





The role of local wisdom on green competitive advantages in batik MSMEs: Green innovation as a mediator

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ABSTRACT

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This study examines the influence of local wisdom on green competitive advantage in micro, small, and medium enterprises (MSMEs) within the batik industry in East Java, Indonesia. It also investigates the mediating role of green innovation in linking local wisdom and green competitive advantage. A purposive sampling method was used, resulting in 79 batik MSMEs selected as study objects, with 122 respondents consisting of MSME owners and/or managers. Data were analyzed using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method. The findings show that local wisdom positively influences green product innovation, green process innovation, and green competitive advantage. Notably, green process innovation plays a significant role in enhancing green competitive advantage, while green product innovation does not demonstrate a similar impact. Furthermore, green process innovation mediates the relationship between local wisdom and green competitive advantage, whereas green product innovation does not. The study highlights the importance of integrating local wisdom into sustainable business practices to strengthen competitiveness. It also emphasizes the need for targeted strategies to overcome barriers such as financial limitations, underdeveloped green markets, and limited government support. Enhancing education and training for MSME owners, alongside increasing consumer awareness of green products, should be prioritized for future development.

Contribution/Originality: This research explains how local wisdom adds environmental advantages to competitiveness. Green process innovation is the main outcome of the study as a strategic intermediary in linking local wisdom to green competitiveness. This research emphasizes the integrity of traditional knowledge.

1. INTRODUCTION

The batik industry is a creative sector rooted in Indonesian culture and economy. Local values serve as resources and identity in the development of Indonesia's batik industry and play a central role in differentiating MSME batik businesses and enhancing their competitiveness. Incorporating local wisdom into company management can improve the company's performance in a competitive and challenging environment (Kawiana, Rexhepi, Arsha, Swara, & Yudhistira, 2023). The batik industry in Indonesia faces increasing challenges in adopting sustainable practices. The batik process still encounters significant issues regarding sustainability, particularly in wastewater management

(Nugroho et al., 2022). The Indonesian MSME batik industry has not yet adopted sustainable practices related to raw material resources, energy resources, water, and waste in the batik process. Additionally, the batik industry in Indonesia has not yet prepared itself to meet the technical standards of the green sector (Kusumawardani, Kurnani, Astari, & Sunardi, 2024).

Local wisdom will then become a driving force in product differentiation through green innovation, which can address the challenges of sustainable practices in the Indonesian batik industry. It will boost the competitiveness of bat MSMEs. Many research studies indicate that an approach based locally can develop green products while promoting cultural values and sustainability (Aguilar-Rivera & de Jesús Debernardi-Vázquez, 2018; Ekawati, Kusumadewi, & Dewi, 2019; Sinha, 2010; Suksikarn & Suksikarn, 2024). Local wisdom, including traditional knowledge and practices, has demonstrated practical value in fostering sustainable innovation. Such knowledge is often based on centuries of local observations and adaptations, which are invaluable for addressing environmental crises (Chakrabarty, Tanoue, & Penteado, 2023; Lunga & Musarurwa, 2016; Suprijo, Tjahjono, Muafi, & Prajogo, 2019). At the local level, this knowledge helps foster innovative behavior through a base of thriving and resilient examples. Local wisdom utilized by managers and organizations can give rise to new, novel, sustainable technologies, methods, and practical experiences (Suprijo et al., 2019).

Eco-friendly product development has consistently been shown to enhance competitive advantage. It strengthens the company's market position by integrating environmentally friendly features into products, attracting ecologically conscious consumers, and differentiating the products from competitors (Abdullah, Zailani, Iranmanesh, & Jayaraman, 2016; Kam-Sing Wong, 2012; Qiu, Jie, Wang, & Zhao, 2020; Roespinoedji, Saudi, Hardika, & Rashid, 2019; Wu, Wu, Wu, Ding, & Fan, 2022). Like product innovation, green process innovation also contributes positively to competitive advantage by improving operational efficiency, reducing waste, and lowering costs (Chen & Liu, 2018; Kam-Sing Wong, 2012; Roespinoedji et al., 2019; Wu et al., 2022).

