

Antecedents and Impacts of Green Process Innovation on Performance: A Study on Jamu MSMEs

Hunik Sri Runing Sawitri^{1*}, Asri Laksmi Riani², Salamah Wahyuni³, Suryandari Istiqomah⁴, Ariyani Wahyu Wijayanti⁵

^{1,2,3,4}Management Department, Faculty of Economics and Business, Universitas Sebelas Maret, Indonesia

⁵Faculty of Economics and Business, Universitas Veteran Bangun Nusantara, Indonesia

^{1*}hunikstri_fe@staff.uns.ac.id, ²asrilaksmi_fe@staff.uns.ac.id, ³salamyuni@staff.uns.ac.id,

⁴suryandari.istiqomah@staff.uns.ac.id, ⁵aryn.3d071208@gmail.com

*Corresponding Author

Abstract

This study investigates the antecedents of Green Process Innovation (GPI) and its impact on business performance. Human capital (HC), and Green Market Orientation (GMO) are considered key drivers of GPI adoption. The study was conducted on micro, small, and medium enterprise (MSMEs) herbal medicine businesses in Sukoharjo Regency, with 236 respondents. Data were collected through offline surveys and analyzed using Smart-PLS. The results indicate that HC and GMO have a significant direct effect on MSMEs' performance. GPI is significantly influenced by GMO, but not by HC. The effects of HC and GMO on business performance are not mediated by GPI. These findings highlight the need for MSMEs to enhance their green market orientation while leveraging intellectual capital to improve performance. Future research should explore additional factors influencing GPI and its role in sustainable business success. Policy makers should support MSMEs with training and incentives to strengthen their green innovation capabilities.

Keywords: Human Capital, Green Market Orientation, Green Process Innovation, Business Performance, MSMEs

Faktor Pendahulu dan Dampak Inovasi Proses Ramah Lingkungan terhadap Kinerja: Studi Kasus pada UMKM Jamu

Abstrak

Penelitian ini menyelidiki anteseden Inovasi Proses Hijau (GPI) dan dampaknya terhadap kinerja bisnis. Sumber daya manusia (HC), serta Orientasi Pasar Hijau (GMO) dianggap sebagai faktor utama dalam adopsi GPI. Penelitian ini dilakukan pada pelaku usaha mikro, kecil, dan menengah (UMKM) *Jamu* di Kabupaten Sukoharjo, dengan 236 responden. Pengumpulan data dilakukan melalui survei offline dan dianalisis menggunakan Smart-PLS. Hasil penelitian menunjukkan bahwa HC dan GMO memiliki pengaruh langsung yang signifikan terhadap kinerja UMKM. Selain itu, GMO berpengaruh signifikan terhadap GPI, sedangkan HC tidak. GPI tidak memediasi pengaruh HC dan GMO terhadap kinerja bisnis. Temuan ini menunjukkan perlunya UMKM untuk meningkatkan orientasi pasar hijau serta memanfaatkan modal intelektual guna meningkatkan kinerja. Penelitian lebih lanjut disarankan untuk mengeksplorasi faktor lain yang memengaruhi GPI dan perannya dalam keberlanjutan bisnis. Pemerintah perlu memberikan pelatihan dan insentif untuk mendukung UMKM dalam memperkuat kapasitas inovasi hijau mereka.

Kata Kunci: Sumber Daya Manusia, Orientasi Pasar Hijau, Inovasi Proses Hijau, Kinerja Bisnis, MSMEs

History: Received: 29 September 2024 Revised: 25 March 2025 Accepted: 23 December 2025

Citation (APA 7th): Sawitri, H. S. R., Riani, A. L., Wahyuni, S., Istiqomah, & Wijayanti, A. W. (2026). *Antecedents and impacts of green process innovation on performance: A study on jamu MSMEs*. Jurnal Economia, 22(1), 108–127. <https://doi.org/10.21831/economia.v22i1.77992>

INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) in Indonesia constitute a significant part of the national economy, with approximately 64.2 million businesses recorded in 2022. These enterprises contribute 61.07% to the National Gross Domestic Product (GDP) (Mariana & Novianti, 2022) and serve as a primary source of employment (Wijayanti & Hanandia, 2022). Given their substantial economic role, it is crucial to explore the factors influencing their business performance to ensure sustainability in an increasingly competitive environment.

The stability of business performance is closely tied to external environmental factors. In response to the growing concerns about environmental degradation, businesses are increasingly required to adopt environmentally friendly innovations, commonly referred to as green innovations. Green innovation encompasses various initiatives, including green process innovation, which aims to minimize environmental harm by optimizing production processes (Chen et al., 2006; Song & Yu, 2018). Such innovations enable businesses to enhance their sustainability while maintaining economic competitiveness (El-Kassar & Singh, 2019).

Green process innovation focuses on reducing energy consumption and repurposing waste into economically valuable products (Rustiarini et al., 2022). This approach supports broader environmental management strategies, such as pollution prevention, energy conservation, and the design of eco-friendly products (Pablo-Romero & Sánchez-Braza, 2015; Yusliza et al., 2020). As public awareness of environmental issues grows, businesses are encouraged to integrate green innovations into their operations to improve both environmental and economic outcomes (Asadi et al., 2020; Li et al., 2022).

Despite the potential benefits of green innovation, its adoption within the MSME sector, particularly in developing countries like Indonesia, remains limited (Rustiarini et al., 2022). Several factors contribute to this research gap. Studies by Asadi et al., (2020) and Neri et al., (2018) highlight that many MSMEs prioritize short-term economic gains over environmental concerns, leading to a lack of investment in sustainable practices. Additionally, Marco-Lajara et al., (2022) note that green innovation is often pursued solely to comply with stringent environmental regulations rather than as a strategic effort to enhance competitiveness. Given these challenges, further investigation into the antecedents and impacts of green process innovation on MSME business performance is warranted.

The successful implementation of green process innovation is heavily influenced by human resources within MSMEs. The extent to which business owners and employees adopt green production practices depends on their human capital. Human capital, a key component of intellectual capital, encompasses education, skills, experience, and other employment-related attributes (Abdullah et al., 2015; Stacchezzini et al., 2019). High-quality human capital fosters innovation by enhancing problem-solving abilities, creativity, and knowledge absorption, all of which are crucial for developing sustainable business practices (Cohen & Levinthal, 1990).

Existing literature establishes a strong link between human capital and business performance (Zhang et al., 2021). Skilled employees contribute to a more innovative work environment, thereby improving overall business outcomes (Edvinsson et al., 1997). In the context of MSMEs, well-developed human capital facilitates a better understanding of green

innovation processes, enabling entrepreneurs to integrate sustainability into their business models effectively (Abadli & Kooli, 2022; Awan et al., 2021). By leveraging their human capital, MSMEs can enhance their competitive edge while fulfilling social and environmental responsibilities.

Another critical factor influencing green innovation adoption is green market orientation (GMO). GMO refers to a company's strategic approach to incorporating environmental concerns into its market orientation (Aljuboori et al., 2022). As consumer preferences shift towards sustainable products, businesses must adjust their market strategies accordingly (Du & Wang, 2022). A strong GMO enables companies to develop green products and processes that align with evolving market demands, thereby enhancing their competitiveness and long-term sustainability (Tjahjadi et al., 2020).

