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Green innovation strategy improve sustainability competitive advantage: Role of organizational green learning and green technological turbulence

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Abstract

This paper discusses the importance of green innovation strategy in improving company sustainability to achieve sustainable competitive advantage. Green innovation strategy is an idea for environmentally friendly innovation options that are effective in achieving sustainability goals. Organizational Green Learning develops knowledge-based theories to help companies improve organizational competence and learning in carrying out Green Innovation Strategy. Green Technological Turbulence emphasizes contingency theory in the appropriate use of green technology in implementing green innovation strategy. This paper reviews the green innovation strategy literature review, how internal and external factors influence green innovation strategy in achieving Sustainability Competitive Advantage and explores the role of Organizational Green Learning and Green Technological Turbulency in implementing Green Innovation Strategy so that the company's sustainability goals will increase Sustainability. Competitive Advantage. The development of Green Innovation Strategy research is a future research opportunity to explore newness in SDGs research in the field of environmental innovation and explore theory development in environmental innovation research in various industrial contexts.

Keywords: Green Innovation Strategy; Sustainable Competitive Advantage; Organizational Green Learning; Green Technological Turbulance

1. Introduction

Increasingly serious environmental problems have attracted the attention of many countries. At the Fifth Session of the United Nations Environmental Assembly (UNEA-5.2) which recently concluded 3-4 March 2022, all countries reaffirmed their commitment to integrating global environmental challenges into the SDGs sustainable development framework (2021)., nd. Organizational sustainability has become a significant global business issue. Climate change and environmental sustainability are very important, sustainability impacts society and a company's long-term growth and success, strategic position and market competitiveness (Teh & Corbitt, 2015) . Understanding how to make a business environmentally friendly is still a challenge for most companies. Sustainability requires a different strategic approach, thinking *sustainability* can increase innovation (McPhee, 2014) . Despite many companies' efforts to minimize environmental impacts through activities such as reducing carbon footprints and improving production systems, economic growth continues to deplete natural resources. Therefore, environmental innovation strategy efforts are needed to overcome the limitations of natural resources in the environment.

The phenomenon of climate change requires humans to live side by side with nature. Human behavior is integrated with nature. With efforts to overcome climate change, it cannot be denied that human actions have the potential to determine the direction of the climate in the future. Reducing carbon emissions, greenhouse gases, carbon dioxide in social life and commercial activities, companies have a role and are initiators of ideas in overcoming environmental problems and

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offering solutions to improve the environment. The government's role in supporting the movement to overcome climate change by implementing carbon tax policy in Law no. 7 of 2021 "Harmonization of Tax Laws (Republic, 1945) and long-term fiscal policy strategy (Finance, 2024) states that the focus is on encouraging the development of a green economy. Reform fiscal policy is expected able to support economic development while mitigating its impact on environmental sustainability. One of the biggest challenge is house gas emissions glass (GHG) which can trigger the increase Earth's temperature and natural disasters, therefore most of the policies The green economy is geared towards maintaining to ensure environmental sustainability sustainable generational development will come.

In the era of *sustainability* where awareness of environmental issues is an important issue in the SDGs, companies are increasingly aware of increasing their competitiveness by starting to adopt environmentally friendly innovation strategies. In developed countries, modern companies face environmental challenges and pressure so that companies realize that *green innovation strategy* is an important strategy in sustainable development so that companies can have a competitive advantage (Song & Yu, 2018) . *Green Innovation Strategy* is a new idea in achieving sustainable development as well as an effective strategy option in improving sustainability performance to face market pressure, government regulatory pressure on compliance with environmental regulations and as an internal driving force in increasing innovation resources and company innovation capabilities towards sustainable development (SDGs). (Cao & Chen, 2019) .

Increasingly dynamic environmental regulations and increasing consumer awareness of the environment encourage managers in companies to increase environmental awareness by integrating environmental issues with strategy, so that companies can increase their unique competitive advantage. In the study (Eiadat et al., 2008a) *Green innovation strategy* is a company strategy to actively reduce environmental impacts in business activities and integrate environmental responsibility into company strategy. In his 2018 study, Eiadat confirmed the factors that encourage companies to implement GIS, including pressure from stakeholders, environmental management concerns and government regulations on environmental regulations.