Local values of the community are urgently needed to manage business organizations to gain a competitive advantage. Policies oriented towards local wisdom contribute significantly to business management (Atahau, Huruta, & Lee, 2020). Inserting local wisdom values into business management will boost company performance, especially under pressure and threats (Kawiana et al., 2023). Local wisdom can be used as an innovation in preparing sustainability strategies, which contributes to increasing competitive advantage and maintaining the sustainability of its business practices (Herdina, Kumalasari, Purnama, & Octavia, 2023). The integration of local wisdom in business strategies has been factually tested and can effectively increase the company's competitive advantage in the creative industry in Indonesia (Mahrinasari, Bangsawan, & Sabri, 2024). Local wisdom plays an important role in efforts to preserve the environment through responsible and sustainable management of natural resources. Based on local wisdom, this approach creates a natural balance, a key factor for long-term sustainability and increased company competitiveness (Lisdiyono, 2017).

On the other hand, local wisdom in realizing competitive advantages directed at green innovation is a potential challenge. Local wisdom requires good organization among organization members and good managerial skills (Herdina et al., 2023). Mindset and perception, the correlation of other aspects of business processes, and technical barriers are hindrances to adopting green innovation in organizations (Abdullah et al., 2016; Gupta & Barua, 2021). Lack of financial resources is another leading reason preventing the implementation of green innovation (Gupta & Barua, 2021; Shahin, Alimohammadlou, & Abbasi, 2024; Thuyen & Bich, 2024). There is also low consumer demand for green products (Abdullah et al., 2016; Stucki, 2019; Thuyen & Bich, 2024) and a lack of market demand for environmentally friendly products, rendering green innovations inoperable. Lack of government support (including infrastructure development and appropriate incentives) poses a challenge to implementing environmentally sustainable practices (Abdullah et al., 2016; Mahrinasari et al., 2024). Another problem is that no planning strategy can link local knowledge to sustainable business strategies (Manyaga, Goldman, & Thomas, 2024).

In particular, some previous studies have identified that green innovation results in differences in its effect on green competitive advantage, and there are no reports on the impact of local wisdom on green competitive advantage with different influence impacts (Du & Wang, 2022; Kam-Sing Wong, 2012; Tariq, Ehsan, Badir, Memon, & Khan Sumbal, 2023). From this, research is needed on using local wisdom in green innovation and sustainable competitive advantage. This study examines the use of local wisdom in the business strategy of batik MSMEs implemented to develop green competitive advantages through green product innovation and green process innovation.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

As a form of environmental wisdom, local knowledge plays an important role in the sustainable management of natural resources. It includes rituals and ancestral knowledge to preserve environmental balance and ecosystems (Handayani & Suparno, 2023; Lisdiyono, 2017; Rahayu, Susanto, & Sudiro, 2025; Yaqin, Hardati, Atmaja, & Hamid, 2024). Cultural knowledge consists of learned information standards to a social group and passed down from generation to generation. It is deeply rooted in society's customs, values, and norms, fostering a certain level of respect for tradition (Helmi, Pebrianto, Hafrida, Kusniati, & Saputra, 2023).

Local wisdom offers a new perspective to improve business competitiveness and value creation (Herdina et al., 2023). Local wisdom can encourage innovation in sustainable practices. Local wisdom supports the development of sustainable practices by utilizing traditional knowledge and methods that have stood the test of time (Suprijo et al., 2019). Traditional knowledge owned by indigenous and local peoples can contribute significantly to sustainable development. This encompasses centuries-old methods of conservation and responsible use of natural resources (Bang, 2022). The first hypothesis can be prepared based on the given description.

H₁: Local wisdom positively influences green competitive advantage.

By guiding local communities' lives with shared ideals and social control, local wisdom helps balance the sustainability of the ecological environment and the needs of local life (Handayani & Suparno, 2023). In the batik industry, natural dyeing techniques can use local plants to produce unique and creative products with high cultural value and support environmental sustainability. Local wisdom contributes to innovation by leveraging traditional knowledge and practices (Suprijo et al., 2019). Traditional ecological knowledge is a powerful enabler of environmental innovation and can be leveraged to incorporate sustainability into modern eco-products (Sebaka, Zhao, & Tumiso Nkgowe, 2024). Based on the above description, we can formulate the second hypothesis.

H₂: Local wisdom positively influences green product innovation.

