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Green Innovation for Small-to Medium-Sized Enterprises (SMEs): Systematic Literature Review

Mediaty[1], Diza Kurnianty Jamal[2*], Abdul Hamid Habbe[3]
Hasanuddin University
Corresponding Author: Diza Kurnianty Jamal dizakurnianty@gmail.com

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A B S T R A C T

The green innovation literature of the past few decades is not only interesting for research due to its high level of environmental awareness and the provision of green products and services, but also because of its widespread and important applications. This study aims to determine research trends related to the adoption of green innovation, especially in SMEs during 2013-2023 by using Systematic Literature Review techniques. The result of this research identifies the key elements factors of GI for managers and ultimately serve as an important reference to help formulate GI activity strategies. This research can serve as a foundation for scientific development so that the number of studies related to new topics related to green innovation also continues to increase

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INTRODUCTION

In recent years, many studies have on the environmental impact of inappropriate use of natural resources. The increasingly rapid growth of the world's population and limited natural resources emphasize the need to find new ways to use these resources more efficiently in order to balance consumption needs with sustainability principles (Simmou et al, 2023). The increasing awareness of sustainability is driving business organizations to improve their business performance and environmental efficiency (Granero, Munoz & Gomez, 2018). This requires new environmentally friendly production methods, improvements in product characteristics, organizational capabilities and green marketing practices (Nath & Siepong, 2022; Li et al., 2021). This goal can be achieved by encouraging companies and countries to implement green innovations, especially in sectors that have a high potential for environmental impact in terms of pollution and water and energy consumption (Lin et al, 2014). These innovations are known as Green Innovation (GI).

In addition to the above considerations, GI is also implemented due to increasing pressure from customers and stakeholders (Abadzhiev et al., 2022). This encouraged companies to operate using cleaner methods throughout their value chain (Albort-Morant et al., 2016). There is a growing expectation that the development of green innovations can provide solutions to these challenges by mitigating environmental risks and providing more sustainable production and consumption alternatives (Wu, Liu, Zhang & Yu, 2019).

For these researchers, it seems that green innovation is the right thing to do, especially affecting product design and aimed at reduce the environmental impact of products during manufacture, use, and end-of-life disposal (Arfi et al., 2018). This research tries to review information that already exists in previous studies. This is because as the world considers more environmentally friendly forms of economic growth, countries and sectors are starting to position themselves to support the developing green economy (Fankhauser et al., 2013).

Apart from large companies, small and medium sized enterprises (SMEs) have also adopted green innovation to improve performance. SMEs have helped accelerate economic development. Although, due to pressure from the government and society, SMEs are starting to take initiatives regarding green innovation. Due to limited time and resources, it remains difficult for SMEs to compete in the market while introducing green innovations. SMEs are thought to further contribute to environmental degradation (Wong, 2013). Therefore, this study highlights the factors that most influence the adoption of green innovation in SMEs, both in developing and developed countries.

Based on the description above, researchers are interested in collecting various information from previous studies to discuss and analyze the concept of green innovation. This study aims to determine the development trend or progress of research related to green innovation, especially in SMEs during 2013-2023 by mapping or classifying topics from a number of related articles. It is hoped that this research can be useful and become a reference for scientific development and provide ideas related to new topics in the future.

LITERATURE REVIEW

Definition of Green Innovation

Green Innovation (GI) is an important opportunity for companies to harmonize the economy, environment, and society (Wang et al., 2020). GI is important strategy to address increasingly severe environmental problems, stringen environmental regulations, and pressure from interest stakeholder (Cui et al., 2021; Tang et al., 2018; Dougherty, 2017). GI should create added value for all stakeholders involved in implementation (Yao, Zeng, Sheng & Gong, 2019). Clear environmental and social contribution can be realized from the value associated with new products or processes as green innovations (Abadzhiev et al, 2022). This allows companies to meet customer demands, increase competitive advantage and achieve sustainable development (Lai, Yue & Chen, 2022).

Green Innovation (GI) refers to the production, assimilation or use of products, production processes, services, management, or business practices that are new to an organization that develops or adopts it. Environmental risks, pollution, and other negative impacts of resource use, including energy consumption, can be reduced in the company's operating cycle (Arfi et al., 2018). In a more comprehensive sense, GI is defined as the actions of relevant actors in developing, implementing, and introducing new ideas, as well as actions, products, and processes that contribute to reducing environmental impacts and achieving ecologically defined sustainability goals. (Huang & Yang, 2014). However, most GI definitions refer to efforts to reduce the environmental impact resulting from a company's business processes based on green products, processes or management practices (Li et al., 2021).