Green marketing activities are implemented by companies to provide green products and processes for consumers (Ahmadzadeh et al., 2017; D'Souza et al., 2015). To respond to market demand and competitor activities, companies not only focus on green products but also on green processes. The green production process represents a company's green image. Consumers' attention is increasingly focused on the environmental benefits and energy savings of a product's production. Consumers' attention will be attracted by the green image of the company (Chang & Fong, 2010). Thus, green market-oriented companies show good identification for green customers and capture information on competitors' environmental strategies. This can motivate companies to maintain a green image for customer acquisition and retention by implementing green process innovation. Thus, companies with a strong green market orientation will increase their process innovation capabilities related to environmental issues (Chang & Fong, 2010). Green market orientation activities are evidenced by customer satisfaction regarding business efforts in green production processes, the commitment of entrepreneurs to serve green consumers, and the large amount of company investment in green process innovation.

Through environmentally friendly innovation practices, companies' performance will improve due to increasing public awareness to protect the environment, thus triggering companies to adopt environmentally friendly business practices (Huang & Li, 2017). Performance is the end result of organizational efforts in managing organizational resources (Muthuveloo et al., 2017; Wang et al., 2015). Environmentally friendly innovation practices that require human capital to innovate and create enable companies to develop capabilities that lead to improved business performance (Singh et al. 2016; Cheng, Yang, & Sheu, 2014). Thus, it can increase competitiveness and make the company better.

This study was conducted on MSMEs in *Jamu* in Sukoharjo Regency. Sukoharjo Regency, Central Java, is a center for the traditional herbal medicine processing industry, encompassing micro, small, medium, and large industries that are members of KOJAI (Indonesian Herbal Medicine Cooperative) (Batubara et al., 2020). However, there are also many traditional herbal medicine industries that are not members of KOJAI. They are mostly home industries that are usually sold door to door or are located in herbal medicine trading centers located in Nguter District, Sukoharjo Regency. The knowledge and skills of industrial business actors and their marketers are still low, especially those related to the product manufacturing process, according to Good Traditional Medicine Manufacturing Methods (CPOTB) and the Regulation of the Food and Drug Supervisory Agency

(PerBPOM) No. 32 of 2009 concerning the safety and quality requirements of traditional medicines. Some product processing that is carried out is not yet quality and safety oriented, but is still based on hereditary habits and information from fellow business actors. Several small and medium industries are still unable to implement CPOTB in the production process, so that the quality of the products produced does not meet the product standards applied by SNI (Indonesian National Standard). Therefore, it is crucial to examine the green production processes implemented by traditional herbal medicine businesses in Sukoharjo Regency, particularly given the increasing public awareness of their importance.

Jamu is a term for traditional medicine from Indonesia, which in the modern era is more popularly known as herbal. This herbal medicine is often also referred to as a medicine made from natural herbal concoctions that do not use chemicals as additives and have proven their efficacy for centuries. The natural ingredients used as medicine are a harmony of nature with an ideal pattern. In general, the herbal medicine industry is a hereditary business from ancestors. Therefore, one of the motivations for engaging in this business is to maintain ancestral heritage and utilize natural resources by continuing a business that has been running for several generations.

Awareness of the importance of backing nature encourages MSME entrepreneurs to try to increase their production capacity, accompanied by various innovations. However, perhaps due to ignorance or because of the increasingly tight business competition, MSME actors often innovate in their production processes by mixing herbal medicine ingredients with dangerous chemicals, such as antalgin, dexamethasone, and so on (Drug and Food Information Data Center, 2006). Such innovative practices are, of course, precarious to the health of consumers and will produce waste that causes environmental damage. In fact, the production process of traditional herbal medicine uses natural ingredients from plants, but in practice, they mix chemicals into it. This is contrary to the mission of preserving ancestral heritage and harms efforts to harmonize the use of natural ingredients with ideal patterns or proportions. Such unethical actions indicate that the company is failing to participate in environmental preservation..

Based on interviews with various trusted parties of the Sukoharjo City Government, this also happened in the herbal medicine industry UMKM in Sukoharjo Regency. Therefore, it is important to conduct a study on how herbal medicine UMKM actors innovate the green herbal medicine production process. This study focuses on the topic of the antecedents and impacts of green process innovation on the performance of MSMEs in the *Jamu* industry in Sukoharjo Regency.

Literature Review and Hypothesis Development

Resource-Based View (RBV)

The Resource-Based View (RBV) posits that a company's resources are crucial for achieving competitive advantage. This perspective emphasizes the uniqueness of resources—such as patents, reputation, and market-focused capabilities—that are difficult for competitors to replicate, thereby providing a foundation for superior performance (Barney, 1991). So, the perspective focuses on internal resources, both tangible and intangible.

Institutional Theory

The pressure to meet environmental demands in order to gain social legitimacy is at the core of Institutional Theory. This theoretical framework is frequently employed to study environmentally friendly innovations (Li et al., 2022). The theory posits that institutional pressures compel companies to align their organizational development strategies with the requirements of external institutions. As awareness of the business impact on the environment grows, this theory suggests that environmental pressures encourage MSMEs to adopt green innovation strategies.

Human Capital

In the Resource-Based View, human capital is recognized as a crucial internal resource for companies. Human capital encompasses all employees, along with their training, experience, expertise, knowledge, skills, and abilities. In most human resources studies, education is considered the most critical component of human capital (Schultz, 1993). This resource enables businesses to tackle challenges by creating environmentally friendly products and production processes, which in turn can potentially enhance their innovation capabilities, productivity, and overall performance.

Green Market Orientation

According to Narver and Slater (1990), market orientation is an organizational strategy that serves as an effective and efficient means of fostering the behaviors necessary to create superior value and sustainable performance for buyers. The rise of environmentally conscious consumers and eco-friendly competitors has transformed the business landscape, leading to increased attention to environmental issues (DeBoer et al., 2017; Soewarno et al., 2019). Green marketing activities aim to build long-term relationships with consumers and other stakeholders by emphasizing environmental responsibility (Moravcikova et al., 2017). Therefore, green market orientation plays a crucial role in achieving business success in an era of environmental awareness.

Green Innovation

Environmental innovation has emerged as a popular concept in recent years, as global warming and environmental degradation continue to pose serious threats to the world's population (Kunapatarawong & Martínez-Ros, 2016; Miao et al., 2017). Academics and entrepreneurs, including those in small and medium-sized enterprises, are increasingly concerned about environmental damage. Alongside the growing public interest in returning to nature, MSMEs are expected to implement environmentally friendly production processes. Green process innovation aims to reduce energy consumption during production and recycle waste into economically valuable products (Marco-Lajara et al., 2022; Ullah et al., 2023).

Business Performance

Every business activity is fundamentally aimed at achieving performance and business objectives (Rustiarini et al., 2022). Business performance generally refers to a company's capability to effectively utilize its resources to attain its goals. This includes the outcomes

or successes that a company perceives in relation to objectives such as sales growth, profit expansion, market share increase, operational efficiency, cash flow from market operations, and market reputation (Cao et al., 2009). In practical terms, "business performance" typically signifies the achievement of a company's goals, which may encompass financial performance, customer satisfaction, and employee satisfaction.

