation (GEO) on sustainable creative enterprise (SCB)

GEO has a positive effect on sustainable creative enterprise (SCB) ($\beta = 0.357$; $p < 0.001$; $f^2 = 0.18$). Meta-analyses by Asad et al. [24] and Asadi et al. [98] noted that green orientation improves triple-bottom-line performance (financial, environmental, and social). The results of this study confirm these findings in the context of cultural heritage destinations. Green innovation, sustainable packaging, and green market proactivity were shown to increase profits and reputation. MSME incubators should provide natural raw material R&D support, eco-design patent access, and risk clinics for green experimentation. The higher the level of business orientation towards green practices, such as the use of eco-friendly materials, reduction of plastic waste or waste recycling, the higher the level of sustainability of the business. Sustainability-focused operational implementation drives efficiency, enhances business reputation, and expands market access, ultimately strengthening the competitiveness and long-term sustainability of creative enterprises.

The findings of this study confirm that sustainability is not only determined by intentions or strategies on paper, but is highly dependent on how environmentally friendly principles are actually implemented in daily operations. The use of environmentally friendly raw materials, efficiency in resource utilization, waste reduction, and education to customers about the importance of green products are concrete practices that reflect green orientation. The study by Chen et al. [99] provided further support to the finding, studying the relationship between environmental orientation in business activities and sustainability performance, competitive advantage. Further, Alt and Spitzack [100] pointed out that firms with green operations are better able to respond to forces in the marketplace and regulations having an impact on the environment and have a stronger potential for creating long-term sustainable economic value by being more innovative.

8. CONCLUSIONS

This study confirms that GEI through GEO and MI are the main determinants of SCB performance in MSMEs, especially creative businesses in the Borobudur tourism SPD area. Access to digital technology (AT) and managerial capacity (MC) act as additional levers. Meanwhile, stakeholder collaboration (SC) and government support (GS) are still hampered by ceremonial governance.

Theoretically, this research integrates the Theory of Planned Behavior (TPB) and the inclusive innovation framework, introducing the social-ecological dual mediation mechanism

and highlighting MC as a lever for inclusion, expanding the repertoire of green entrepreneurship in emerging tourism destinations. Practically, the findings emphasize the need for: (i) digital and managerial upskilling programs that transform green intentions into operational SOPs, and (ii) concise performance-based green certification to replace ceremonial collaboration initiatives.

The practical implication is that MSMEs players need to establish key performance indicator-based green SOPs and systematically involve vulnerable groups. The government should transform environmental certification into a results-based one-stop service and link fiscal incentives to waste reduction achievements. Digital platforms should provide IoT-based carbon footprint dashboards to make green performance measurable and marketable.

Future research should test the moderation of policy quality and financial capability, and assess the effectiveness of digital green voucher schemes in accelerating green technology adoption. Thus, the green-inclusive entrepreneurship agenda can move from the conceptual realm to measurable policy protocols at the national level.

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NOMENCLATURE

B	dimensionless heat source length
CP	specific heat, J. kg ⁻¹ . K ⁻¹
g	gravitational acceleration, m.s ⁻²
k	thermal conductivity, W.m ⁻¹ . K ⁻¹
Nu	local Nusselt number along the heat source

Greek symbols

α	thermal diffusivity, m ² . s ⁻¹
β	thermal expansion coefficient, K ⁻¹
ϕ	solid volume fraction
Θ	dimensionless temperature
μ	dynamic viscosity, kg. m ⁻¹ . s ⁻¹

Subscripts

p	nanoparticle
f	fluid (pure water)
nf	nanofluid

APPENDIX

A-1

Inverse Square Root (ISR)

The formula used is:

$$N_{\text{ISR}} = \left\lceil \left(\frac{z_{1-\alpha} + z_{\text{power}}}{|\beta_{\min}|} \right)^2 \right\rceil$$

Assumptions used here:

- Significance level $\alpha = 0.05$ (one-tailed) $\rightarrow z_{1-\alpha} = 1.645$
- Power = 0.80 $\rightarrow z_{\text{power}} \approx 0.8416$
- Numerator constant: $z_{1-\alpha} + z_{\text{power}} = 2.4866$

If the actual $|\beta|_{\min}$ value in your model is ≥ 0.31 , then according to ISR, the minimum required N is ≤ 65 , so $n = 65$ is sufficient.