Green Innovation Classification

According to Arfi et al. (2018), the types of GI are classified into two categories, namely the environmental benefits obtained from the production of goods or services and the benefits derived from the after-sales use of goods or service. Furthermore, the six types of GI refer to the environmental benefits obtained from the production of goods or services, including:

- reduction in material consumption per unit of production;
- reduction in energy consumption per unit of production;
- reduction in carbon dioxide emissions (total CO2 production);
- replacing materials with environmentally friendly or hazardous alternatives;
- reduction in soil, water, noise and air pollution; and
- recycle waste, water, or materials.

The other three innovations relate to the benefits derived from using of goods or service safter the sale, including:

- reduction in energy consumption.
- reduction in air, water, soil and noise pollution; and
- increased recycling of products after use.

According to the available literature, green innovation is divided into three components: green process innovation, green product innovation, and managing green innovation (Amores, Martín & Navas, 2014; Yao, Zeng, Sheng &

Gong, 2019; Abadzhiev et al, 2022). A study by Antonioli et al. (2013) showed that green product innovations are environmentally friendly products, and green process innovations are new methods, techniques, and equipment to produce environmentally friendly products. Furthermore, managerial innovation or green systems relate to new management methods that promote environmentally friendly practices in organizations. Meanwhile, according to Dangelico (2016), green product innovation is defined as a company's capabilities to develop innovate products that use fewer resources, have less environmental impact and risk, and prevent environmental damage.

RESEARCH METHODS

This study uses the Systematic Literature Review (SLR) approach method which aims to identify, review, and evaluate all relevant research so that a result is obtained that summarizes it as a whole. This research consists of several stages following the Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) method described by Page et al (2021).

In the initial stage, existing literature was collected from Science Direct, Google Scholar, and Emerald databases using Publish or Perish software. The selection process was also carried out based on articles published during 2013-2023. The keyword written was "green innovation". After searching, 200 articles each were obtained for searches in Science Direct, Google Scholar, and Emerald for a total of 600 articles. Next, screening was carried out and 35 duplicate articles were found, so these articles were excluded. After removing duplicate articles, the next selection was made based on the specific article title and reading the abstract, 453 articles were excluded, leaving 112 articles for further review. As for the exclusion criteria, the articles had to be peer-reviewed journals, so books or chapters in books were excluded. In addition, exclusion also applied to all literature published not in English, published outside the scope of 2013-2023, and literature that did not fall into the category of journal articles. After reading all the selected articles, it was found that only 38 articles were fully relevant for in-depth review. Thus, this review based its analysis on the 38 most relevant articles. A PRISMA flow chart illustrating the stages in this systematic literature review is shown in Figure 1.

