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Eco-Friendly Innovation Strategy: Analysis of Absorption Capacity and Knowledge Management of MSMEs in Yogyakarta

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Abstract– This study aims to investigate how absorptive capacity and knowledge management affect green innovation and how the interaction between absorptive capacity and knowledge management affects green innovation, especially in the context of creative industry MSMEs in Yogyakarta. This study was designed using a purposive sampling technique. Data was collected through a survey of 100 MSMEs in the creative product industry sector in the Special Region of Yogyakarta. The research data were processed using the PLS-SEM analysis tool. The research findings indicate that absorptive capacity significantly impacts the implementation of green innovation, while knowledge management does not significantly impact the implementation of green innovation. The interaction between the company's absorptive capacity and knowledge management also does not significantly affect green innovation. The results of this study contribute to the theory and practice for MSMEs to design strategies for implementing green practices and knowledge management to enhance innovation.

Keywords: *Absorption Capacity; Knowledge Management; Environmentally Friendly Innovation; MSMEs*

INTRODUCTION

Eco-friendly innovation is considered an important approach to reducing the negative impact on the natural environment as a form of corporate social responsibility. Eco-friendly innovation can reduce environmental pollution by saving resource consumption and applying environmental regulations. The improvement of eco-friendly technology is carried out to help companies recycle materials, save energy, and reduce environmental pollution. This function is the planning of the production process in eco-friendly process innovation (Maynard et al., 2020; Spangenberg, 2005). This is reflected in the data on the percentage of consumers who prioritize purchasing the eco-friendly products, 2022 (Pandey & Shivarkar, 2024):

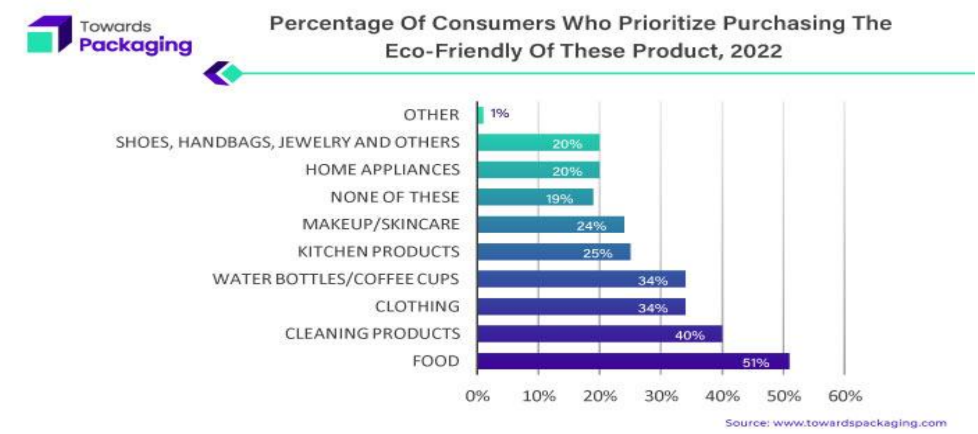

Figure 1. Percentage of Consumers Who Prioritize Purchasing Eco-Friendly Products

Source: Pandey & Shivarkar (2024)

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Jovanović et al. (2023) Their research showed that three main categories of green innovation are green product innovation (GPI), green process innovation (GPI), and green management. Therefore, to solve many environmental and socio-economic problems, a lot of knowledge is needed. As a result, the concept of knowledge management must be incorporated into the organization. New knowledge, especially knowledge from external sources, can be a powerful catalyst for corporate transformation and improvement. In addition to knowledge management (KM), environmental absorptive capacity (EAC), or the capacity to absorb the environment, is also an important requirement for green innovation. Environmental absorptive capacity (GAC) in particular helps companies learn and solve environmental problems, which has an impact on the effectiveness of green innovation. Another important internal factor that influences green innovation is the capacity to adapt to the environment (Du & Wang, 2022).