This paper wants to discuss a review of *green innovation strategy literature*, the role of *green innovation strategy* in creating *Sustainability Competitive Advatange* and explore the role of *organizational green learning* and *Green Technology* in implementing *Green Innovation Strategy* and a review of *green innovation strategy research*. Future research opportunities are interesting topics for research.

2. Literature Review Green Innovation Strategy

SDGs are a company agenda in exploring renewable energy opportunities, through a *green innovation strategy* companies can balance sustainability performance, becoming a challenge in solving environmental problems so that sustainability competitive advantage (SCA) can be achieved through company options in adopting a green innovation strategy. GIS has been proven to achieve sustainable development (De Resende Ribeiro & Neto, 2021) . The following is a definition of *green innovation strategy* that is universally accepted.

Table 1 Review the definition of *Green Innovation Strategy*

Author (Year)	Definition of Green Innovation Strategy
(Eiadat et al., 2008b)	Green innovation strategy is one of the most important types of environmental strategy, involving changes in practices of reducing resource consumption, preventing pollution and implementing environmental management systems.
(Ge et al., 2018)	<i>Green Innovation Strategy</i> is a process where a company adopts green technology or green management to improve or change its production and operational activities for the purpose of reducing environmental pollution, conserving resources, reducing waste and improving the environment in line with organizational conditions.
(Cao & Chen, 2019)	GIS is a strategy where companies actively reduce environmental impacts among business activities and incorporate environmental responsibility into business strategy planning.
(Soewarno et al., 2019)	Green innovation strategy is a type of strategy carried out by companies in order to implement green innovation so as to achieve competitive advantage, meet market needs and meet stakeholder expectations.

(Zhang et al., 2022)	GIS is a company innovation strategy related to the development of green product innovation and green process innovation that can reduce environmental burden, increase competitive advantage, and improve company performance by promoting the effective utilization of the company's tangible and intangible resources.
(Song & Yu, 2018)	GIS is a strategy where the emphasis of green innovation is on reducing waste and preventing pollution, along with implementing systems that focus on environmental management.
(M. Wang & Liu, 2022)	GIS is an organization's sustainable development strategy in responding to environmental challenges and increasing consumer satisfaction by increasing the value of green attributes. Green innovation strategies are used to reduce organizational efforts to conserve energy, reduce emissions through green treatment processes in 3 pillars, namely green product innovation, green process innovation,

Source: various literature

3. Discussion

3.1. Green Innovation Strategy and Sustainability Competitive Advantage

Green innovation strategy is carried out for the purpose of adopting green technology and green management to adapt to company activities and operations with the aim of reducing environmental pollution, conserving resources, reducing waste and improving the environment and in line with organizational conditions.

Companies need to be active and initiative in reducing the environmental impact caused by the company's business activities and incorporate environmental responsibility into strategic planning as part of the company's CSR activities. (Hart, 1997) identified green strategies as playing a role in *sustainability*. Companies are not just carrying out greening efforts designed to prevent environmental damage, but are switching to a more comprehensive strategy known as a *sustainable global economy*. This drive aims to make the world environmentally clean throughout civilization, companies should ideally chart a course for this sustainability by implementing activities involving pollution prevention, product management, and environmentally friendly technologies. Companies must take advantage of the economic and business opportunities offered by environmentally friendly technology, such as the opportunity to develop new products to realize *sustainable development goals*.

3.2. How Green Innovation Strategy has an impact on Sustainability Competitive Advantage through Green Process Innovation and Green Product Innovation.

Contributing steps to take action to prevent environmental degradation and balance social responsibility, companies can choose a sustainable development path through environmentally friendly, low-carbon development in the concept of environmentally friendly innovation strategy. A similar concept to *green innovation strategy* includes sustainable innovation through an ecological innovation strategy, which means taking the initiative to reduce negative impacts on the environment in the company's business activities and incorporating environmental responsibility into the company's strategic planning to become an achievement target in balancing sustainable performance. The simple logic is that in adopting a *Green Innovation Strategy*, companies require special resources which will have an impact on increasing company costs, but several practices in companies have found that *green innovation strategies* not only reduce profits but increase performance through superior company competitiveness and environmental performance.