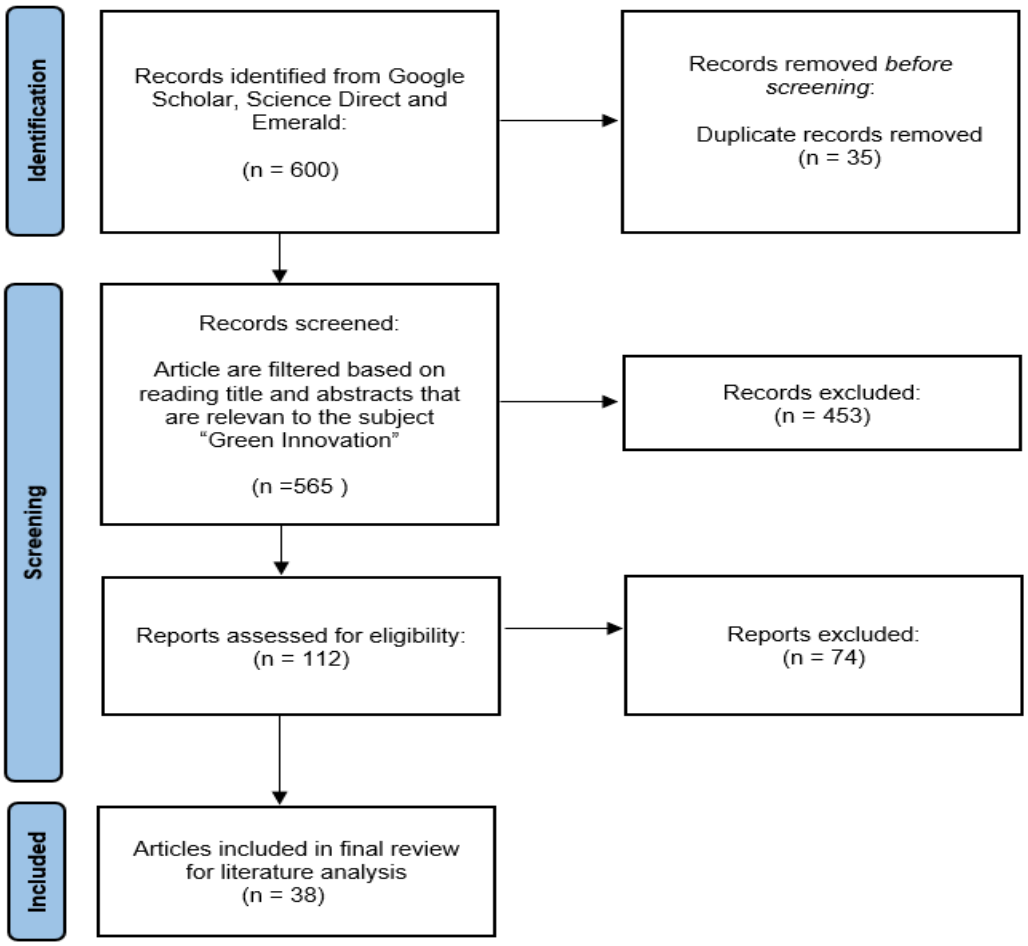

Figure 1. Article Selection Process

The results of the article distribution are shown in Table 1. The most widely used articles came from Science Direct at 53% compared to Google Scholar 37% and Emerald 11%. Of these articles, most used quantitative methods, namely 79%, compared to qualitative and conceptual/literature methods, each of which only used 8% of the total articles, while only 5% used mixed methods. From the table, it is also known that research relevant to this literature study has been conducted in various countries and most of them were conducted in China, namely 42% of total articles compared to research in other countries. Followed by Spain and the United States at 11%, then there are other countries with a percentage of 5% and 3%. Table 2 shows that the journals analyzed are mostly published by the Journal of Cleaner Production at Elsevier, which is 29% of the total articles.

Table 1. Articles Distribution

Jurnal	Publish Year											Total	Persentase
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
Science Direct	2	2	1	2	2	3	2	0	2	1	3	20	53%
Google Scholar	2	1	0	1	2	2	4	1	0	1	0	14	37%
Emerald	0	1	0	0	0	0	1	0	1	1	0	4	11%
Total	**4**	**4**	**1**	**3**	**4**	**5**	**7**	**1**	**3**	**3**	**3**	**38**	**100%**
Research Method													
Kuantitative	3	3	0	2	3	3	7	1	3	2	3	30	79%
Kualitative	1	0	0	0	0	1	0	0	0	1	0	3	8%
Mix Method	0	1	1	0	0	0	0	0	0	0	0	2	5%
Conceptual and Literature	0	0	0	1	1	1	0	0	0	0	0	3	8%
Total	**4**	**4**	**1**	**3**	**4**	**5**	**7**	**1**	**3**	**3**	**3**	**38**	**100%**
Study Location													
China	1	1	1	0	2	3	3	1	3	1	0	16	42%
France	0	0	0	0	0	1	0	0	0	0	0	1	3%
India	0	0	0	1	0	0	0	0	0	0	0	1	3%
Italy	1	0	0	0	0	0	0	0	0	0	0	1	3%
Malaysia	0	1	0	0	0	0	0	0	0	0	0	1	3%
Pakistan	0	0	0	0	1	0	1	0	0	0	0	2	5%
Several Countries	1	0	0	0	0	0	0	0	0	0	2	3	8%
Slovenia	0	0	0	1	0	0	0	0	0	0	0	1	3%
Spain	0	1	0	1	0	1	1	0	0	0	0	4	11%
Sweden	0	0	0	0	0	0	0	0	0	1	0	1	3%
Taiwan	0	1	0	0	0	0	0	0	0	0	0	1	3%
Thailand	0	0	0	0	0	0	1	0	0	1	0	2	5%
United States	1	0	0	0	1	0	1	0	0	0	1	4	11%
Total	**4**	**4**	**1**	**3**	**4**	**5**	**7**	**1**	**3**	**3**	**3**	**38**	**100%**