Hypothesis Development

Human capital affects business performance.

Human capital, as a component of intellectual capital, plays a vital role in maintaining a balance between achieving economic performance, preserving the natural environment, and harmonizing social environments (Pedro et al., 2018). The knowledge and skills of employees foster innovation (Messabia et al., 2022) to address issues related to environmental pollution and energy consumption (Pablo-Romero & Sánchez-Braza, 2015; Yusliza et al., 2020). Previous research has demonstrated a positive relationship between green intellectual capital and green performance (Marco-Lajara et al., 2022). Similarly, employees equipped with competencies, skills, and knowledge can generate competitive advantages that enhance an organization's economic performance (Messabia et al., 2023; Yusliza et al., 2020). Based on this discussion, the following hypothesis is formulated.

Hypothesis 1: Human capital affects business performance.

Green Market Orientation affects business performance

Market orientation is an organizational strategy that serves as a highly effective and efficient means of fostering the behaviors necessary to achieve superior performance (Narver & Slater, 1990). Companies with a market orientation gather information about buyer needs and competitor activities, then coordinate this information to create exceptional customer value (Chabowski & Mena, 2017; Masa'deh et al., 2018; Narver & Slater, 1990). To enhance business performance, companies must adopt environmentally friendly practices (Papadas et al., 2017). Previous research has revealed that green marketing strategies can lead to improvements in operational performance and marketing performance (Amegbe et al., 2017; Fraj et al., 2011). Drawing from the preceding arguments, we propose the following hypothesis:

Hypothesis 2: Green market orientation affects business performance.

Human Capital affects Green Process Innovation

As with other business ventures, MSMEs cannot be separated from the effects of environmental degradation. MSMEs must enhance their internal capabilities, particularly their human capital, to foster the development of green innovations, including green processes. A dynamic business environment requires employees' knowledge, experience, and skills to create green innovations (Jardon & Dasilva, 2017). Companies with high intellectual capital have more innovative competencies (Ali et al., 2021; Arsawan et al., 2022; Marco-Lajara et al., 2022). Therefore, we formulate our hypothesis as follows:

Hypothesis 3: Human capital affects green process innovation.

Green market orientation has an impact on green process innovation.

Previous research has shown that market orientation is an antecedent of innovation (Block et al., 2017) and affects innovation performance (Song et al., 2015). Lin et al. (2014), in their study, found that market demand for green products has a positive effect on green product innovation and green process innovation. Drawing on the preceding arguments, we formulate the hypothesis as follows:

Hypothesis 4: Green market orientation has an impact on green process innovation.

Green process innovation positively influences business performance.

Previous empirical studies by Weng et al., (2015) have demonstrated that green innovation practices improve both environmental performance and business performance. Green process innovation has a direct and positive effect on organizational and business performance (El-Kassar & Singh, 2019). Therefore, as green innovations are increasingly implemented, business performance also rises. Based on the preceding arguments, the hypothesis is formulated as follows:

Hypothesis 5: Green process innovation positively influences business performance.

Green process innovation mediates the effect of human capital on business performance

Human capital plays a crucial role in providing a deeper understanding of the background related to the creation of green innovations (Ali et al., 2021). Therefore, entrepreneurs must strive to maximize their human capital to drive the development of green innovations aimed at preventing pollution from production processes, conserving energy, recycling waste, designing eco-friendly products, and implementing effective environmental management (Abadli & Kooli, 2022; Awan et al., 2021; Marco-Lajara et al., 2022). Companies that adopt green innovations demonstrate a commitment to fulfilling social and environmental responsibilities while enhancing productivity, efficiency, and cost savings, which directly contribute to competitive advantage and improved financial performance (Li et al., 2022). Previous empirical studies have shown that green innovation mediates the impact of intellectual capital on business performance (Marco-Lajara et al., 2022). Based on these arguments, the hypothesis is formulated as follows:

Hypothesis 6: Green process innovation mediates the impact of human capital on business performance.

Green process innovation mediates the effect of green market orientation on business performance.

The growing environmental awareness is driving companies to adopt a more environmentally friendly market orientation to enhance their social and environmental responsibilities (El-Kassar & Singh, 2019). This shift encourages companies to implement green process innovations. Thus, the adoption of green innovations is crucial for companies to address pressures from customers, competitors, and regulators (Lin et al., 2014; Porter & Van Der Linde, 2017). Green innovations implemented in manufacturing MSMEs can significantly impact business performance (Singh et al., 2016). Therefore, as MSMEs become more oriented toward green markets, their understanding of applied green

innovations increases, leading to enhanced business performance. Based on the preceding explanation, the hypothesis is formulated as follows:

Hypothesis 7: Green innovation mediates the impact of green market orientation on business performance.

The following model shows the relationship between the variables described in the hypothesis formulation.

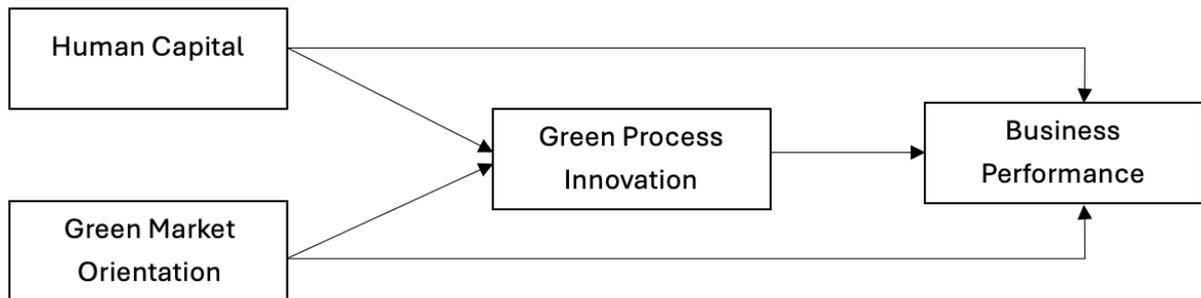


Figure 1. Research Framework

METHOD

Participants and procedures

This study employs a survey method with MSME respondents, as the unit of analysis is the organization, specifically MSMEs. The respondents in this study are MSME owners, as they have the authority and knowledge to accurately answer the questionnaire. Data were collected using a structured questionnaire that had been tested for validity and reliability. The study sampled 236 MSME owners using a convenience sampling method. The population consists of herbal medicine (*Jamu*) MSME owners in Sukoharjo Regency. Data collection was conducted through an offline survey to ensure a higher response rate and accuracy.

Validity and Reliability Test

Data were collected by a structured questionnaire. The questionnaire included the following four constructs: human capital, green market orientation, green process innovation, and business performance. Human capital is measured with 5 items adopted from Aljuboori et al. (2022). An example of an item is that our employees are more creative. Green market orientation is measured with 10 items adopted from Tjahjadi et al. (2020). An example of an item is that customer satisfaction drives our business efforts to run an environmentally friendly business. Green process innovation is measured with 3 items adopted from Singh et al. (2016). An example of an item is our business's production processes that effectively reduce hazardous substances or waste. Then, business performance is measured with 4 items adopted from Chen et al. (2006) and Achi et al., (2022). An example of an item is compared to similar MSMEs; our business profit level is good. All questions measured the respondents' opinions using a Likert scale (five-point).