Green process innovation for batik MSMEs refers to the adoption of green technologies and technology-based processes or management systems that prioritize energy-efficient and low-carbon production methods. The goal is to minimize environmental impacts while enhancing resource efficiency and sustainability (Bi, Ma, & Li, 2012). In this context, the concept of eco-phronesis rooted in local wisdom plays a significant role in shaping environmentally friendly practices among batik MSMEs. This includes the use of natural dyes and the implementation of life cycle assessments, covering stages from raw material procurement to product delivery, all aimed at promoting harmony with nature (Umboh & Aryanto, 2023). Resource efficiency, as a form of local wisdom, is already evident in traditional batik practices. For instance, artisans often reuse water for dyeing or repurpose leftover fabrics. These practices align with the core objectives of green process innovation, which emphasize waste reduction and resource maximization. Based on this discussion, a third hypothesis can be developed.

H₃: Local wisdom positively influences green process innovation.

In these studies, in collaboration with researchers and practitioners from hundreds of countries, we show how green product innovation can be a source of competitive advantage. For example, in China's manufacturing sector, it has been found that there is a positive relationship between competitive advantage and green product innovation (Qiu et al., 2020). A study on chemical industry plants in Jordan indicated that green product innovations could significantly improve competitive advantage (Al-Abdallah & Al-Salim, 2021). In Bangladesh, research conducted by

Zhu, Zhang, Siddik, Zheng, and Sobhani (2023) based on data from manufacturing businesses explores how green product innovation mediated the relationship between green technology adoption and competitive advantage, indicating that green product innovation significantly contributes to competitive advantage. Even in Batik SMEs in Yogyakarta, Indonesia, green product innovations have positively affected the green competitive advantage (Nuryakin & Maryati, 2022). Based on the above explanation, the following is the 4th hypothesis.

H₄: Green product innovation positively and significantly impacts green competitive advantage.

Green process innovation plays a crucial role in achieving sustainable competitive advantage, especially in contexts where resources are limited (Kam-Sing Wong, 2012). Previous studies highlight the importance of green process innovation in achieving carbon neutrality and significantly improving environmental performance (Zameer, Wang, Vasbieva, & Abbas, 2021). The impact of green process innovation on competitive advantage has been documented across various industries. For instance, in Brazil's electrical and electronics sector, the adoption of green process innovations has contributed to enhanced competitiveness, albeit to a moderate extent (Arenhardt, Battistella, & Grohmann, 2016). Green process innovation and ambidexterity in the textile industry are proven to increase green competitive advantages (Purnomo et al., 2024). The positive correlation between green process innovation and a company's competitive advantage is a convincing argument for investment in this area, demonstrating that it benefits businesses (Chen, Lai, & Wen, 2006). Another study confirms that eco-friendly process improvement significantly affects a company's competitive advantage and performance (Novitasari & Agustia, 2023). Green process innovation has been proven to positively and significantly affect the competitiveness of green products and success in Batik SMEs (Nuryakin & Maryati, 2020). The fifth, sixth, and seventh hypotheses can be formulated based on the explanation above.

H₅: Green process innovation positively influences green competitive advantage.

H₆: Local wisdom indirectly influences green competitive advantage through green product innovation.

H₇: Local wisdom indirectly influences green competitive advantage through green process innovation.

3. METHODOLOGY

3.1. Sample and Data Collection

This study employs a quantitative approach with primary data collection through questionnaires. The main data used in this study were obtained from batik MSMEs in East Java Province, which constitute the study population. A purposive sampling method was used to select districts and cities with batik MSMEs, chosen for their relevance based on the division of four cultural regions in East Java: Mataraman, Arek, Pandalungan, and Madura (Santosa, 2014). The sample of districts and cities includes Mojokerto Regency and Mojokerto City, representing Arek culture; Bangkalan Regency, representing Madura culture; Blitar Regency and Blitar City, representing Mataraman culture; and Probolinggo Regency and Probolinggo City, representing Pandalungan culture. The sampling of MSME batik also uses purposive sampling, with the criteria that MSMEs have implemented green innovation and sustainable business practices.