We assessed sample adequacy using the inverse square root (ISR) approach with $\alpha = 0.05$ (one-tailed) and power = 0.80 (z

= 2.4866). The ISR formula yields $N = \lceil (2.4866/|\beta_{\min}|)^2 \rceil$. For several representative values of $|\beta|_{\min}$ the required sample sizes are shown in Table A-1. Critically, if the smallest absolute path coefficient observed in our model is $|\beta|_{\min} \geq 0.31$, ISR indicates $N_{\text{ISR}} \leq 65$, i.e., the realized sample ($n = 65$) meets the minimum requirement. In addition, the Gamma–Exponential (GE) method of Kock & Hadaya—known to produce equal or slightly smaller $N_{\min}$ than ISR—was computed for the observed $|\beta|_{\min}$ and yielded an equal or lower requirement, further supporting adequacy. Finally, all focal paths of substantive interest in our model were statistically significant in bootstrap tests, indicating sufficient power for the effects examined. (Detailed ISR computations and GE spreadsheet results are provided here.)

Table A1. Indicator (outer) loadings

	(X1)	(X3)	(X5)	(Z2)	(X4)	(Z1)	(X2)	(Y)
ATD1	0.917							
ATD2	0.831							
ATD3	0.907							
ATD4	0.826							
GEI1			0.770					
GEI2			0.907					
GEI3			0.782					
GEI4			0.842					
GEI5			0.807					
GEO1				0.849				
GEO2				0.724				
GEO3				0.749				
GEO4				0.745				
GPS1		0.837						
GPS2		0.874						
GPS3		0.877						
GPS4		0.827						
MCT1					0.589			
MCT2					0.721			
MCT3					0.901			
MCT4					0.881			
MI1						0.928		
MI2						0.908		
MI3						0.865		
MI4						0.811		
SC1							0.911	
SC2							0.818	
SC3							0.813	
SC4							0.815	
SC5							0.837	
SDCI1								0.749
SDCI2								0.709
SDCI3								0.815
SDCI4								0.752
SDCI5								0.655

Table A2. Reliability and convergent validity (α , ρ_A , CR, AVE)

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Access to Technology and Digital (X1)	0.894	0.906	0.926	0.759
Government Policy Support (X3)	0.876	0.879	0.915	0.729
Green Entrepreneurial Intention (X5)	0.880	0.889	0.913	0.677
Green Entrepreneurial Orientation (Z2)	0.769	0.783	0.852	0.590
Managerial Capacity and Training (X4)	0.873	0.998	0.909	0.715
Marginalized Inclusion (Z1)	0.901	0.909	0.931	0.773
Stakeholder Collaboration (X2)	0.895	0.897	0.923	0.705
Sustainable Development in Creative Industry (Y)	0.790	0.797	0.856	0.544

Table A3. Fornell–Larcker discriminant validity

	Access to Technology and Digital (X1)	Government Policy Support (X3)	Green Entrepreneurial Intention (X5)	Green Entrepreneurial Orientation (Z2)	Managerial Capacity and Training (X4)	Marginalized Inclusion (Z1)	Stakeholder Collaboration (X2)	Sustainable Development in Creative Industry (Y)
Access to Technology and Digital (X1)	0.871							
Government Policy Support (X3)	0.480	0.854						
Green Entrepreneurial Intention (X5)	0.577	0.567	0.823					
Green Entrepreneurial Orientation (Z2)	0.532	0.437	0.829	0.768				
Managerial Capacity and Training (X4)	0.461	0.314	0.264	0.288	0.845			
Marginalized Inclusion (Z1)	0.571	0.600	0.511	0.473	0.683	0.879		
Stakeholder Collaboration (X2)	0.548	0.675	0.406	0.414	0.540	0.560	0.839	
Sustainable Development in Creative Industry (Y)	0.655	0.496	0.650	0.678	0.550	0.754	0.494	0.738