Table. 2 Jurnal Published

Jurnal	Publish Year											Total	Persentase
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
Asia Pacific Journal of Manage	0	0	0	0	0	0	1	0	0	0	0	1	3%
Business Strategy and the Env	1	0	0	0	0	2	2	1	0	0	0	6	16%
Ecological Economics	0	0	0	0	0	0	0	0	0	0	1	1	3%
Energy Economics	0	0	0	0	0	0	0	0	1	0	0	1	3%
Energy Policy	0	0	1	0	0	0	0	0	0	0	0	1	3%
Environmental Science and Pc	0	0	0	0	0	0	0	0	0	1	0	1	3%
European Journal of Innovatic	0	0	0	0	0	0	1	0	1	1	0	3	8%
Global Environmental Change	1	0	0	0	0	0	0	0	0	0	0	1	3%
International Review of Econc	0	0	0	0	0	0	0	0	0	0	1	1	3%
Journal of business ethics	0	1	0	0	0	0	0	0	0	0	0	1	3%
Journal of business research	0	0	0	1	0	0	1	0	0	0	0	2	5%
Journal of Cleaner Production	0	2	0	1	2	2	1	0	1	1	1	11	29%
Journal of Commerce and Soc	0	0	0	0	1	0	0	0	0	0	0	1	3%
Journal of Human Sport and E	0	0	0	0	0	0	1	0	0	0	0	1	3%
Journal of Open Innovation: T	0	0	0	0	1	0	0	0	0	0	0	1	3%
Management research review	0	1	0	0	0	0	0	0	0	0	0	1	3%
Research Policy	1	0	0	0	0	0	0	0	0	0	0	1	3%
Strategic Management Journa	1	0	0	0	0	0	0	0	0	0	0	1	3%
Technological forecasting and	0	0	0	0	0	1	0	0	0	0	0	1	3%
Uncertain Supply Chain Mana	0	0	0	1	0	0	0	0	0	0	0	1	3%
Total	**4**	**4**	**1**	**3**	**4**	**5**	**7**	**1**	**3**	**3**	**3**	**38**	**100%**

RESULT DAN DISCUSSION

Implementation of Green Innovation in Several Countries

Currently, concern for the environment and social issues has led to green innovation increasingly popular with researchers and practitioners around the world. Developed countries tend to focus more on these issues than developing countries (Jun et al, 2019). For example, in Europe, policymakers are increasingly placing economic growth at the center of discussions regarding environmental management. They want environmental policy to create much-needed jobs, new technology and competitiveness for industry, and protect the environment. It is also an explicit goal of GI policy in Europe to create new market opportunities (Meles et al, 2023).

Several countries continue to promote the development of green industries, prioritizing efforts to use resources efficiently and effectively in a sustainable manner. In this way, industrial development must be compatible with the preservation of environmental functions and bring benefits to society. There are sectors that are environmentally friendly, such as the motor vehicle, engine and turbine sectors. However, in many other countries, those currently enjoying comparative advantage are not leading green innovators., which means they may lose their competitiveness. This depends on the country's strengths and weaknesses in forming institutional networks and their ability to shape the innovation system in a country's sector.

Japan's manufacturing sector is the one that has the most to gain from environmental changes. While Italy's manufacturing sector is not expected to be able to compete in the green race. South Korea has also made environmentally friendly growth an industrial strategic priority (Fankhauser et al., 2013). However, the results of this research literature review found that more research results have been conducted in developing countries, especially China. This is shown in the following article distribution chart.