Data was collected for four months, from June to September 2024. The study participants included owners and managers (husband/wife of the owner or employees entrusted as managers). Based on these criteria, as many as 79 batik MSMEs were selected as samples, with a total of 122 people as respondents.

Table 1 presents the demographic characteristics of the respondents, including gender, age, education level, and years of experience. Most respondents were women, comprising 71.31% of the group, while male respondents accounted for only 28.69%. The age distribution indicated that the most significant segment was in the age range of 47 to 52 years, representing 23.77% of the participants. This suggests a tendency for slightly older individuals to be involved in the sector. Regarding educational background, the data shows that respondents with a high school diploma are predominant, making up 54.92% of the total. This indicates a relatively low level of higher education among participants, highlighting potential areas for educational support and development. Additionally, business

ownership is the dominant role, with 64.75% of respondents identifying as business owners, while the remaining are in managerial positions. Experience in managing batik MSMEs is also notable, with 45.08% of respondents having 3 to 8 years of experience. This suggests that the majority possess substantial practical experience, which may require gradual management practices and deeper insights into the batik market. The data encompasses 122 respondents and provides valuable insights into the demographic composition of the sector.

Table 1. Respondents' demographics.

Characteristics	Frequency	Percentage
Gender		
Male	35	28.69%
Female	87	71.31%
Age		
23-28 years	11	9.02%
29-34 years	12	9.84%
35-40 years	22	18.03%
41-46 years	24	19.67%
47-52 years	29	23.77%
53-58 years	18	14.75%
59-64 years	5	4.10%
65-70 years	1	0.82%
Educational background		
Primary school	3	2.46%
Junior high school	22	18.03%
Senior high school	67	54.92%
University	30	24.59%
Position		
Owner	79	64.75%
Manager	43	35.25%
Experience in managing batik MSMEs		
3-8 years	55	45.08%
9-14 years	49	40.16%
15-20 years	13	10.66%
21-26 years	3	2.46%
27-32 years	2	1.64%
Total	122	

3.2. Operational Definition and Measurement of Variables

Local wisdom is a set of knowledge, values, norms, and practices that emerge in a local community and are inherited from generation to generation. Three dimensions measure local wisdom variables: traditional knowledge, sustainable practices, and environmental values and ethics (Phang et al., 2022). This variable instrument has five questions.

Green product innovation refers to the development of batik products with a low environmental impact, starting from the selection of raw materials to the entire production process. The goal is to minimize environmental effects throughout the product life cycle. This type of innovation strongly depends on the choice of materials and process efficiency (Roy, Chavan, Rajeev, Praveenraj, & Kolazhi, 2024). In this study, green product innovation is measured using three questions

Green process innovation involves a systematic effort to introduce and adopt new techniques, methods, and practices in production and operational activities. The purpose is to reduce negative environmental impacts, improve resource efficiency, and support sustainability. This variable is measured across three dimensions: efficient energy utilization, waste disposal, and emission reduction (Kandpal, Jaswal, Santibanez Gonzalez, & Agarwal, 2024). The green process innovation variable is assessed using six questions.

Green competitive advantage refers to the strategic benefits an organization gains by implementing sustainable and environmentally friendly business practices. These practices enhance the company's market competitiveness while creating value for both stakeholders and the environment. This variable is measured using three dimensions: operational efficiency advantages, environmental reputation, and product-added value (Barakat et al., 2023). The green competitive advantage instrument includes five questions. All items in the questionnaire are rated using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

3.3. Research Procedure

The study employs SEM-PLS as the analysis technique, utilizing Smart PLS software for its implementation. SEM-PLS can be used to develop models when the underlying theory is not strong enough, and the sample size is small (Hair, Hult, Ringle, & Sarstedt, 2017). This study model includes variables of local wisdom associated with green product innovation, green process innovation, and green competitive advantage, whose underlying theory is not sufficiently strong. The researcher conducts validity and reliability tests before carrying out hypothesis tests to ensure the accuracy and consistency of the measurement instruments. Validity testing is carried out through convergent validity and discrimination analysis.

4. RESULTS

4.1. Outer Model Testing

The outer model is tested in three stages: convergent validity test, discriminant validity test, and reliability test.