Several previous studies have tested the relationship between knowledge management and green innovation. For example, conducted by Shahzad et al. (2020) tested the role of the knowledge management process on the sustainable performance of green innovation in companies. In their study, they found that knowledge management or Knowledge Management Practice (KMP) has a positive impact on green innovation or Green Innovation (GI). Then, green innovation (GI) also has a positive effect on the Company Sustainability Process (CSP). In their study, Makhloufi et al. (2023) also emphasized the important role of knowledge management in increasing the influence of big data analysis on green innovation. This study shows that traditional knowledge management technology cannot process and analyze large-scale data well. However, this technology helps managers make better decisions and predict threats. Innovative products and processes depend on knowledge management. It helps businesses acquire and analyze large-scale data so they can improve their operations. When companies seek to change their management practices to be more environmentally friendly, there is a relationship between knowledge management and innovation. The relationship between knowledge management and green innovation has also been studied by Jovanović et al. (2023).

Absorptive capacity also contributes uniquely to green innovation by enabling organizations to identify, assimilate, transform, and exploit green knowledge. This supports the development of relevant, adaptive, and competitive sustainability solutions to effectively address environmental challenges. This is found in (Camisón & Forés, 2010; Cooper & Molla, 2014) research. Du & Wang (2022) stated that although there have been many previous studies discussing the influence of absorptive capacity or knowledge management on green innovation. However, most previous studies only explore the individual impact of absorptive capacity or knowledge management on green innovation. Few discuss the impact of both on green innovation when considered together. Previous studies have revealed the contribution of knowledge management (KM) and environmental absorptive capacity (EAC) to green innovation, but most have discussed them separately. Methodological inconsistencies, such as the application of traditional KM technologies in the context of big data, limit practical relevance. Furthermore, studies rarely explore the synergistic interaction between KM and GAC, which is potentially more significant in driving green innovation holistically.

The findings of this study are expected to contribute to the academic understanding of GI and offer practical guidance for SMEs seeking to generate green innovations in an increasingly competitive environment. This study underlines the importance of absorptive capacity in generating green innovations and highlights the potential of knowledge

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management to drive green innovation in the SME sector (Sakhawat-ur-rehman et al., 2023).

LITERATURE REVIEW

Natural Resource-Based View (NRBV)

In this study, there are four variables to be studied, that is, green product innovation, green process innovation, absorptive capacity, and knowledge management. These variables are a replication of research Du & Wang (2022) on how the influence of green market orientation and absorptive capacity on the sustainability of green innovation in manufacturing companies in China. However, there are several modifications. In addition to changing the object and location to the Yogyakarta creative product industry MSME, this study also tests the differential influence of two internal factors on green product innovation and green process innovation. Modifying several variables, such as replacing the green market orientation variable with knowledge management.

This study uses the natural resource-based theory, or Natural Resource-based View (NRBV), as the main research framework to explain the relationship between absorptive capacity and the sustainability of green innovation in companies. According to the natural resource-based (NRBV) perspective, companies must consider the benefits of increasing challenges and environmental protection through a good relationship between natural resources and competitive advantage. Natural Resource-based View (NRBV) also covers the relationship between a firm's resources, strengths, and sources of competitive advantage and the constraints imposed by the natural environment on current and future profits (Hart, 1995; Shafira & Hersugondo, 2023).

Natural resource-based theory (NRBV) states that firms must change their resources and capacities and innovate more to adapt to changing environmental pressures. Innovation is a change that involves creating new things or improving existing ones. Therefore, businesses may play a very important role in creating environmentally friendly products and solutions. According to this theory, as environmental problems increase, firms must develop resources and capabilities to control the impact of their products and production processes on the natural environment. NRBV has been widely used to analyze and explain the relationship between a firm's resources, capabilities, and green innovation effectiveness (Alkaraan et al., 2024; Du & Wang, 2022; Hart, 1995; Lau & Wong, 2024; Tang et al., 2024).

Knowledge-Based View (KBV)

The second theory used in this study is the knowledge-based view (KBV), where knowledge is the most important resource for an organization. The Knowledge-Based View (KBV) theory is a further development of the theory and complements the Resource-Based View (RBV) theory. The Knowledge-Based View (KBV) theory discusses that the resource that has an important and most strategic role in a company is knowledge (Maulana et al., 2022).

In the era of the knowledge economy, where new knowledge is frequently emerging, it is crucial for organizations to consistently ensure the influx of modern and innovative knowledge to gain a sustainable competitive advantage. The idea of inter-organizational collaboration is increasingly recognized as a tool to expand the knowledge

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base of organizations and create new and innovative knowledge pools based on previous organizational knowledge due to the rapid shift in information and communication technologies. The importance of knowledge acquisition has increased in recent years (Sakhawat-ur-rehman et al., 2023).