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used for data analysis, employing SmartPLS software to examine complex causal relationships between variables. The testing process was carried out in 3 phases, including internal consistency reliability, convergent validity and discriminant validity. The results of internal consistency reliability testing were carried out using Cronbach's Alpha. From the data analysis carried out, the results were obtained as shown in the following Table 1.

Table 1. *Internal Consistency Reliability Testing*

Variables	Cronbach Alpha	Conclusion
Green Market Orientation	0.9375	Very Good
Green Process Innovation	0.7554	Very Good
Human Capital	0.9818	Very Good
Business Performance	0.9548	Very Good

The test results in Table 1 show a reliability value above 0.7. Hair et al. (2021) stated that a Cronbach alpha score above 0.7 is included in the very good category. Thus, overall, it can be concluded that all variables passed the internal consistency reliability test. Convergent validity testing is carried out by looking at the Indicator Reliability (Outer Loading) value and the AVE (Average Variance Extracted) value. Hair et al. (2021) stated that the standard outer loading value is very good if it has a score above 0.7, and the standard AVE value above 0.5 has very good criteria. The results of the convergent validity test can be seen in the Table 2.

Table 2. *Convergent Validity Testing*

Variable	Indicator	Loading Factor	Composite Reliability	AVE
Green Market Orientation	GMO1	0.7180	0.9469	0.6416
	GMO10	0.7509		
	GMO2	0.7866		
	GMO3	0.7852		
	GMO4	0.8525		
	GMO5	0.8507		
	GMO6	0.7370		
	GMO7	0.8453		
	GMO8	0.8302		
	GMO9	0.8394		
Human Capital	HC1	0.9547	0.9856	0.9321
	HC2	0.9648		
	HC3	0.9747		
	HC4	0.9753		
	HC5	0.9576		
Green Process Innovation	GPI1	0.8547	0.8564	0.6657
	GPI2	0.8176		
	GPI3	0.7733		
Business Performance	BP1	0.9191	0.9672	0.8807
	BP2	0.9471		
	BP3	0.9447		
	BP4	0.9427		

The results of the convergent validity test in Table 2 show an outer loading value above 0.7 and an AVE value above 0.5. So, it can be concluded that each variable and its indicators have very good convergent validity. Discriminant validity testing using the Fornell-Larcker criteria (Hair et al., 2021) shows the highest cross-loading correlation value. The test results can be seen in Table 3.

Discriminant validity was assessed through the Fornell-Larcker criterion, following the rule of thumb that all variables should have a higher correlation with themselves than with other variables (Table 3). We employed composite reliability values and Cronbach's alpha to assess the instrument's dependability. The reliability of all measurement instruments is demonstrated in Table 1 and Table 2, where the composite reliability values and Cronbach's alpha for each construct satisfy the necessary standards.

Table 3. *Fornell-Larcker Criterion*

Variable	HC	GMO	GPI	BP
Human Capital (HC)	0.965			
Green Market Orientation (GMO)	0.558	0.801		
Green Process Innovation (GPI)	0.334	0.524	0.816	
Business Performance (BP)	0.474	0.616	0.370	0.938

The evaluation of the model structure with the coefficient of determination R^2 value represents the amount of variance in the endogenous construct described by the exogenous construct associated with the endogenous construct (Hair et al., 2021). The complete test results R^2 can be seen in Table 4.

Table 4. *R-Square Testing*

Dependent	R-Square	R-Square Adjusted	FCVIF	Status
Green Process Innovation	0.2766	0.2704	1.382	Weak
Business Performance	0.4070	0.3993	1.686	Moderate

The results of the Common Method Bias (CMB) test with Full Collinearity Variance Inflation Factors (FCVIFs) show that most of the values are below 3.3. It can be concluded that CMB does not occur.

Structural Model Testing is conducted to test the explanatory power of the model created. F^2 refers to the effect size of the predictor variables on the existing construct. Chin (1998) classifies the validity of the model using the scores of the F^2 produced into three categories, including large (0.35), medium (0.15), and small (0.02). The complete test results can be seen in Table 5.

Table 5. *F-Square Testing*

	Green Process Innovation	Business Performance
Green Market Orientation	0.2244	0.2198
Human Capital	0.0034	0.0401
Green Process Innovation		0.0037

The F^2 effect size results provide insights into the strength of relationships within the model, influencing its overall fit and explanatory capability. Green Market Orientation (GMO) demonstrates a moderate effect on both Green Process Innovation ($F^2 = 0.2244$) and Business Performance ($F^2 = 0.2198$), suggesting that market orientation plays a crucial role in driving innovation and improving business outcomes. In contrast, Human Capital (HC) has a negligible effect on Green Process Innovation ($F^2 = 0.0034$) and only a small effect on Business Performance ($F^2 = 0.0401$), indicating that human capital alone does not strongly influence the adoption of green innovation or significantly enhance business performance. Additionally, Green Process Innovation (GPI) has an extremely low effect on Business Performance ($F^2 = 0.0037$), implying that the green innovations implemented by MSMEs may not directly contribute to improved business outcomes.

These findings suggest that the overall model fit is partially supported, with GMO emerging as the primary driver of both innovation and performance, while HC and GPI show limited direct influence. The weak effects of HC and GPI indicate that other unexamined factors, such as financial resources, regulatory pressures, or competitive dynamics, may play a more substantial role in shaping business performance. While the model effectively captures the impact of market orientation on MSME performance, its ability to explain the role of human capital and green innovation remains limited. This suggests that further research should explore additional mediating or moderating variables to enhance the explanatory power of the model and provide a more comprehensive understanding of the factors influencing MSME success.

Finding And Discussion

As presented in Table 6, the statistical test results with bootstraps indicate that human capital significantly impacts business performance, resulting in a p-value of 0.010, which is less than 0.05. Therefore, we support Hypothesis 1, which suggests that human capital influences business performance. Likewise, green market orientation has a significant impact on business performance, as indicated by a p-value of 0.000 (<0.05). Therefore, we support hypothesis 2, which asserts that green market orientation influences business performance. Human capital does not significantly affect green process innovation, as indicated by a p-value of 0.502 (>0.05). Thus, hypothesis 3, which states that human capital affects green process innovation, is not supported. Green market orientation has a significant impact on green process innovation, as indicated by a p-value of 0.000 (<0.05). Thus, hypothesis 4, which states that green market orientation affects green process innovation, is supported. Green process innovation does not significantly affect business performance, as indicated by a p-value of 0.464 (>0.05). Thus, hypothesis 5, which states that green process innovation affects business performance, is not supported.

As presented in Table 7, a p-value of 0.723 (>0.05) indicates the lack of support for Hypothesis 6, which asserts that green process innovation mediates the impact of human capital on performance. Hypothesis 7, which states that green process innovation mediates the effect of green market orientation on business performance, is not supported, as indicated by a p-value of 0.489 (>0.05).

Hypothesis 1 proposes that human capital significantly impacts business performance. This finding is in line with previous research conducted by Marco-Lajara et al., (2022); Messabia

et al., (2023); Yusliza et al., (2020). These studies show that human capital is positively related to performance. This implies that an increase in human capital leads to an enhancement in their performance. Employees with competence, skills, and knowledge can improve the economic performance of the organization.