4.2. Convergent Validity Test

The outer loading (load factor) is an important indicator for both the verification of the model fit and the convergent validity of the measured constructs in SEM-PLS analysis. Outer loading shows how much each indicator contributes to the construct under study (Hair et al., 2017). It clarifies that an outer loading value above 0.5 implies that the indicator substantially contributes to the measured construct.

Table 2. The outer loading.

Indicator <- Construct	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
GCA1 <- Green competitive advantage	0.829	0.826	0.044	18.969	0.000
GCA2 <- Green competitive advantage	0.877	0.875	0.026	33.187	0.000
GCA3 <- Green competitive advantage	0.857	0.857	0.025	34.890	0.000
GCA4 <- Green competitive advantage	0.802	0.802	0.037	21.421	0.000
GCA5 <- Green competitive advantage	0.892	0.890	0.020	43.663	0.000
GPCI1 <- Green process innovation	0.676	0.660	0.085	7.932	0.000
GPCI2 <- Green process innovation	0.670	0.656	0.101	6.646	0.000
GPCI3 <- Green process innovation	0.606	0.595	0.106	5.692	0.000
GPCI4 <- Green process innovation	0.726	0.724	0.071	10.183	0.000
GPCI5 <- Green process innovation	0.683	0.676	0.072	9.534	0.000
GPCI6 <- Green process innovation	0.717	0.727	0.040	17.998	0.000
GPI1 <- Green product innovation	0.730	0.734	0.058	12.566	0.000
GPI2 <- Green product innovation	0.717	0.700	0.091	7.841	0.000
GPI3 <- Green product innovation	0.763	0.753	0.063	12.021	0.000
LW1 <- Local wisdom	0.840	0.837	0.037	22.848	0.000
LW2 <- Local wisdom	0.751	0.745	0.051	14.721	0.000
LW3 <- Local wisdom	0.794	0.793	0.039	20.230	0.000
LW4 <- Local wisdom	0.729	0.729	0.042	17.434	0.000
LW5 <- Local wisdom	0.562	0.564	0.078	7.178	0.000

Table 2 indicates that all outer loading is more than 0.5 and the p-value is less than 0.05; hence, it meets the convergent validity criteria.

4.3. Discriminant Validity Test

One of the most common methods for testing the validity of discrimination is the Fornell–Larcker criterion. In this method, the validity of discrimination is verified when the square root of the Average Variance Extracted (AVE) of each construct exceeds the correlation of that construct with other constructs in the model (Hair et al., 2017).

Table 3. The Fornell-Larcker criteria.

Variables	Green competitive advantage	Green process innovation	Green product innovation	Local wisdom
Green competitive advantage	0.852			
Green process innovation	0.673	0.681		
Green product innovation	0.634	0.637	0.737	
Local wisdom	0.634	0.572	0.591	0.742

The outcome of the discriminant validity test based on the Fornell-Larcker measure is shown in Table 3. The validity of the discriminant was fulfilled for all study variables because the root of the average variance extracted (AVE) of each latent variable was higher than the correlation coefficient between the latent variable and other latent variables.

4.4. Reliability Test

The internal reliability consistency of PLS models is a measure of its internal reliability, which uses Cronbach's alpha and composite reliability (Hair et al., 2017). A latent variable is considered reliable if the Cronbach's Alpha value and Composite Reliability exceed 0.70. According to Table 4, all latent variables in this study meet these criteria because the Cronbach's Alpha value and Composite Reliability are greater than 0.70.

Table 4. Reliability analysis.

Variables	Cronbach's alpha	Composite reliability
Local wisdom	0.788	0.857
Green product innovation	0.704	0.781
Green process innovation	0.781	0.839
Green competitive advantage	0.905	0.930

4.5. Inner Model Test

The inner Model will be tested by analyzing the determination coefficient (R^2) and path coefficient.

4.6. Coefficient of Determination (R^2)

The determination coefficient indicates how exogenous latent variables affect endogenous latent variables. Table 5 illustrates the results of the determination coefficient. Table 5 shows that local wisdom, green product innovation, and green process innovation affect green competitive advantage by 0.563, and other factors influence the remaining 0.437.

Table 5. Coefficient of determination (R^2).