Therefore, many studies have focused on the antecedents and consequences of knowledge acquisition. The view on this theory is that to create value in a company, someone must know. Companies always make efforts to increase new knowledge that is more active and faster than their competitors so that for long-term advantages, knowledge and information factors are no less important for companies to have (Maulana et al., 2022; Pramadita & Siswantini, 2024; Sakhawat-ur-rehman et al., 2023).

Hypothesis Development

Eco-friendly Absorption Capacity and Eco-friendly Innovation

Absorptive capacity was first defined in the context of research and development by Cohen & Levinthal (2000) and related literature has grown. Empirically, the relationship between absorptive capacity and green innovation has been examined by many researchers in various research contexts. For example, Du & Wang (2022) found that green absorptive capacity has a positive impact on green product innovation and green process innovation. Green absorptive capacity is an organizational mechanism that allows businesses to acquire, transform, and implement external green technologies (Pacheco et al., 2018).

Green product innovation aims to change or modify product designs by using nontoxic compounds or biodegradable materials during the production process to reduce the disposal impact on the environment and to improve energy efficiency (Lin et al., 2013; Xie et al., 2019). Therefore, high green energy absorptive capacity allows companies to develop new environmentally oriented products and processes that emphasize environmental conservation while also fulfilling organizational and customer needs (Ismail et al., 2023; Soetanto et al., 2024). Based on the explanation above, the researcher formulates the following hypothesis:

H1a: Green absorptive capacity has a positive impact on green product innovation.
H1b: Environmentally friendly absorptive capacity has a positive impact on environmentally friendly process innovation.

Knowledge Management and Green Innovation

The relationship between KMP and GI occurs when top management invests in green resources for innovation development by using employee knowledge and competencies. In this context, organizational learning emphasizes the integration of corporate strategy with KM strategy so that GI goals can be achieved (Shahzad et al., 2020). Empirical results from previous studies on the relationship between the role of knowledge management and green innovation indicate that there is a positive, direct, and significant relationship between knowledge management and green innovation (Jovanović et al., 2023; Makhloufi et al., 2023). Knowledge makes a major contribution to creativity and innovation creation. Therefore, knowledge management activities and the company's ability to use and combine various sources of knowledge are essential to creating various types of innovation, including green innovation (Yu et al., 2022).

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Knowledge management transforms a company's skills and knowledge into product and process development. Effective knowledge management enables companies to produce sustainable products through innovative production process technologies (Idrees et al., 2023). Based on the explanation above, the researcher formulated the following hypothesis:

H2a: Knowledge management (KM) has a positive impact on green product innovation (PDI).
H2b: Knowledge management (KM) has a positive impact on green process innovation (PCI).

The Synergistic Effect of Environmentally Friendly Absorption Capacity and Knowledge Management on Environmentally Friendly Innovation

Technological knowledge and knowledge management are essential in innovation studies. The innovation process relies heavily on knowledge. Green absorptive capacity reflects a technology-push approach that emphasizes scanning, acquiring, integrating, and utilizing external technological knowledge (Sahoo et al., 2023). Knowledge management is recognized as an essential part of the design and development of new products and services because technology and knowledge development drive innovation. Technology and knowledge should be considered complementary, not mutually exclusive (Koshelieva et al., 2023). If green absorptive capacity and knowledge management are invested simultaneously, it can have a positive impact on green product and process innovation (Du & Wang, 2022; Forés & Fernández-Yáñez, 2023; Javeed et al., 2023; Y. Z. Wang & Ahmad, 2024). Therefore, we propose the following synergistic effects of green absorptive capacity and knowledge management on green product innovation or green process innovation:

H3a : The interaction between green absorptive capacity and knowledge management has a positive effect on green product innovation.
H3b : The interaction between green absorptive capacity and knowledge management has a positive effect on green process innovation.

METHODOLOGY

The population in this study is creative product MSMEs in the Yogyakarta Region that carry out environmentally friendly production processes, especially in the craft sector. A total of 100 MSMEs participated, including business owners, managers, employees, and other stakeholders who are directly involved in the organization's business processes. Non-probability sampling was used to obtain sample data from the population. In this study, the author used a purposive sampling technique with two main criteria, namely, carrying out environmentally friendly innovations and having been established for at least 6 months.