Table 6. Summary of Structural Model Test Statistics Hypotheses

H	Path		Direct effect coefficient	Confidence Interval		Conclusion
	From	To		Lower (5%)	Upper (95%)	
H ₁	Human Capital	Business Performance	2.589 (0.010)	0,0796	0,3032	Supported
H ₂	Green Market Orientation	Business Performance	6.977 (0.000)	0,3795	0,5871	Supported
H ₃	Human Capital	Green Process Innovation	0.671 (0.502)	-0,1026	0,2029	Not Supported
H ₄	Green Market Orientation	Green Process Innovation	6.599 (0.000)	0,3772	0,6296	Supported
H ₅	Green Process Innovation	Business Performance	0.732 (0.464)	-0,0617	0,1764	Not Supported

Table 7. Mediating Analysis

H	Path		Indirect Effect Coefficient	Conclusion
	From	To		
H ₆	Human Capital	Business Performance	(via Green Process Innovation) 0.354 (0.723)	Not Supported
H ₇	Green Market Orientation	Business Performance	(via Green Process Innovation) 0.692 (0.489)	Not Supported

Based on the result of testing hypothesis 2, green market orientation significantly affects performance. This result is in line with previous studies conducted by Fraj et al., (2011) and Amegbe et al. (2017). These studies revealed that green marketing strategies can lead companies to improve performance. The increasing number of green consumers and green competitors has changed the business world, causing it to become increasingly concerned with environmental issues, including MSMEs. MSMEs need to get information about green buyers' needs and competitors' needs, to be able to serve them according to their needs. Therefore, green market orientation plays an important role in achieving business process success in the era of environmental awareness. To achieve better business performance, companies need to adopt environmentally friendly practices.

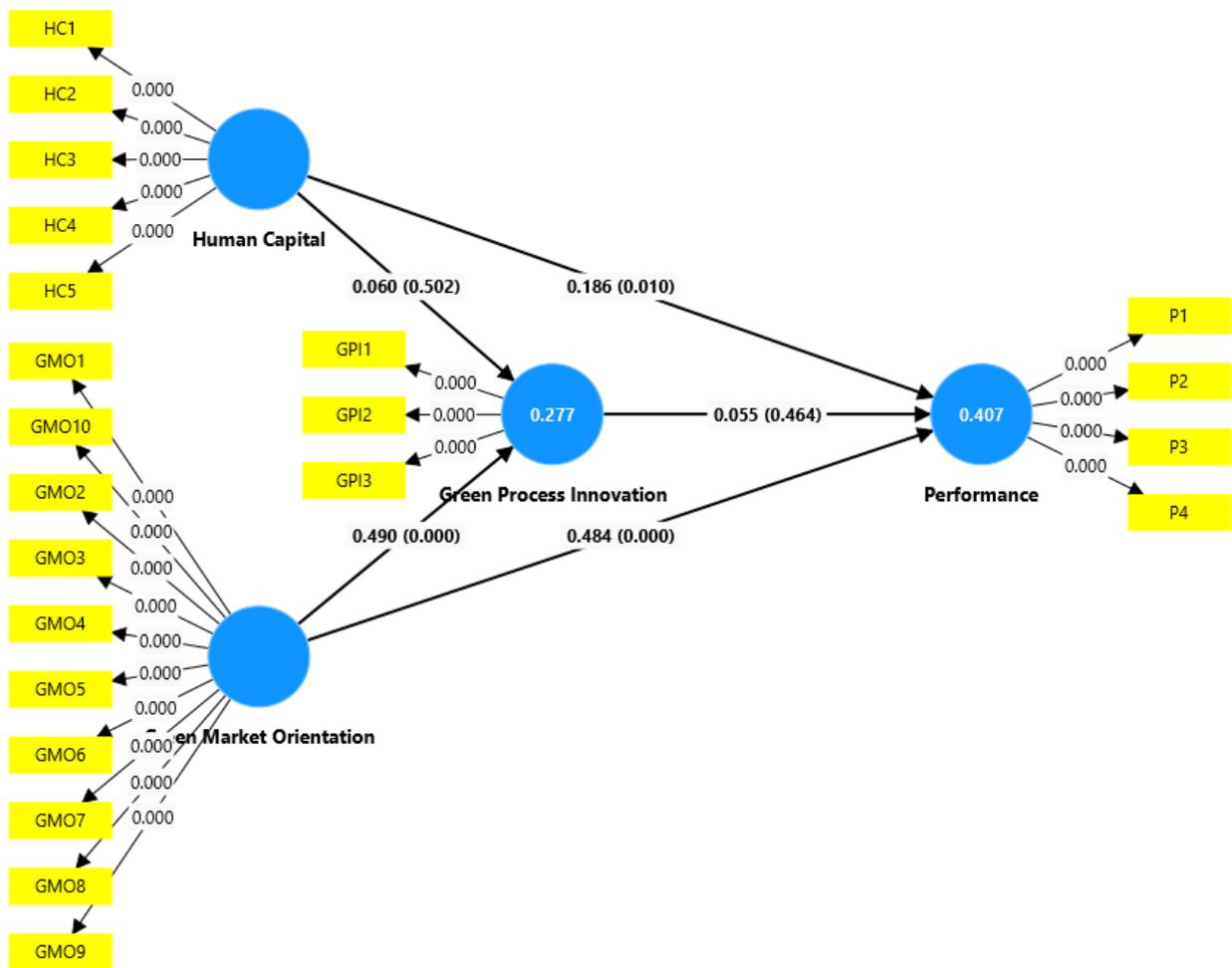


Figure 2. Inner Model

Based on the results of testing hypothesis 3, human capital does not significantly impact green innovation processes. This means that competence, skills, and knowledge in MSMEs do not significantly affect green process innovation. Green process innovation means reducing energy consumption during the production process and recycling waste into goods of economic value. In a dynamic business environment, it requires employee knowledge, experience, and skills to create environmentally friendly innovations (Jardon & Dasilva, 2017). MSMEs should increase their internal capacity, such as human capital, to create green innovations in both products and processes. But the results of this study contradict previous research conducted by Ali et al. (2021); Arsawan et al. (2022); Marco-Lajara et al. (2022), which found that companies with high intellectual capital have more innovative competencies. Given that traditional herbal medicine entrepreneurs reside in rural areas, it's plausible that their innovations are self-initiated and don't intentionally utilize their existing human capital. Alternatively, the knowledge and skills of MSMEs may not align with the anticipated innovations in green processes. This can be seen from the condition of human capital, which is not so good (mean = 3.79) compared to the relatively high green process innovation (mean = 4.30).

In contrast to hypothesis 3, the results of hypothesis 4 test show that green market orientation significantly influences green process innovation. Through the adoption of green

market innovation, MSMEs will try to obtain information about consumer tastes and their competitors, which will then be coordinated to be able to serve and satisfy consumers according to the needs of green consumers. In the era of the green environment, MSMEs inevitably try to carry out green process innovation through production practices that do not cause environmental damage. The results of this hypothesis test are in accordance with previous studies that market orientation is an antecedent of innovation (Beck et al., 2011; Block et al., 2017). Lin et al., (2014), in their study, produced findings that market demand for environmentally friendly products has a positive effect on environmentally friendly product innovation and environmentally friendly process innovation.