Variables	R-square	R-squared adjusted
Green competitive advantage	0.574	0.563
Green process innovation	0.328	0.322
Green product innovation	0.349	0.433

4.7. Path Coefficient

Table 6 presents the results of the path coefficient analysis, showing the relationships between local wisdom, green product innovation, green process innovation, and green competitive advantage. The hypothesis test results in this study show a significant relationship between local wisdom, green innovation, and green competitive advantage among batik MSMEs. The first hypothesis (H1) found that local wisdom significantly influences green competitive advantage with a path coefficient of 0.315, indicating that local values can increase competitiveness in a market that prioritizes sustainability. The second (H2) and third (H3) hypotheses were also accepted, and local wisdom positively influences green product innovation and green process innovation with path coefficients of 0.591 and 0.572. On the other hand, H4 was rejected, indicating that green product innovation does not play a role in producing green competitive advantage, although it is related to local wisdom. In contrast, we accept the fifth hypothesis (H5), which indicates that green process innovation positively influences green competitive advantage.

Hypothesis six (H6) verifies that the indirect effect of green competitive advantage through green product innovation in local wisdom is rejected. The seventh hypothesis (H7) is accepted, indicating that local wisdom has a positive and significant effect on green competitive advantage through green process innovation, with a path coefficient of 0.230. These insights highlight the role of local wisdom in driving sustainable innovation and demonstrate that the pursuit of competitive advantage relies more on green process innovation than on green product innovation. Local values influence batik MSME innovation strategies.

Table 6. Path coefficient.

Path analysis	Original sample	Sample mean	Standard deviation	T-statistics	P-value	Decision
Local wisdom → Green competitive advantage	0.315	0.313	0.076	4.140	0.000	H1 is accepted
Local wisdom → Green product innovation	0.591	0.604	0.058	10.188	0.000	H2 is accepted
Local wisdom → Green process innovation	0.572	0.585	0.058	9.934	0.000	H3 is accepted
Green product innovation → Green competitive advantage	0.151	0.145	0.102	1.484	0.139	H4 is rejected
Green process innovation → Green competitive advantage	0.401	0.414	0.092	4.379	0.000	H5 is accepted
Local wisdom → Green product innovation → Green competitive advantage	0.090	0.086	0.061	1.462	0.144	H6 is rejected
Local wisdom → Green process innovation → Green competitive advantage	0.230	0.240	0.050	4.564	0.000	H7 is accepted

5. DISCUSSION

Local wisdom also plays a key role in improving and implementing a sustainable competitive advantage in MSMEs' batik. Local wisdom, also known as traditional knowledge and practices, has been used by the community for environmental balance and protection (Handayani & Suparno, 2023; Lisdiyono, 2017; Rahayu et al., 2025; Yaqin et al., 2024). This knowledge is transmitted from generation to generation and integrated into society's customs, values, and norms (Helmi et al., 2023). Its utilization in business refers to how local wisdom becomes an innovative strategy for achieving competitiveness and creating value (Herdina et al., 2023).

Integrating local wisdom into key organizational factors enhances green creativity, thereby improving green competitiveness. According to Zhang (2024), this is realized through green market orientation and knowledge management, which support green innovation capabilities. Local wisdom also supports the formation of sustainable practices by employing traditional knowledge and methods that have passed the test of time (Suprijo et al., 2019).

Traditional knowledge from indigenous and local communities can help companies make a substantial contribution to achieving sustainable development, conservation practices, and the use of natural resources preserved for generations (Bang, 2022).

Local wisdom helps strengthen the green competitive advantage of batik MSMEs. Traditional knowledge and practices not only contribute to environmental protection but also promote innovative strategies that enhance competitiveness. Inheriting these practices to the next generation and embedding them in community values, local wisdom makes sustainability and conservation of natural resources a unified policy, which positively impacts achieving an eco-friendly market advantage in the batik industry.

Local wisdom serves an essential function in the green product innovation of batik MSMEs. It acts as social control and reflects community values that help regulate local community life and maintain the balance between local livelihoods and the long-term sustainability of the ecological environment (Handayani & Suparno, 2023). Natural dyeing techniques in the batik industry using local raw materials can create unique and creative products, have high cultural value, and are environmentally friendly. This indicates local wisdom in utilizing traditional knowledge so that it can be used for innovation (Suprijo et al., 2019).