The types and sources of data used in this study are primary data, which are data collected and obtained directly from the results of questionnaires with respondents and other data obtained from research objects. This study uses a questionnaire as a method of collecting primary data. The questionnaire consists of many question items given to respondents to fill in according to their business conditions. Filling in is done offline.

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With a 5-point Likert scale starting from 1 (strongly disagree) to 5 (strongly agree). The questionnaire that will be given to respondents consists of various questions related to the influence of absorption capacity and knowledge management on environmentally friendly innovation.

This study is divided into 4 constructs consisting of Green Absorption Capacity (GAC), Knowledge Management (KM), Green Product Innovation (GPI), and Green Process Innovation (GPI). The Green Absorption Capacity (GAC), Green Product Innovation, and Green Process Innovation indicators used in this study were adopted from research conducted by (Du & Wang, 2022). The knowledge management used in this study was adopted from research conducted by (Shahzad et al., 2020). This study uses a partial least squares structural model (PLS-SEM) approach and SmartPLS software to analyze quantitative data. PLS-SEM is used in two stages: measurement model (outer model) and structural model assessment (inner model) (Haryono, 2016).

This study successfully obtained 100 respondents. All respondents were selected based on the predetermined purposive sampling criteria, namely creative product industry UMKM, which carry out environmentally friendly innovations and are domiciled in Yogyakarta. The collected research data were transformed into a numeric table so that they are easy to understand and interpret. Descriptive analysis was used by researchers to provide information on the demographic characteristics of respondents. The results of the descriptive analysis can be seen in Table 1 below:

Table 1. Respondent Profile Demographics

Demographic Variables	N
Type of Business	
Craft	88
Culinary	6
Others	6
Position	
Business Owner	93
Manager/Administrator	3
Staff	4
Business Age	
<3 Year	8
3-5 Year	4
>5 Year	88
Working Capital Amount	
<Rp 100 Million	90
Rp 100-500 Million	10
Total	100

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RESULT

Evaluation of Measurement Model (Outer Model)

The measurement model is assessed in terms of reliability and validity to ensure that the construct is measured accurately. There are two types of validity tests, namely convergent validity tests and discriminant validity tests. Two things to consider when conducting convergent validity tests are outer loading and average variance extracted (AVE). All indicators have met the above criteria (> 0,50). So it can be interpreted that all indicators have good loading factors and average variance extracted (AVE) values (Hair et al., 2014). Reliability tests can be measured using Cronbach's alpha (CA) and composite reliability (CR). A variable is considered reliable if it has a Cronbach's alpha value and a composite reliability value of over 0,40 (Noor, 2017). Both of these measures exceed the acceptable threshold, indicating that the construct has good internal consistency, as presented in Table 2 below:

Table 2. Construct Outer Model

Construct	Item	Convergent Validity	Reliability Indicator	Cronbach's Alpha	Composite Reliability
		Outer Loading	AVE		
GAC*KM (1)	24	0,789-1,115	0,614	0,972	0,974
GAC*KM (2)	24	0,791-1,124	0,612	0,972	0,974
Green Product Innovation (GPI)	4	0,783-0,843	0,662	0,829	0,887
Green Process Innovation (PCI)	4	0,819-0,879	0,729	0,876	0,915
Green Adsorption Capacity (GAC)	8	0,700-0,829	0,604	0,907	0,924
Knowledge Management (KM)	3	0,864-0,930	0,807	0,88	0,926

Structural Model Testing (Inner Model)

This study also conducted a structural model test or also called the inner model, which is used to determine the relationship between variables. For testing, the structural model is done by analyzing the value of R-squared (R2) for the dependent variable. As for the independent variable, test the path coefficient. The collinearity test is one approach to conducting the structural model test, which tests the relationship between latent

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variables. In the context of PLS-SEM, the tolerance value of 0,20 is a collinearity problem. When the level of collinearity is very high or the VIF value is 5 or more, then it should be considered to remove one of the appropriate indicators (Hair et al., 2014). In this study, such as the relationship between the variables of Green Product Innovation (GPI) and Green Absorption Capacity (GAC) has a value of 2,849; the variables of Green Process Innovation (PCI) and Knowledge Management (KM) are worth 2,997. The following are more detailed results that can be seen in Table 3:

Table 3. Inner VIF Values

	GAC*KM (1)	GAC*KM (2)	Green Product Innovation (GPI)	Green Process Innovation (PCI)	Green Adsorption Capacity (GAC)	Knowledge Management (KM)
GAC*KM (1)			1,519			
GAC*KM (2)				1,521		
Green Product Innovation (GPI)						
Green Process Innovation (PCI)						
Green Adsorption Capacity (GAC)			2,849	2,852		
Knowledge Management (KM)			2,999	2,997		

Table 4. R-Square Results

	R Square	R Square Adjusted
Green Product Innovation (GPI)	0,562	0,548
Green Process Innovation (PCI)	0,639	0,627

Table 5. Q-Square Results

	SSO	SSE	Q^2 (=1-SSE/SSO)
GAC*KM (1)	2400	2400	
GAC*KM (2)	2400	2400	
Green Product Innovation (GPI)	400	256,916	0,358
Green Process Innovation (PCI)	400	220,486	0,449
Green Adsorption Capacity (GAC)	800	800	
Knowledge Management (KM)	300	300	

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The structural model was also evaluated using R-squared and Q-squared. It can be seen from Table 4 that Green Product Innovation (GPI) is described by its antecedent variable of 54,8%. This means that there is still an influence of 45,2% of other variables outside the Green Product Innovation (GPI) variable. Then, Green Process Innovation (PCI) is described by its antecedent variable of 62,7%. This means that there is still an influence of 37,3% of other variables outside the Green Process Innovation (PCI) variable.

It can also be seen in Table 5 that the variable Green Product Innovation (GPI) has a Q-square value of 0,358; Green Process Innovation (PCI) has a Q-square value of 0,449. As for the variables GAC*KM (1), GAC*KM (2), Green Absorption Capacity (GAC), and Knowledge Management (KM) have a Q-square value of 0. Although the value is 0, the results are normal because the four variables are independent.

Path Coefficient (Hypothesis Testing)

Path coefficient is a step to test the hypothesis results, which are calculated using the SmartPLS application using the bootstrapping technique. Based on the bootstrapping results in Table 6, it shows that H1a and H1b are supported, while H2a, H2b, H3a, and H3b are not supported.

This is because it is in line with the principle of Hair et al. (2016), which states that the T-statistic value must be over 1.96; and the value of the P-value must be less than 0.05. Therefore, H1a and H1b are supported while H2a, H2b, H3a, and H3b are not supported. The following table 6 explains in detail the results of the path coefficient test:

Table 6. Path Coefficient Results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Conclusion
Green Adsorption Capacity (GAC) -> Green Product Innovation (GPI)	0,839	0,853	0,104	8,101	0,000	H1a Supported
Green Adsorption Capacity (GAC) -> Green Process Innovation (PCI)	0,910	0,921	0,098	9,264	0,000	H1b Supported
Knowledge Management (KM) -> Green Product Innovation (GPI)	-0,071	-0,079	0,120	0,590	0,555	H2a Not Supported
Knowledge Management (KM) -> Green Process Innovation (PCI)	-0,141	-0,150	0,115	1,233	0,218	H2b Not Supported
GAC*KM (1) -> Green Product Innovation (GPI)	0,056	0,051	0,061	0,924	0,356	H3a Not Supported
GAC*KM (2) -> Green Process Innovation (PCI)	0,003	0,001	0,045	0,070	0,944	H3b Not Supported

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DISCUSSION

The results of the study indicate that absorptive capacity significantly impacts the implementation of environmentally friendly product and process innovation in creative product industry MSMEs in the Special Region of Yogyakarta. This implies that companies with high absorptive capacity are better at finding and obtaining information about environmentally friendly technologies. This includes knowing market trends, new technologies, and environmental regulations that are not available internally. Good absorptive capacity also helps companies transform the information they obtain into integrated and sustainable processes. They can implement more efficient technologies in energy use, better waste management systems, or production processes that reduce environmental impacts (Alkaraan et al., 2024; Cohen & Levinthal, 2000; Forés & Fernández-Yáñez, 2023). The results of this study are in line with Du & Wang (2022) research with previous research that examined the effect of absorptive capacity on environmentally friendly product innovation in manufacturing companies in China as the object of research.