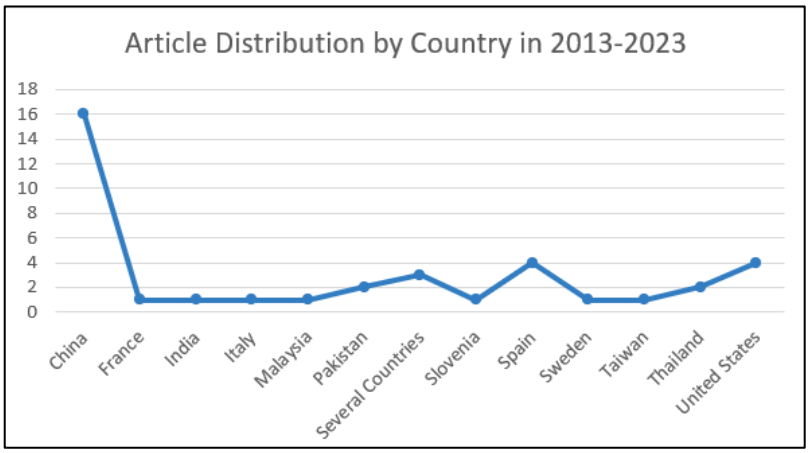

Figure 2. Article Distribution By Country in 2013-2023

In research on Green Innovation based on Figure 2, it shows that there are 13 groups formed based on the division of the country. It is known that most research is conducted in China, namely 16 articles out of the total that raise the issue of green innovation. Environmental problems are getting worse and

causing strong criticism in China due to the country's rapid economic expansion (Cao & Wang, 2017). Therefore, China is also promoting industrial strategies, these include green energy, environmental protection and eco-friendly vehicles, which are expected to put China at the forefront of green growth. (Wang, Nie, Peng & Li, 2017; Yuan & Xiang, 2018). GI is not only an essential skill, but also a business imperative, especially in developing countries where companies seek to reduce pollution, improve the use of scarce resources, and gain competitive advantage (Yao, Zeng, Sheng & Gong, 2019).

In the SMEs sector in China, green innovation as green innovation develops not only environmental performance, but also provides a competitive advantage. SMEs can improve the clarity and compatibility of green innovation, enhance employee learning and innovative capabilities and make organizational resources easily available to companies (Kousar et al., 2017).

The Relationship Green Innovation, Performance and Risk

Innovation in the green industrial sector is interpreted the same as in other industries. It is an intangible asset that determines competitive advantage and has a more global nature to firm performance (Benkraiem, 2023). Green innovation (GI) should generate future benefits for the firm by way of cost reduction (e.g. use of better raw materials) or stronger consumer demand (Yao, Zeng, Sheng & Gong, 2019). There are several factors that influence a company's performance, which can be financial (increased profit margins, revenues, or several financial ratios) or several different characteristics that cannot be measured with certainty, such as reputation (Ng, Butt, Khong, & Ong, 2014). In fact, the literature summarizes these factors into two dimensions, namely environmental performance and competitive advantage. Against this background, several empirical researches have analyzed the relationship of a company's GI performance with its environmental performance and competitive advantage. Based on the research results, a company's green process and product innovation have a positive effect on competitive advantage (Amores, Martín & Navas, 2014). Moreover, GI has a positive effect on environmental performance (Xie, Huo & Zou, 2019).

However, in other literature the potential influence of GI on performance can be modified by various factors (Simmou et al, 2023). In particular, it depends on the type of knowledge provided related to GI. There is a risk that the firm loses control of their knowledge and that competitors may use information exchange to imitate its evolving innovations. Thus, protecting innovation and the knowledge mobilized in the innovation process is fundamental to a company's performance and survival (Noailly and Ryfisch, 2015).

The more SMEs utilize external knowledge, the greater the likelihood of risks occurring. This risk can break the positive relationship between GI and company performance, and cause financial failure in environmentally friendly innovation (Jun et al, 2019). The risk occurs because large companies can pay attention to the development and control of their knowledge and, in some ways, protect their innovations with patents. However, SMEs do not generally manage these aspects due to limited resources, especially in terms of patent registration.

In addition to the knowledge, resources, and skills to implement GI, companies also need the involvement of external organizations to reduce risk (Albort-Morant et al., 2016; Zhao et al., 2018). On the one hand, GI is a complex project that meets different needs and solves different technical, economic, and environmental problems (Ardito et al., 2019). On the other hand, GI is more uncertain and risky than traditional innovations due to high investment costs and uncertain outcomes (Ardito et al., 2019). Therefore, companies need to obtain the latest knowledge and technology from various sources (Martnez-Ros & Kunapatarawong, 2019). It is important to examine how green innovation strategies affect a company's performance from various perspectives.