Traditional ecological knowledge positively influences environmental innovation by providing a rich source of sustainable practices and expertise, which can be integrated into modern eco-friendly products (Sebaka et al., 2024). One relevant form of local wisdom is eco-phronesis, which encourages environmentally friendly practices in Batik MSMEs. It promotes a natural dyeing process and complies with life cycle assessment, aligning with green product innovation (Umboh & Aryanto, 2023). Because batik MSMEs are close to the market and the community, they know the local needs and challenges. This intuitive insight allows them to dip into the regional problem-solving aspects, which must be addressed first to obtain green product innovations (Heuër, 2017). Local wisdom integration involves utilizing local knowledge and traditions to promote green product innovations (Muafi & Uyun, 2019). Therefore, local wisdom has an indispensable role in enhancing green product innovation.

Local wisdom is essential for fostering green process innovation in Batik MSMEs. The wisdom of locality, such as eco-phronesis, combines local knowledge with eco-materials aimed at minimizing the environmental impact of batik production processes. The connection between the idea, which emphasizes the use of natural dyes and life cycle assessment from raw materials to finished products, is vital for nature conservation efforts (Umboh & Aryanto, 2023). Green process innovation involves industries adopting environmentally friendly, energy-efficient, and low-carbon management technologies, processes, or practices that utilize resources more efficiently and have a reduced environmental impact (Bi et al., 2012).

There is local wisdom on how traditional values can help in the adoption of sustainable innovation. This wisdom guarantees that new practices are consistent with traditional values, where their aims can enhance environmental health and sustainability (Suasih, Budhi, Yasa, & Saskara, 2018). Local wisdom can also be encouraged in adopting innovative green technology into batik MSMEs to minimize the environmental impact of traditional production processes (Hamdani, Herlianti, & Solihat, 2019). Traditional culture can promote local green innovation (You & Zhang, 2024). Thus, by combining traditional knowledge with cutting-edge green technology, local wisdom can be important in fostering green process innovations among culturally and community-compliant batik MSMEs.

Green product innovation has emerged as a key strategy for many businesses, including batik MSMEs, to gain a green competitive advantage. However, its effectiveness in this context is often limited. Several factors contribute to this challenge. One major barrier is the need for new resources and competencies, which are essential for implementing green innovation. For many MSMEs, acquiring these capabilities is difficult because they differ significantly from existing operational routines (Calza, Parmentola, & Tutore, 2017). This resource gap can hinder the successful adoption of green product innovation and reduce its potential to strengthen green competitive advantage.

Technological limitations present another challenge. Implementing green innovations often requires scientific and technical capabilities that many MSMEs do not possess (Calza et al., 2017). Addressing these deficiencies may require partnerships or collaborations, which are difficult to establish and sustain for small enterprises.

Financial constraints also serve as a significant barrier. The use of green materials and the integration of suppliers for eco-friendly practices tend to increase procurement costs, making it harder for small firms to adopt such practices (Gupta & Barua, 2021; Runtuk, Ng, & Ooi, 2024). Additionally, investing in green technologies and systems can place a financial burden on batik MSMEs (Shahin et al., 2024).

Another important consideration is consumer demand. The success of green product innovation is highly dependent on market interest. Unfortunately, consumers often show reluctance to pay more for eco-friendly products, especially in traditional industries like batik, where aesthetics and cultural value take precedence (Abdullah et al., 2016; Thuyen & Bich, 2024). Furthermore, limited government support in terms of infrastructure and policy incentives adds to the difficulty of pursuing green innovation (Mahrinasari et al., 2024).

Organizational factors also play a crucial role. Strong leadership and effective human resource management are vital for overcoming the technological and financial challenges related to green innovation. Without them, batik MSMEs may struggle to implement environmentally sustainable practices (El-Kassar & Singh, 2019).

In contrast, green process innovation appears to offer a more feasible and impactful route to sustainable competitiveness. Research has shown that environmental process innovation is a key driver of long-term competitive advantage in both industrial sectors and batik MSMEs (Zameer et al., 2021). It improves environmental performance and supports carbon neutrality, thereby enhancing sustainable competitiveness.