The effect of knowledge management does not significantly impact the implementation of environmentally friendly product and process innovation in creative product industry MSMEs in the Special Region of Yogyakarta. This contrasts with previous studies conducted by (Jovanović et al., 2023; Makhloufi et al., 2023; Shahzad et al., 2020) in their studies found that KM has a significant positive impact on environmentally friendly innovation. A potential reason behind the irrelevant research results is that knowledge management in MSMEs, especially in the craft sector, is often not as formal or structured as in large companies, because most craft MSMEs do not have a formal knowledge management system or adequate technology to manage and distribute information effectively. Craft MSMEs also often rely on established and traditional production methods, and knowledge management focuses on existing processes, which may not be directly related to efforts to implement environmentally friendly processes (Kofler & Walder, 2024). The interaction between absorptive capacity and knowledge management on environmentally friendly product and process innovation also showed insignificant results. This is also in contrast to the results of the study (Du & Wang, 2022).

This study tries to see the mediator function of GAC, and the results show that absorptive capacity (GAC) is not proven as a mediator variable that links knowledge management with green product and process innovation. It can be said that absorptive capacity and knowledge management may not focus on green product innovation, so that the knowledge absorbed or managed is more related to other innovations, such as general technology or operational efficiency, but not to environmental practices (Ning et al., 2023; J. Wang et al., 2020). The potential reason behind the irrelevant research results is that green innovation often requires investment in new technology or more expensive raw materials. Meanwhile, for craft SMEs that have limited capital, the development of green innovation may be considered unrealistic or not profitable in the short term (Chen et al., 2023; Meidute-Kavaliauskiene et al., 2021; Y. Z. Wang & Ahmad, 2024).

Furthermore, the insignificant impact of knowledge management contradicts previous studies because, based on the Pelayanan Parampara Praja Daerah Istimewa Yogyakarta (2024) report, craft MSMEs in Yogyakarta tend to use traditional methods without a formal knowledge management system. This study lacks contextual analysis, such as local culture or technological and methodological limitations. In addition,

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financial and resource constraints, such as investment in new technology, hinder the adoption of green innovations, thus limiting the practical application and relevance of these findings (Hidayati et al., 2024; Shahzad et al., 2020).

The practical insight is the importance of providing financial support, training, and access to environmentally friendly technologies for craft MSMEs. The government or related institutions need to provide incentives, subsidies, or assistance programs to ease the initial investment costs, so that green innovations can be adopted more realistically and sustainably by MSMEs in this sector.

CONCLUSION

This study investigates how absorptive capacity and knowledge management affect green product innovation and green process innovation, as well as explores how the interaction between absorptive capacity and knowledge management affects green product innovation and green process innovation, especially in the context of creative product industry SMEs in Yogyakarta.

Based on the results and discussion, it can be concluded: (1) The company's absorptive capacity has a positive effect on green product innovation; (2) The company's absorptive capacity has a positive effect on green process innovation; (3) Knowledge management does not have a positive effect on green product innovation; (4) Knowledge management does not have a positive effect on green process innovation; (5) The interaction between the company's absorptive capacity and knowledge management does not significantly affect green product innovation; (6) The interaction between the company's absorptive capacity and knowledge management does not significantly affect green process innovation.

Meanwhile, knowledge management and absorptive capacity failed to show significance in Yogyakarta because craft MSMEs generally do not have a formal and structured knowledge management system. In addition, limited resources and investment in environmentally friendly technologies are major obstacles, making the adoption of green innovations difficult to realize in daily practice.

LIMITATION AND IMPLEMENTATIONS

The research conducted currently still has many shortcomings and limitations, including: (1) From the results of the study, there are problems with the research model, which are caused by the presence of 2 moderating variables and 2 dependent variables that should be analyzed separately, causing the model fit to be suboptimal; (2) in terms of respondent profiles, this study failed to collect balanced data. Several criteria dominate other criteria by over 80%. Based on the amount of business capital, the amount of business capital that dominates is less than 100 million rupiah. Meanwhile, based on the position of the respondent, the business owner dominates the sample. Furthermore, in terms of business type, craft businesses dominate. This dominance phenomenon can lead to biased results.