Table A4. HTMT matrix

	Access to Technology and Digital (X1)	Government Policy Support (X3)	Green Entrepreneurial Intention (X5)	Green Entrepreneurial Orientation (Z2)	Managerial Capacity and Training (X4)	Marginalized Inclusion (Z1)	Stakeholder Collaboration (X2)	Sustainable Development in Creative Industry (Y)
Access to Technology and Digital (X1)								
Government Policy Support (X3)	0.520							
Green Entrepreneurial Intention (X5)	0.625	0.641						
Green Entrepreneurial Orientation (Z2)	0.602	0.518	0.983					
Managerial Capacity and Training (X4)	0.476	0.336	0.296	0.281				
Marginalized Inclusion (Z1)	0.623	0.679	0.576	0.555	0.680			
Stakeholder Collaboration (X2)	0.605	0.756	0.453	0.473	0.591	0.619		
Sustainable Development in Creative Industry (Y)	0.750	0.585	0.772	0.855	0.571	0.871	0.568	

Table A5. Indicator-level collinearity (Outer VIF)

	VIF
ATD1	4.775
ATD2	1.809
ATD3	4.473
ATD4	2.159
GEI1	2.152
GEI2	3.584
GEI3	2.002
GEI4	2.550
GEI5	1.925
GEO1	2.019
GEO2	1.721
GEO3	1.396
GEO4	1.412
GPS1	1.977
GPS2	2.655
GPS3	2.451
GPS4	1.998
MCT1	2.951
MCT2	1.779
MCT3	2.142
MCT4	2.788
MI1	4.236
MI2	3.068
MI3	2.878
MI4	1.999
SC1	4.284
SC2	2.734

SC3	2.335
SC4	2.721
SC5	2.220
SDCI1	1.845
SDCI2	1.973
SDCI3	2.589
SDCI4	2.201
SDCI5	1.716

Table A6. Inner / Full-collinearity VIF

	Access to Technology and Digital (X1)	Government Policy Support (X3)	Green Entrepreneurial Intention (X5)	Green Entrepreneurial Orientation (Z2)	Managerial Capacity and Training (X4)	Marginalized Inclusion (Z1)	Stakeholder Collaboration (X2)	Sustainable Development in Creative Industry (Y)
Access to Technology and Digital (X1)								1.859
Government Policy Support (X3)								2.153
Green Entrepreneurial Intention (X5)				1.000		1.075		
Green Entrepreneurial Orientation (Z2)								1.519
Managerial Capacity and Training (X4)						1.075		
Marginalized Inclusion (Z1)								1.948
Stakeholder Collaboration (X2)								2.129
Sustainable Development in Creative Industry (Y)								

Table A7. Path analysis-Second-order GEO (reflective–reflective) measurement results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ((O/STDEV))	P Values
Access to Technology and Digital (X1) -> Sustainable Development in Creative Industry (Y)	0.211	0.203	0.097	2.169	0.031
Government Policy Support (X3) -> Sustainable Development in Creative Industry (Y)	-0.055	-0.051	0.102	0.537	0.592
Green Entrepreneurial Intention (X5) -> Green Entrepreneurial Orientation (Z2)	0.829	0.840	0.036	22.899	0.000
Green Entrepreneurial Intention (X5) -> Marginalized Inclusion (Z1)	0.356	0.355	0.073	4.876	0.000
Green Entrepreneurial Orientation (Z2) -> Sustainable Development in Creative Industry (Y)	0.357	0.368	0.093	3.833	0.000
Managerial Capacity and Training (X4) -> Marginalized Inclusion (Z1)	0.589	0.597	0.070	8.442	0.000
Marginalized Inclusion (Z1) -> Sustainable Development in Creative Industry (Y)	0.506	0.496	0.099	5.101	0.000
Stakeholder Collaboration (X2) -> Sustainable Development in Creative Industry (Y)	-0.016	-0.003	0.129	0.124	0.901