Based on the results of testing hypothesis 5, green process innovation does not significantly impact business performance. While green innovation is generally implemented to minimize waste and improve efficiency, the findings of this study differ from previous research, such as that of Weng et al., (2015) and El-Kassar & Singh, (2019), which found that green innovation enhances both environmental and corporate performance. This discrepancy suggests that the impact of green process innovation on business performance may not always be straightforward and could be influenced by several contextual factors. One possible explanation is that MSMEs may not perceive green process innovation as a strategic tool for enhancing competitiveness but rather as a means of regulatory compliance (Marco-Lajara et al., 2022). Many small businesses, particularly in traditional industries such as herbal medicine (*Jamu*) in Sukoharjo, operate with limited resources and knowledge about green innovations (Rustiarini et al., 2022), leading them to adopt green practices primarily to meet environmental regulations rather than to drive operational efficiency or market advantage (Asadi et al., 2020; Neri et al., 2018). Additionally, green process innovations may not be effectively integrated into overall business strategies, reducing their potential to improve performance. According to Teng et al., (2023), for green process innovation to yield positive results, it must be supported by investments in human capital, technology, and operational improvements; however, many MSMEs lack access to these resources, making it difficult to transform green initiatives into tangible business gains. Without a clear link between green innovation and business objectives, the expected improvements in efficiency, cost savings, and customer trust may not materialize, further weakening the relationship between green process innovation and business performance. These findings highlight the need for a more comprehensive approach to green innovation in MSMEs, as simply adopting environmentally friendly practices is not enough to enhance business performance. Instead, businesses must integrate green process innovations into their broader strategic planning, focusing on market competitiveness, production efficiency, and long-term sustainability. Furthermore, policy support, financial incentives, and capacity-building programs are crucial to helping MSMEs overcome resource limitations and maximize the benefits of green innovation. Ultimately, while green process innovation has the potential to improve business outcomes, its effectiveness depends on how well it is implemented, supported, and aligned with the overall business strategy.

Based on the results of hypothesis test 6, green process innovation does not significantly mediate the effect of human capital on business performance. While human capital plays a crucial role in fostering knowledge and skills for developing environmentally

friendly innovations (Ali et al., 2021) and mitigating pollution caused by production processes (Abadli & Kooli, 2022; Awan et al., 2021; Marco-Lajara et al., 2022), the findings of this study contradict previous research. Studies such as Marco-Lajara et al. (2022) have demonstrated that green innovation mediates the impact of intellectual capital on business performance, suggesting that firms with strong human capital are more likely to generate effective green innovations that contribute to improved performance. The inconsistency in this study's findings may stem from the way MSMEs utilize their human capital, which may not be directly focused on developing green process innovations. Many MSMEs, particularly in traditional industries such as herbal medicine (*Jamu*) in Sukoharjo, prioritize short-term operational efficiency and financial sustainability over sustainability-driven innovation (Rustiarini et al., 2022). This could mean that although human capital is beneficial for business performance, it is not necessarily channeled into green process innovation efforts, limiting its role as a mediator. Furthermore, Teng et al. (2023) highlight that successful green process innovation requires a combination of human capital, technological investments, and strong organizational commitment—factors that many MSMEs may lack. Without sufficient resources and strategic alignment, MSMEs may struggle to translate their human capital into meaningful green innovation initiatives, thereby weakening the expected mediation effect. The implications of these findings suggest that enhancing business performance through human capital alone is insufficient unless MSMEs actively integrate sustainability-driven practices and green innovation strategies into their operational models. Additionally, policy interventions, training programs, and financial incentives could help bridge the gap by encouraging MSMEs to leverage their human capital more effectively in developing green process innovations that contribute to long-term business success.

The results of hypothesis test 7 indicate that green process innovation does not significantly mediate the effect of green market orientation on business performance, even though green market orientation directly improves business performance. This suggests that MSMEs can enhance their performance without necessarily relying on green process innovation. In theory, green market orientation helps businesses identify and respond to the preferences of environmentally conscious consumers, thereby encouraging companies to adopt green innovations to minimize environmental impact (Lin et al., 2014; Porter & Van Der Linde, 2017). Previous studies, such as those by (Singh et al., 2016), have found that green innovation positively affects business performance, reinforcing the idea that green process innovation should serve as a critical intermediary in translating green market orientation into better performance. However, the findings of this study diverge from these conclusions, suggesting that while green market orientation promotes green process innovation, the resulting innovations may not be strategically implemented to generate tangible business benefits. One possible explanation for this discrepancy is that many MSMEs, particularly those in traditional industries such as *Jamu* production, may adopt green process innovations only as a reaction to external pressures rather than as a proactive strategy for competitive advantage (Rustiarini et al., (2022). Marco-Lajara et al., (2022) argue that companies often introduce green innovations to comply with regulations or meet stakeholder expectations, rather than as a deliberate effort to improve performance. Additionally, green process innovations may not yet be mature or efficient enough to yield

significant financial returns, particularly in resource-constrained MSMEs that struggle with investment in advanced technology and sustainability-oriented infrastructure (Teng et al., 2023). This could explain why, despite a strong green market orientation, MSMEs do not experience notable business growth through green process innovation. The implication of this finding is that while green market orientation remains a key driver of performance, MSMEs must integrate green process innovations more effectively into their business strategies to fully capitalize on their market positioning. Policy makers and industry stakeholders should consider providing financial incentives, technical support, and market access initiatives to help MSMEs implement green innovations in ways that not only meet environmental goals but also drive competitive advantage and long-term profitability.

CONCLUSION

Based on the previous discussion, this study concludes that both human capital and green market orientation directly influence business performance. Green market orientation also has a direct effect on green process innovation, but human capital does not. In addition, green process innovation does not have a significant effect on business performance. As a result, green process innovation fails to mediate the effect of human capital and green market orientation on business performance. This implies that Sukoharjo Regency's traditional herbal medicine MSMEs can directly enhance their business performance through human capital and green market orientation, bypassing the need for green process innovation.

This study relied solely on data obtained through questionnaires, so it was considered less than optimal for exploring information from MSMEs, especially related to the implementation of green process innovation activities. For future research, researchers are advised to employ data collection through interviews so that they can explore the variables in this study more deeply.

ACKNOWLEDGMENT

The authors gratefully acknowledge the financial support provided by Universitas Sebelas Maret (UNS) through the Research Group Grant Scheme under the Non-APBN UNS Research Funding Program for the Fiscal Year 2024, with contract number 194.2/UN27.22/PT.01.03/2024. This support has been instrumental in enabling the successful completion of this research.