Based on these limitations, several recommendations are made to produce better results for further research as follows: (1) For a more optimal fit model, it is recommended that further research examine absorption capacity and knowledge management separately or choose one of the dependent variables between GPI or PCI; (2) For the respondent profile, it would be better if further research collects data with a wider scope, both in terms of the number of respondents and the variety of creative businesses in Yogyakarta by involving MSMEs from other sectors such as fashion, food and beverages, or creative technology, so that the research results can reflect the broader reality of the creative industry. This is important to minimize the dominance of one type of business or a particular profile, such as craft businesses or the dominance of respondents from business owners. Using stratification techniques in sampling to ensure that each group or stratum (business capital, position, type of business) is represented proportionally. For example, make sure each business capital group (less than 100 million, 100-500 million, and over 500 million) has a balanced number of respondents. In addition to overcoming the dominance of respondents with small business capital (less than 100 million rupiah) and the dominance of business owners, it is recommended that the research population be expanded to include MSMEs with a larger scale or more diverse business capital categories. This can be done by expanding the geographical reach or targeting more diverse business sectors.

Based on the results of this study, it shows that in the context of MSMEs in the creative product industry, the company's absorptive capacity, which includes the ability to acquire and apply external knowledge, significantly impacts environmentally friendly process innovation because MSMEs that can absorb external knowledge are more flexible in adopting green technology and environmentally friendly practices. This emphasizes the importance of openness to external information and collaboration to support innovation in a more sustainable production process. Absorptive capacity also significantly affects environmentally friendly product innovation, reflecting the reality that MSMEs in the creative industry highly depend on their ability to obtain relevant external knowledge in the field of sustainability.

Absorptive capacity helps them innovate in products in a way that is more responsive to market demands and environmental regulations. Meanwhile, internal knowledge management does not significantly affect environmentally friendly process innovation due to the limitations of an unstructured system and a focus on traditional knowledge. The results of this study indicate that the current knowledge management implemented may not be effective enough to encourage environmentally friendly product and process innovation. This study suggests that there is a need to re-evaluate how knowledge is managed and disseminated in MSMEs in the creative product industry and whether the knowledge follows the requirements of environmentally friendly innovation. This study also provides an opportunity to reconsider the knowledge management approach currently used. This study suggests that other factors may be more important in driving green innovation, such as collaboration with other parties, adoption of new technologies, or incentives from other parties.

Therefore, the managerial implications in managing green innovation in creative industry MSMEs in Yogyakarta are as follows: (1) to improve the ability of creative product industry MSMEs to absorb external knowledge relevant to green product innovation, managers can hold regular training on environmentally friendly practices and technologies in the product manufacturing process. The focus is on the development of

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sustainable materials, environmentally friendly product design, and environmentally friendly production processes; (2) to improve the ability to absorb external information, managers can teach how to monitor industry trends, market research, and the latest innovations in environmentally friendly product design; (3) to develop more sustainable products, managers can encourage MSMEs to collaborate with environmentally friendly technology providers and suppliers of sustainable raw materials. Then to gain access to new technologies, facilitation also collaborates with universities or R&D (Research and Development) institutions; (4) to improve the ability of MSMEs to absorb external knowledge relevant to be applied in environmentally friendly process innovation. Managers can provide training for MSMEs on innovations in production processes, such as clean production techniques, energy-saving technologies, and waste reduction methods; (5) to improve the ability of MSMEs to manage and use knowledge to create environmentally friendly product innovations. Managers can introduce a digital platform that helps MSMEs collect information on environmentally friendly technologies, sustainable materials, and market trends. This platform can also be used to share knowledge between MSMEs; (6) to measure the impact of environmentally friendly process innovations implemented by MSMEs. Managers can develop a system to monitor the impact of implementing process innovations on energy efficiency, waste reduction, and emission reduction.

Specific managerial implications for craft SMEs in Yogyakarta are the importance of building a more structured knowledge management system, such as training and collaboration with external parties. In addition, financial and technological support from the government or related institutions needs to be strengthened, so that SMEs can adopt effective and sustainable green innovations. One example of good cooperation is the Tokopedia Hijau program. Tokopedia Hijau is an initiative from Tokopedia that aims to invite Tokopedia sellers to contribute to environmental conservation efforts (PT. Tokopedia, 2025).

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