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Application The Role of Green Innovation for Sustainable Development Theoretical and Practical Studies East Java Province, Indonesia

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Abstract

Purpose: This study aims that the green innovation strategy is able to answer various issues of environmental damage that require consumers and companies to create and fulfill needs in different ways to produce the minimum environmental impact possible. Theoritical Reference: This study of theory and research practice was carried out using the literacy of several studies that have obtained results. Method: The study conceptual framework is proposed, and the not-hypotheses were considered for empirical problems in the context of SMEs, because it evaluates existing research (literature review), The literature reviews have an important role in writing a scientific article or essay. Result and Conclusion: Companies and individuals embracing these technologies play a vital role in reducing our carbon footprint and protecting our planet for future generations. As we continue to invest in and adopt these green technologies, we move closer to a world where economic growth and environmental conservation go hand in hand. that green innovation performance the important tools that drive innovative behaviour based on investment and awareness in the business process. Research Implications: Based on the results of this research, it is recommended that further research can carry out research replication from the perspective of SMEs which discusses green innovation and the consequences of failure in implementing it, so that the difficulties experienced by SMEs can be overcome. Value: The novelty of this research is the result of several research studies which then compare the combination of green innovation with green technology, for sustainable development, especially in SMEs.

Keywords: *Green innovation, Implementation, Development and Sustainability.*

1. Introduction

Green innovation is not only needed by large scale companies, but is also needed by medium and small scale companies. Two important objectives of the present study were achieved. First, to investigate the influence of green innovation practices adopted by SMEs on consumer resistance to green innovation products. Second, environmental knowledge and pro-environmental behavior moderate consumer resistance to green innovation products. firms struggle to foster green innovation practices (Musaad O et al., 2020). However, owing to rising environmental challenges, resource depletion, and environmental stress, green innovation has received much attention from academics in the last decade. (Kawai, Strange, & Zucchella, 2018). Environment knowledge includes the

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knowledge of product manufacturing, its impact on the environment, and how collective responsibility is required for long-term sustainable development (Kaufmann, Panni, & Orphanidou, 2012).

Considering the important role of higher education institutions in implementing education for sustainable development, entrepreneurship learning needs to integrate the triple bottom line as a critical context for entrepreneurship education and responsibility in creating green entrepreneurs, (Djatmika, 2016). Supporting this statement, "batik training work program using the gradation dab technique is an effort to help develop and preserve Sujo batik, by adding a new technique in making batik, namely the gradation technique. This work program is able to increase the branding and selling power of Batik Sujo in the sales market by adding new, more modern and innovative techniques" (Agung Winarno, et al., 2021). Then there is another example,:" that the implementation of this work program is proceeding according to plan. Apart from that, the training participants have also gained knowledge and skills and can understand the material presented by the presenters, this is proven by the satisfactory final practical results and the residents are very enthusiastic if they are given training again. Based on the training activities that have been carried out, there is a recommendation that the Sumberagung Village PKK mothers who have taken part in the training should be able to become pioneers in conveying knowledge and skills" (Winarno, 2020). To achieve Green innovation can be done by paying attention to Corporate Social Responsibility (CSR). The CSR disclosure standards in Indonesia refer to the standards applied by the Global Reporting Initiative (GRI). The underlying reason is that GRI is concerned more about utilizing sustainability reporting. Concerning Indonesia, the GRI-G4 standard has been widely used by companies in Indonesia (Puji Handayani, 2022)

There is limited research on consumer resistance toward environment-friendly innovative ideas. Few studies have recorded this resistance and its integration with environmental knowledge and behavior. Thus, this study attempts to address this research gap. Consumers encounter with green innovation products is important in implementing consumer behavior. Consumers are more concerned about the environmental issues of protection. States frequently enact strict environmental policies to reduce emissions bolstered by industries, such as small and medium businesses (SMEs) (Mohsin, Zhou, Iqbal, & Shah, 2018). However, due to their small size, SMEs' addition to environmental degradation is overlooked at the local and national levels in the form of rule (Khan, Jam, Shahbaz, & Mamun, 2018; Sun et al., 2020).

According to previous studies, SMEs account for about 70% of the business's general surplus waste and environmental releases of useless material. Consequently, due to pressure from numerous stakeholders, awareness grew, and the state also increased its duty to SMEs to minimize hazard environment impact (Rasheed & Anser, 2017). Consumers' resistance can be explained as a hesitancy to try fresher technologies in their elementary form. This is the key reason for market dissatisfaction with innovation, also known as consumer opposition to green innovation. Similarly, it is the main element that stymies or delays the admission of novel technologies (Laukkanen, Sinkkonen & Laukkanen, 2008).

According to empirical studies, green innovation practices have a significant failure rate, indicating that many inventions flop due to consumer resistance to green product innovation. Consumers' resistance has been an important concern for commerce, and it will become a major threat in the upcoming era (Abbas, Shahid Nawaz, Ahmad, & Ashraf, 2017; Ahmad, 2021; Haq, Ramay, Rehman, & Jam, 2010; Jam, Singh, Ng, & Aziz, 2018). Globally, business groups significantly contribute to the economies of developing countries (Chege & Wang, 2020). However, with rapid economic development, difficulties relating to the environment and pollution, such as waste pollution, vast industrial excess, and severe emissions such as carbon, are increasing daily (Xu et al., 2020).