Green innovation strategy can be carried out through 3 parts of *green process innovation*, *green product innovation* and *green services innovation*. The importance of carrying out green innovation for economic development purposes has been carried out in research in Chinese industry due to the awareness that environmental damage must be overcome with environmentally friendly technological innovation. Reason why Environmentally friendly technological innovation at the corporate level is appreciated because this innovation can not only solve internal environmental problems production and consumption processes, but can also increase market competitiveness through increasing production sustainability (Chan et al., 2016).

Environmentally friendly product innovation meets consumers' needs for environmental protection, helps companies develop new markets, makes it difficult for other companies to imitate products, and maintains product competitiveness. Successful environmentally friendly product innovation can not only increase the efficiency of resource utilization but also enable companies to gain competitive advantages (Dangelico and Pujari, 2010; Chang, 2016; Andersén, 2021).

Path analysis research proves that a *green innovation strategy* can be carried out with *green process innovation* and *green product innovation* which can improve industrial financial performance through the impact of *environmental performance* and *market competitiveness*. (M. Wang et al., 2021)

In exploring GIS and SCA, previous research explains the need for pollution control strategies, which are material technology assets that must be owned, and environmental strategies involving redesigning product and service delivery processes that are developing in the current phenomenon, redesigning production processes to reduce pollution, in addition the need to reprocess raw materials and by-products and develop new processes that can reduce pollution (Ge et al., 2018). Companies that can achieve SCA can increase the efficiency of the production process and reduce the costs of raw materials and waste disposal, which can have an impact on reducing production costs and creating competitive advantages (Carnahan et al., 2010). To be able to achieve SCA, companies must develop proactive environmentally friendly innovation rather than reactive environmentally friendly innovation to increase environmentally friendly creativity and improve product development performance as a competitive advantage (Chen et al., 2016). GIS impacts SCA through the conceptual model below:

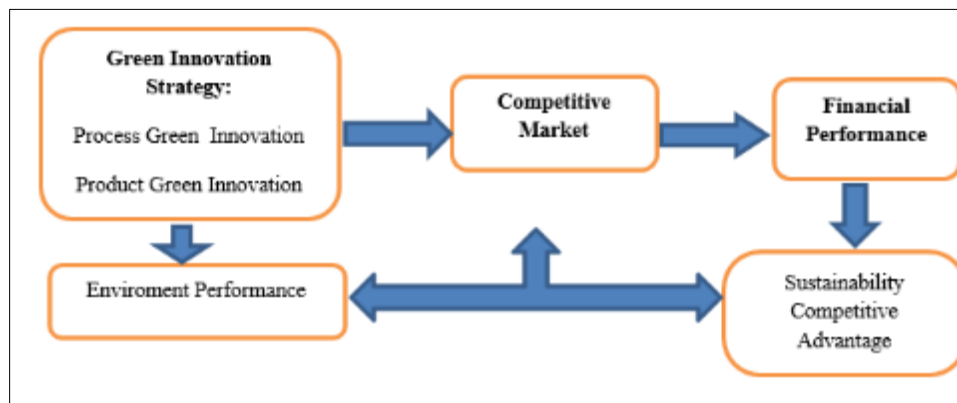


Figure 1 Conceptual Model of Green Innovation Strategy and Sustainability Competitive Advantage

3.3. Internal and External Factors that influence the adoption of *Green Innovation Strategy*

Companies that adopt GIS will be able to meet pressure from government policies on environmental regulations as well as pressure on consumers regarding market demand, suppliers and competitors (Tang & Tang, 2012). Based on these external pressures, companies are motivated to adopt GIS, thus companies take the initiative to meet external pressures to be able to maintain business continuity and fulfill the interests of various stakeholders. Previous research (Carnahan et al., 2010) states that GIS is influenced by company characteristics which have double externalities, namely normative and regulatory pressures. Normative pressure regarding environmental issues has a positive effect on a company's propensity to engage in environmental innovation. Analysis of environmentally related patents from 326 public companies from industries that have a pollution impact in the United States shows that institutional pressure can trigger green innovation, especially in companies that show a larger deficiency gap, that is, companies that produce relatively more pollution than similar companies in the industry. In addition, *the green innovation strategy* adopted is triggered by resource ownership at high asset specificity, and resource availability plays a different role depending on the type of pressure faced.