In batik production, green process innovation can help reduce pollution by using eco-friendly chemicals and minimizing waste. These practices not only benefit the environment but also lower operational costs over time, improving the firm's market position.

In the broader textile industry, green process innovation is essential for achieving an eco-friendly competitive advantage (Arenhardt et al., 2016; Purnomo et al., 2024). Using environmentally safe and cost-efficient dyeing technologies, for example, can enhance product quality and increase its market value. This supports previous findings that green innovation, particularly process innovation, is positively linked to market competitiveness (Chen et al., 2006). Improved process efficiency and product appeal also foster sustainable development and generate economic returns.

Moreover, green process innovation significantly boosts the success of green products (Nuryakin & Maryati, 2020). As consumer awareness of environmentally friendly products grows, batik MSMEs that implement green process innovations can deliver higher-quality products with greater competitive appeal. Empirical studies also show that green technological innovation has a substantial effect on green competitive advantage. It enables firms to comply with environmental regulations while offering product differentiation and enhancing brand image. Consequently, green process innovation serves as a strategic approach to achieving a sustainable edge in the global market.

Several interconnected reasons explain why local wisdom does not directly enhance green competitive advantage through green product innovation. First, the resource and technological limitations faced by batik MSMEs impede their ability to successfully implement such innovations (Calza et al., 2017). Second, consumer demand for green products remains low, particularly in an industry where tradition and craftsmanship are highly valued (Abdullah et al., 2016). Third, a lack of government support and infrastructure further hinders innovation efforts (Mahrinasari et al., 2024). While local wisdom may inspire green product innovation, it cannot function effectively as a mediator in this process due to these barriers.

However, local wisdom plays a more significant role in promoting sustainable process innovation and green competitive advantage. Concepts such as eco-phronesis, which integrate traditional values with ecological awareness, support practices like using natural dyes and conducting life cycle assessments (Umboh & Aryanto, 2023). Green

process innovation, defined as the use of environmentally friendly and energy-efficient technologies and practices, improves resource utilization (Bi et al., 2012). Traditional knowledge systems can help ensure that green practices are aligned with local culture and environmental values, promoting balanced development across the economy, society, and nature (Suasih et al., 2018). In the textile sector, including batik production, green process innovation improves product quality and adds value (Arenhardt et al., 2016; Purnomo et al., 2024). Therefore, incorporating local wisdom can effectively drive green process innovation, helping batik MSMEs build sustainable competitive advantages in the global market (Zameer et al., 2021).

6. CONCLUSION AND RECOMMENDATION

Local wisdom plays an important role in enhancing the competitiveness of sustainable batik MSMEs in Indonesia. As part of the country's traditional creative industry, the batik sector faces various challenges, particularly in adopting sustainable practices. Environmental concerns such as waste disposal, inefficient resource use, and the need for eco-friendly production methods are central issues in batik production. Local wisdom offers potential solutions to these challenges by supporting sustainability efforts and contributing to value-added differentiation and improved competitiveness.

Incorporating local wisdom into business strategies can encourage green innovation, promote environmentally friendly products and processes, and strengthen market positioning. Traditional knowledge enables batik MSMEs to efficiently utilize local resources and improve operational effectiveness, which can lead to increased profitability especially in markets that value sustainability.

However, while local wisdom has shown a strong positive influence on green process innovation, it does not necessarily translate into a significant competitive advantage through green product innovation. Evidence from batik MSMEs in East Java highlights several barriers to adopting green innovation, including financial limitations and weak consumer demand for eco-friendly products. To overcome these constraints, a comprehensive approach is needed one that involves active government participation and support from industry stakeholders. Providing financial aid and technological assistance will be essential for enabling batik MSMEs to fully adopt and benefit from green innovations based on local knowledge.

Markets require investment in capacity building and technological advancement. In this regard, educating MSMEs through training programs and workshops could help them adopt green process innovations efficiently. Furthermore, market demand for green batik products should be increased through various awareness campaigns and collaborative efforts with partners to promote the advantages of sustainable practices. These recommendations can enhance the batik industry's sustainability and competitive advantage, contributing to more significant environmental and economic objectives. Additional studies are needed to determine consumer perspectives and market demand for green batik. These dynamics will be key to shaping marketing strategies that successfully align consumer behavior with sustainable consumption practices.

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