REFERENCES

- Abadli, R., & Kooli, C. (2022). Sustainable energy policies in Qatar: On the green path. In *Advances in Science, Technology and Innovation*. Springer. https://doi.org/10.1007/978-3-030-76081-6_97
- Abdullah, D. F., Sofian, S., & Bajuri, N. H. (2015). Intellectual capital as the essence of sustainable corporate performance. *Pertanika Journal of Social Sciences and Humanities*, 23(May), 1–12.
- Achi, A., Adeola, O., & Achi, F. C. (2022). CSR and green process innovation as antecedents of micro, small, and medium enterprise performance: Moderating role of

- perceived environmental volatility. *Journal of Business Research*, 139. <https://doi.org/10.1016/j.jbusres.2021.10.016>
- Ahmazadeh, M., Eidi, F., & Kagopour, M. (2017). Studying the effects of environmental commitments on green marketing strategies. *International Journal of Economic Perspectives*, 11(1).
- Ali, M. A., Hussin, N., Haddad, H., Alkhodary, D., & Marei, A. (2021). Dynamic capabilities and their impact on intellectual capital and innovation performance. *Sustainability (Switzerland)*, 13(18). <https://doi.org/10.3390/su131810028>
- Aljuboori, Z. M., Singh, H., Haddad, H., Al-Ramahi, N. M., & Ali, M. A. (2022). Intellectual capital and firm performance correlation: The mediation role of innovation capability in Malaysian manufacturing SMEs perspective. *Sustainability (Switzerland)*, 14(1). <https://doi.org/10.3390/su14010154>
- Amegbe, H., Owino, J. O., & Nuwasiima, A. (2017). Green Marketing Orientation (GMO) and performance of SMEs in Ghana. *Journal of Marketing Development and Competitiveness*, 11(1).
- Arsawan, I. W. E., Kariati, N. M., Shchokina, Y., Prayustika, P. A., Rustiarini, N. W., & Koval, V. (2022). Invigorating employee's innovative work behavior: Exploring the sequential mediating role of organizational commitment and knowledge sharing. *Business: Theory and Practice*, 23(1). <https://doi.org/10.3846/btp.2022.15684>
- Asadi, S., OmSalameh Pourhashemi, S., Nilashi, M., Abdullah, R., Samad, S., Yadegaridehkordi, E., Aljojo, N., & Razali, N. S. (2020). Investigating influence of green innovation on sustainability performance: A case on Malaysian hotel industry. *Journal of Cleaner Production*, 258. <https://doi.org/10.1016/j.jclepro.2020.120860>
- Awan, U., Arnold, M. G., & Gölgeci, I. (2021). Enhancing green product and process innovation: Towards an integrative framework of knowledge acquisition and environmental investment. *Business Strategy and the Environment*, 30(2). <https://doi.org/10.1002/bse.2684>
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1). <https://doi.org/10.1177/014920639101700108>
- Batubara, I., Purnaningsih, N., & Mawasti, T. (2020). Profile of micro, small, and medium industrial herbal medicine products in Sukoharjo Regency. *Jurnal Jamu Indonesia*, 5(3), 106–113. <https://doi.org/10.29244/jji.v5i3.186>
- Beck, L., Janssens, W., Debruyne, M., & Lommelen, T. (2011). A study of the relationships between generation, market orientation, and innovation in family firms. *Family Business Review*, 24(3). <https://doi.org/10.1177/0894486511409210>
- Block, J. H., Fisch, C. O., & van Praag, M. (2017). The Schumpeterian entrepreneur: a review of the empirical evidence on the antecedents, behaviour and consequences of innovative entrepreneurship. *Industry and Innovation*, 24(1). <https://doi.org/10.1080/13662716.2016.1216397>
- Cao, Q., Gedajlovic, E., & Zhang, H. (2009). Unpacking organizational ambidexterity: Dimensions, contingencies, and synergistic effects. *Organization Science*, 20(4). <https://doi.org/10.1287/orsc.1090.0426>
- Chabowski, B. R., & Mena, J. A. (2017). A review of global competitiveness research: Past advances and future directions. In *Journal of International Marketing* (Vol. 25, Issue 4). <https://doi.org/10.1509/jim.16.0053>
- Chang, N. J., & Fong, C. M. (2010). Green product quality, green corporate image, green customer satisfaction, and green customer loyalty. *African Journal of Business Management*, 4(13)(13).

- Chen, Y. S., Lai, S. B., & Wen, C. T. (2006). The influence of green innovation performance on corporate advantage in Taiwan. *Journal of Business Ethics*, 67(4). <https://doi.org/10.1007/s10551-006-9025-5>
- Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In *Modern Methods for Business Research* (pp. 295–336). Lawrence Erlbaum Associates. <https://www.researchgate.net/publication/311766005>
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128. <https://doi.org/10.2307/2393553>
- DeBoer, J., Panwar, R., & Rivera, J. (2017). Toward a place-based understanding of business sustainability: The role of green competitors and green locales in firms' voluntary environmental engagement. *Business Strategy and the Environment*, 26(7). <https://doi.org/10.1002/bse.1957>
- D'Souza, C., Taghian, M., Sullivan-Mort, G., & Gilmore, A. (2015). An evaluation of the role of green marketing and a firm's internal practices for environmental sustainability. *Journal of Strategic Marketing*, 23(7). <https://doi.org/10.1080/0965254X.2014.1001866>
- Du, Y., & Wang, H. (2022). Green innovation sustainability: How green market orientation and absorptive capacity matter? *Sustainability (Switzerland)*, 14(13). <https://doi.org/10.3390/su14138192>
- Edvinsson, L., Malone, M. S., & Karlgaard, pról. de Rich. (1997). Intellectual capital: Realizing your company's true value by finding its hidden brainpower / L. Edvinsson, M.S. Malone ; pról. de Rich Karlgaard. *New York, NY*.
- El-Kassar, A. N., & Singh, S. K. (2019). Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices. *Technological Forecasting and Social Change*, 144. <https://doi.org/10.1016/j.techfore.2017.12.016>
- Fraj, E., Martínez, E., & Matute, J. (2011). Green marketing strategy and the firm's performance: The moderating role of environmental culture. *Journal of Strategic Marketing*, 19(4). <https://doi.org/10.1080/0965254X.2011.581382>
- Hair, J. F., Jr., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). A primer on partial least squares structural equations modeling (PLS-SEM). Sage Publications. *Journal of Tourism Research*, 6(2).
- Huang, J. W., & Li, Y. H. (2017). Green Innovation and Performance: The View of Organizational Capability and Social Reciprocity. *Journal of Business Ethics*, 145(2). <https://doi.org/10.1007/s10551-015-2903-y>
- Jardon, C. M., & Dasilva, A. (2017). Intellectual capital and environmental concern in subsistence small businesses. *Management of Environmental Quality: An International Journal*, 28(2). <https://doi.org/10.1108/MEQ-05-2015-0085>
- Kunapatarawong, R., & Martínez-Ros, E. (2016). Towards green growth: How does green innovation affect employment? *Research Policy*, 45(6). <https://doi.org/10.1016/j.respol.2016.03.013>
- Li, M., Tian, Z., Liu, Q., & Lu, Y. (2022). Literature review and research prospect on the drivers and effects of green innovation. *Sustainability* (Vol. 14, Issue 16). <https://doi.org/10.3390/su14169858>
- Lin, R. J., Chen, R. H., & Huang, F. H. (2014). Green innovation in the automobile industry. *Industrial Management and Data Systems*, 114(6). <https://doi.org/10.1108/IMDS-11-2013-0482>
- Marco-Lajara, B., Zaragoza-Sáez, P., Martínez-Falcó, J., & Ruiz-Fernández, L. (2022). The effect of green intellectual capital on green performance in the spanish wine