Previous research findings have identified internal and external factors that encourage companies to implement GIS.

(Eiadat et al., 2008a) in their research identified 3 factors that influence GIS adoption, namely *perceived stakeholder pressure*, *managerial environmental concerns*, *government environmental regulations*. This research examines the relationship between the implementation of environmental innovation strategies and company business performance. This research identifies environmental innovation strategies as influenced by environmental pressures, including government environmental regulations, the importance of stakeholder pressures, and managerial environmental issues. Survey data from the chemical industry in Jordan show that (1) environmental innovation strategies are associated with improved firm business performance; (2) the implementation of environmental innovation strategies is influenced by the strength of certain environmental pressures, and (3) environmental innovation strategies completely mediate between the strength of certain environmental pressures and the company's business performance.

(Cao & Chen, 2019) identified external environmental factors, namely coercive policies and market pressure, as having a positive and significant impact on GIS. The driving influence of internal *innovation capability* has a positive effect on GIS, but *innovation resources* do not have a significant effect on GIS.

(Alnaim et al., 2022) conducted research by identifying the strength of internal and external environmental challenges on green innovation strategy, by developing *Green Organizational Identity*, *Green Innovation* and *Green Creativity*. This research confirmed that external pressures such as *Policy Pressure* and Market Pressure and internal forces such as *Innovation Resources* and *Innovation Capability* have an influence positive and significant towards *green innovation strategy*.

3.4. Organizational Green Learning

Companies face dynamic environmental changes, through organizing environmentally friendly learning companies can respond to changes quickly to maintain the company's business environment.

Knowledge-Based Theory argues that differences in knowledge levels among companies can influence differences in competence and organizational learning that help companies acquire knowledge resources (N. Wang et al., 2022), and organizational learning is closely related to innovation performance, previous research (Authors, 2013) explain how interorganizational learning (including supply chain learning and imitation prevention) mediates the relationship between supply chain integration and two focal firm performance dimensions (i.e. customer service performance and innovation performance).

Organizational Green Learning (OGL) can increase a company's environmental awareness and encourage the smooth implementation of environmentally friendly innovation strategies. Learning environmental knowledge can influence a company's green innovation strategy by influencing company decisions. Several studies have found that environmentally friendly learning in organizations has a positive impact on the company's environmentally friendly innovation capabilities. Companies face dramatic environmental changes; only through organizing green learning can they respond to current changes in a timely manner to maintain the company's normal business environment. Organizing environmentally friendly learning can turn environmentally friendly or clean ideas into business opportunities and increase the efficiency of existing products. Companies can also learn from green conditions

This continuous improvement requires continuous learning and innovation of existing technology and knowledge. Green learning in organizations is the main way for companies to carry out green innovation strategy. Through environmentally friendly learning in organizations, companies master the latest environmentally friendly ideas and methods, and then apply them to environmentally friendly innovation practices. Green innovation strategies can promote environmental knowledge learning and stimulate green innovation behavior, thereby achieving green innovation performance [38]. This means that green innovation strategies can indirectly influence a company's green innovation performance through organizational green learning.

3.5. Green Technological Turbulance

Green Technological Turbulance (GTT) reflects production equipment, methods, processes, product design and product delivery mechanisms that can save energy and natural resources. It is hoped that GTT can reduce environmental burdens from human activities

Contingency theory emphasizes that no one theory or method can be applied to all situations, and the "fit" between a firm's structure and certain environmental characteristics does not necessarily determine firm performance.