Factors Affecting the Adoption of Green Innovation in SMEs

The sustainable performance of SMEs is the result of the serious and real efforts they continuously make, including their business, environmental and social performance (Aeknarajindawat & Jermsittiparsert, 2019). On the other hand, if a company has above-average competitiveness from an environmental perspective, it indicates that the company already has an environmental competitive advantage (Zameer et al, 2022). Based on previous research, the factors that influence the adoption of green innovations in SMEs are:

a. Rules and regulations

Environmental regulations exist as an important tool and method for the government to encourage companies to carry out environmentally friendly technological transformation (Jun et al, 2019; Dhull & Narwal, 2016). This is the initial driver for companies to carry out environmentally friendly innovations. For example, China is ranked 120th out of 180 countries, reflecting the threat to the environment due to rapidly increasing economic growth. In 2007, the term "Environmental Protection Expenditures" was added to the state financial budget. Since 2010, total investment in environmental pollution control has experienced an upward trend, until in 2017 it reached 953.9 billion yuan and is now getting bigger from year to year. Environmental regulations are gradually being standardized and formalized into environmental protection for economic and social development (Lv, Shao & Lee, 2021).

b. External partnerships and cooperation

External partnerships and cooperation are considered as important factors to promote green innovation practices in SMEs. The literature shows that if a company wants to produce in an environmentally friendly manner, cooperation and interdependence among companies, customers, distributors, and suppliers are necessary (Dhull & Narwal, 2016).

c. Government support

Government policies such as financial incentives, technological resources, pilot projects, and training programs are factors that motivate SMEs to adopt green innovation practices. This can be achieved through financial incentives and subsidies from the government or loans from banks that encourage small and medium-sized enterprises to adopt green innovations (Hojnik and Ruzzier, 2016). In addition, SMEs have limited resources and therefore require additional resources and government support for implementation.

d. Markets and customers

Customer pressure to produce green product innovations and customer awareness of the environment forces SMEs to adapt green innovation practices. Green product innovation can be an opportunity to get incentives to gain a wider market share (Xie, Huo & Zou, 2019). There is awareness among customers as end users of products to prefer environmentally friendly products. Thus, the influence of customer demand factors is also higher compared to other factors in encouraging producers to adopt green innovations (Jun et al, 2019).

e. Organizational and human resources

Another factor that is also considered as one of the main factors that motivate companies to adopt green innovations is the availability of skilled human resources and the commitment of managers to green innovation practices. Introducing environmental management systems and investing in research and development will increase the efficiency and capabilities of the company. In addition, involvement in green innovation training and activities will improve the quality of staff within the company.

SMEs need to pay attention to employee activities in terms of behavior and psychology in implementing green innovation. Green IT requires a positive mental attitude to commit to implementing green innovation for environmental management. However, its implementation requires facilities from the company such as adequate training and ongoing socialization. So that employee awareness is embedded to care about the environment. (Berrone et al., 2013)

f. Technological factors

The use of technology is important in an institution in increasing the effectiveness of control (Imran, Habbe & Ferdiansah, 2015). In line with the competent human resource factor for implementing green IT, this is a form of investment for SMEs in the technology sector which can be an opportunity to not be less competitive in the market with its competitors. Almost all business models owned by companies and SMEs are digital-based and if they do not adapt they will be left behind. Efficient use of green IT will be able to reduce carbon emissions and waste. In addition, the application of green IT also improves company performance and competitiveness, as evidenced by previous research which states that there is a positive relationship between these two variables. (Kousar et al., 2017).

CONCLUSION

The trend of green innovation (GI) research from 2013 to 2023 remains fluctuating. Researcher use a systematic literature review (SLR) and GI practices are presented from the perspective of several countries that have analyzed this topic in recent years, with the focus on the SME sector. As part of this study, 38 articles on the topic of GI were selected. These articles were used for a literature review and screening based on a number of important characteristics to obtain and review the most relevant articles for GI use. Ultimately, this study reveals the factors that influence the adoption of GI in small and medium-sized enterprises. These factors include regulation, external partnerships and collaborations, government support, markets and customers, organizations and people, and technology. Additionally, there are a number of factors that can

influence the success of broader GI development, including improved knowledge flows within and outside the organization, cross-functional integration, and resource development. Therefore, this study may serve as an important reference for managers to identify important GI factors that can ultimately facilitate the development of GI activity strategies.

FUTURE RESEARCH

The results of this research indicate that a manager's GI can improve organizational performance. Future research can use this research as a basis for scientific development and research on new topics related to green innovation. In this research, no research was found that was conducted in Indonesia, so further research can focus on research in Indonesia that still needs to be developed.

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