- industry: A structural equation modeling approach. *Complexity*, 2022. <https://doi.org/10.1155/2022/6024077>
- Mariana, H., & Novianti, S. (2022, February 4). *Pentingnya Peran dan Kontribusi UMKM dalam Pemulihan Ekonomi Indonesia*. <https://Money.Kompas.Com/Read/2022/02/04/070800426/Pentingnya-Peran-Dan-Kontribusi-Umkm-Dalam-Pemulihan-Ekonomi-Indonesia?Page=all>.
- Masa'deh, R., Al-Henzab, J., Tarhini, A., & Obeidat, B. Y. (2018). The associations among market orientation, technology orientation, entrepreneurial orientation and organizational performance. *Benchmarking*, 25(8). <https://doi.org/10.1108/BIJ-02-2017-0024>
- Messabia, N., Beauvoir, E., & Kooli, C. (2023). Governance and management of a savings and credit cooperative: The successful example of a Haitian SACCO. *Vision*, 27(3). <https://doi.org/10.1177/09722629221074130>
- Messabia, N., Fomi, P. R., & Kooli, C. (2022). Managing restaurants during the COVID-19 crisis: Innovating to survive and prosper. *Journal of Innovation and Knowledge*, 7(4). <https://doi.org/10.1016/j.jik.2022.100234>
- Miao, C., Fang, D., Sun, L., & Luo, Q. (2017). Natural resources utilization efficiency under the influence of green technological innovation. *Resources, Conservation and Recycling*, 126. <https://doi.org/10.1016/j.resconrec.2017.07.019>
- Moravcikova, D., Krizanova, A., Kliestikova, J., & Rypakova, M. (2017). Green marketing as the source of the competitive advantage of the business. *Sustainability (Switzerland)*, 9(12). <https://doi.org/10.3390/su9122218>
- Muthuveloo, R., Shanmugam, N., & Teoh, A. P. (2017). The impact of tacit knowledge management on organizational performance: Evidence from Malaysia. *Asia Pacific Management Review*, 22(4). <https://doi.org/10.1016/j.apmr.2017.07.010>
- Narver, J. C., & Slater, S. F. (1990). The effect of a market orientation on business profitability. *Journal of Marketing*, 54(4). <https://doi.org/10.1177/002224299005400403>
- Neri, A., Cagno, E., Di Sebastiano, G., & Trianni, A. (2018). Industrial sustainability: Modelling drivers and mechanisms with barriers. *Journal of Cleaner Production*, 194. <https://doi.org/10.1016/j.jclepro.2018.05.140>
- Pablo-Romero, M. del P., & Sánchez-Braza, A. (2015). Productive energy use and economic growth: Energy, physical and human capital relationships. *Energy Economics*, 49. <https://doi.org/10.1016/j.eneco.2015.03.010>
- Papadas, K. K., Avlonitis, G. J., & Carrigan, M. (2017). Green marketing orientation: Conceptualization, scale development and validation. *Journal of Business Research*, 80. <https://doi.org/10.1016/j.jbusres.2017.05.024>
- Pedro, E., Leitão, J., & Alves, H. (2018). Intellectual capital and performance. *Journal of Intellectual Capital*, 19(2), 407–452. <https://doi.org/10.1108/JIC-11-2016-0118>
- Porter, M. E., & Van Der Linde, C. (2017). Green and competitive: Ending the stalemate. In *Corporate Environmental Responsibility*. <https://doi.org/10.4337/9781782543978.00010>
- Rustiarini, N. W., Bhegawati, D. A. S., & Mendra, N. P. Y. (2022). Does green innovation improve SME performance? *Economies*, 10(12). <https://doi.org/10.3390/economies10120316>
- Schultz, T. W. (1993). The economic importance of human capital in modernization. *Education Economics*, 1(1). <https://doi.org/10.1080/09645299300000003>
- Singh, M. P., Chakraborty, A., & Roy, M. (2016). The link among innovation drivers, green innovation and business performance: Empirical evidence from a developing economy. *World Review of Science, Technology and Sustainable Development*, 12(4). <https://doi.org/10.1504/WRSTSD.2016.082191>

- Soewarno, N., Tjahjadi, B., & Fithrianti, F. (2019). Green innovation strategy and green innovation. *Management Decision*, 57(11), 3061–3078. <https://doi.org/10.1108/MD-05-2018-0563>
- Song, J., Wei, Y. S., & Wang, R. (2015). Market orientation and innovation performance: The moderating roles of firm ownership structures. *International Journal of Research in Marketing*, 32(3). <https://doi.org/10.1016/j.ijresmar.2015.03.005>
- Song, W., & Yu, H. (2018). Green innovation strategy and green innovation: The roles of green creativity and green organizational identity. *Corporate Social Responsibility and Environmental Management*, 25(2). <https://doi.org/10.1002/csr.1445>
- Stacchezzini, R., Florio, C., Sproviero, A. F., & Corbella, S. (2019). An intellectual capital ontology in an integrated reporting context. *Journal of Intellectual Capital*, 20(1). <https://doi.org/10.1108/JIC-05-2018-0090>
- Teng, Z. lu, Guo, C., Zhao, Q., & Mubarik, M. S. (2023). Antecedents of green process innovation adoption: An AHP analysis of China's gas sector. *Resources Policy*, 85. <https://doi.org/10.1016/j.resourpol.2023.103959>
- Tjahjadi, B., Soewarno, N., Hariyati, H., Nafidah, L. N., Kustiningsih, N., & Nadyaningrum, V. (2020). The role of green innovation between green market orientation and business performance: its implication for open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(4). <https://doi.org/10.3390/joitmc6040173>
- Ullah, I., Hameed, R. M., & Mahmood, A. (2023). The impact of proactive personality and psychological capital on innovative work behavior: evidence from software houses of Pakistan. *European Journal of Innovation Management*. <https://doi.org/10.1108/EJIM-01-2022-0022>
- Wang, Y., Bhanugopan, R., & Lockhart, P. (2015). Examining the quantitative determinants of organizational performance: Evidence from China. *Measuring Business Excellence*, 19(2). <https://doi.org/10.1108/MBE-05-2014-0014>
- Weng, H. H. R., Chen, J. S., & Chen, P. C. (2015). Effects of green innovation on environmental and corporate performance: A stakeholder perspective. *Sustainability (Switzerland)*, 7(5). <https://doi.org/10.3390/su7054997>
- Wijayanti, A., & Hanandia, D. F. (2022). Pengaruh personality traits dan competitive advantage terhadap keberlanjutan usaha dimoderasi oleh social innovation orientation. *Owner*, 6(3). <https://doi.org/10.33395/owner.v6i3.1005>
- Yusliza, M. Y., Yong, J. Y., Tanveer, M. I., Ramayah, T., Noor Faedah, J., & Muhammad, Z. (2020). A structural model of the impact of green intellectual capital on sustainable performance. *Journal of Cleaner Production*, 249. <https://doi.org/10.1016/j.jclepro.2019.119334>
- Zhang, J., Li, X., Liu, H., Zhou, J., Chen, J., & Du, G. (2021). Hydrodynamics and mass transfer in spinner flasks: Implications for large scale cultured meat production. *Biochemical Engineering Journal*, 167. <https://doi.org/10.1016/j.bej.2020.107864>