This means that there is a significant relationship between the external environment and company behavior and performance results. The turbulent technological environment has posed challenges for green innovation in companies. The green technology upheaval has magnified the potential for unexpected risks. In existing studies, green technology turbulence (GTT) is an important situational condition for green innovative companies facing external environmental uncertainty, and plays an important role in strategy formulation and implementation.

3.6. Mapping Theory Green Innovation Strategy Research and future research directions

Previous research related to GIS has become a concern in developing SDGs literature in the environmental dimension. There is a need to develop GIS research in various industrial contexts. From various existing literature, previous GIS research has concentrated on research in the manufacturing industry, there is still very limited research in Indonesia, also in other service industries, for example. hospital services industry, education.

Table 2 Summary of *Green Innovation Strategy Research* in various industrial sectors

Article Source	Title	Industry	Theory Approach
(Soewarno et al., 2019)	Green innovation strategy and green innovation	156 companies that listed in the Investor Guidance Book of the Surabaya Industrial Estate Rungkut.	organizational identity theory, the organizational legitimacy theory.
(Nanath & Pillai, 2017)	The Influence of Green IS Practices on Competitive Advantage: Mediation Role of Green Innovation Performance	144 IT companies in India	IT-Enabled organizational capabilities perspective The Resource based viewTheory
(Asadi et al., 2020)	Investigating the influence of green innovation on sustainability performance: A case on Malaysian hotel industry	183 hotels in Malaysia	Resource based view Theory
(S. Huang et al., 2020)	The Impact of Startups' Dual Learning on Their Green Innovation Capability: The Effects of Business Executives' Environmental Awareness and Environmental Regulations	212 enterprises established within 4 years in the Pearl River Delta of China	the theory of organizational learning, institutional theory, and green innovation theory,
(Zhang et al., 2022)	How Do New Ventures Implementing Green Innovation Strategy Achieve Performance Growth?	240 sample enterprises in China	<i>Natural resource-based view theory</i>
(Su et al., 2020)	Environmental Leadership, Green Innovation Practices, Environmental Knowledge Learning, and Firm Performance Xiaofeng	353 agricultural products corporations in China	Social Learning Theory The
(Alnaim et al., 2022)	Environmental Challenges and Green Innovation Strategy: A Vigorous Development of Greener Dynamics Abdullah	300 survey forms among Saudi Arabia's various manufacturing companies. In return, we received 192 which	resource-based theory explains
(Fernando et al., 2019)	Pursuing green growth in technology firms through the connections between environmental innovation and sustainable business performance: Does service capability matter? Judy	survey involving 95 Malaysian firms which use green technology.	two complimentary theories of the resource-based view and the knowledge-based view, the framework that has been developed creates a better understanding of the green technology movement to support servitization
(Song & Yu, 2018)	Green Innovation Strategy and Green Innovation: The Roles of Green Creativity and Green Organizational Identity	manufacturing, service industries, from firms in Guangdong province in China.	organizational identity and organizational creativity theory
(Ge et al., 2018)	An Empirical Study on Green Innovation Strategy and Sustainable Competitive Advantages: Path and Boundary	241 new Chinese green firm	dynamic capabilities theory

(Cao & Chen, 2019)	The driving effect of internal and external environment on green innovation strategy-The moderating role of top management's environmental awareness	327 manufacturing enterprises from Shandong, Jiangsu, Zhejiang, Guangdong and Shanxi provinces.	strategic choice theory
(JW Huang & Li, 2017)	Green Innovation and Performance: The View of Organizational Capability and Social Reciprocity	418 CEOs or managers of the information and communication technology industry (ICT industry) in Taiwan	Social Reciprocity and Green Innovation Social

4. Conclusion

Green innovation strategy is a strategy for creating environmental performance. Green technology adoption is a growing issue throughout the world that encourages organizations to develop green innovation strategies. Green innovation strategy is carried out for the purpose of adopting green technology to reduce environmental pollution, conserve resources, reduce waste and improve the environment and is in line with organizational conditions. Companies that engage in green innovation can meet government and industry requirements while reducing waste and pollution, thereby protecting the environment and bringing many positive impacts to environmental performance, increasing market share so that the company's financial performance can improve and the organization can achieve sustainable competitive advantage.

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