Literature concerning environmental knowledge and behavior relevance to consumer resistance to innovation is scarce. Thus, the current study provides a theoretical basis for determining these two constructs as moderators of an existing relationship. Companies must pay greater attention to environmental management creativity and environmental planning strategies. The present study is incremental in examining consumers' attitudes toward green innovation practices and consumer resistance to green innovation products with environment and pro-environment behavior in the context of SMEs. This study addresses research questions on how adoption of innovation practice helps overcome consumer resistance to green innovation. What role is played by environmental knowledge.

Researchers have argued that companies must first recognize the causes of product failures to accomplish innovation inventiveness efficiently. The controversy in research reporting has highlighted the need to explore and highlight the factors that are integrated and that can moderate the controversial relationship between innovation practices and consumer resistance to innovation. The practical importance of this study is that it is expected to provide key policy insights for policymakers striving to achieve sustainable development goals, especially those related to environmental awareness and rehabilitation. This study is vital for academic scholars working to determine integrated aspects of environmental management concerning the environmental research domain.

2. Literature Review

Green innovation will reduce specific environmental risks, such as CO2 emissions andother consequences of climate change, as well as product usage. Environmental design is defined as creating innovative environmental systems, developing sustainable processes, and applying eco-design principles (Anser, Yousaf, Nassani, Abro, & Zaman, 2020). Several researchers have presented definitions of green innovation in the past (Anser et al., 2020; Wang et al., 2020). A description of ecosystem innovation has been provided. Green innovation involves generating new ideas and promoting creativity in products, services, processes, and procedures (Afridi et al., 2020).

The current research theme is grounded in multiple innovation and organizational ehavior theories. According to the diffusion of innovation theory by Rogers, Singhal, and Quinlan (2014), when a product is at its introduction level, there are some reasons, such as a lack of knowledge about green products and green activities. When green practices are in the initial stage, defects may need to be addressed to improve consumer utility. Furthermore, according to the expectancy theory (Ferris, 1977), until the consumers are fully aware of, know the performance and have motivations, they would like to use and think positively about the innovation. The diffusion of innovation theory and expectancy theory support the basis of the framework investigated in this study (Eagly & Chaiken, 1993). According to Hoeffler (2003), truly novel items are associated with higher levels of uncertainty than incrementally new products. Based on the characteristics explained as green innovation practices and reasons for consumer resistance to innovation, it is expected that consumers with less environmental knowledge will resist the development of green innovation products by SMEs. Thus, we propose the following hypothesis:

As approaching evidence advocates, according to these theories, this is not the end of the narrative and consumers are not always as sensible or systematic as they appear to be regarding establishing attitudes. The diffusion of innovation theory has different stages according to the product life cycle, from introduction to decline. During the growth stage, green products are at the highest point of acceptance by consumers (Wang et al., 2020). However, consumers in the laggard stage are mostly resistant to green product innovation. In expectancy theory, customers see different benefits from the product based on environmental knowledge and may show pro-environment behavior. This knowledge

helps them shape their attitudes toward green products, which are innovative and helpful in improving the environment (Chen, Chang, & Hsiao, 2022).

Businesses involved in environmentally responsible activities have high integrity. If a consumer is offered information on the causes and effects on the environment, their level of awareness will rise, and they will likely choose green products for daily activities. Thus, environmental knowledge has been reported as a key external factor influencing consumer resistance toward green innovation products (Huang, Jin, & Coghlan, 2021). Recent research has concluded that rituals and personal image are the strongest barriers to consumer acceptance of innovation (Sadiq et al., 2021; Shahbaz, Tiwari, Jam, & Ozturk, 2014; Waheed, Kaur, Ain, & Sanni, 2015). Additional findings have revealed that environmental concerns reduce the negative impact of value and image building on consumer resistance to green products (Sadiq et al., 2021). Another recent study reported that innovation resistance theory factors are negatively related to the intention to use innovative applications. However, some studies have reported that consumer communication significantly influences innovation resistance factors (Chen et al., 2022).

Consumers are the most important participants in green marketing; thus, examining their green consumption habits is critical. Humans are responsible for conserving the environment by limiting their use of natural resources. Consumers must switch from conventional to green products to reduce their environmental impact. Green consumer behavior is a panacea for preventing future environmental devastation. A recent study on consumer innovation resistance factors reported pro-environmental behaviors as key influencers in determining consumer attitudes and resistance toward eco-friendly innovations (Huang et al., 2021). Another study reported similar findings that beliefs and attitudes, and people's political ideologies, are greatly influenced by pro-environmental behaviors compared to social and demographic attributes (Smiley, Chen & Shao, 2022). Another study investigated the adoption of information and communication technology (ICT) as a moderator between energy efficiency-based behavior, intrinsic motivation and green thinking. The study confirmed that pro-environmental behaviors have stronger associations with technology and innovation adoption (Mansoor & Paul, 2022). Thus, leading toward testing the moderating influence of pro-environmental behaviors on green innovation practices and consumer resistance to green innovation products.

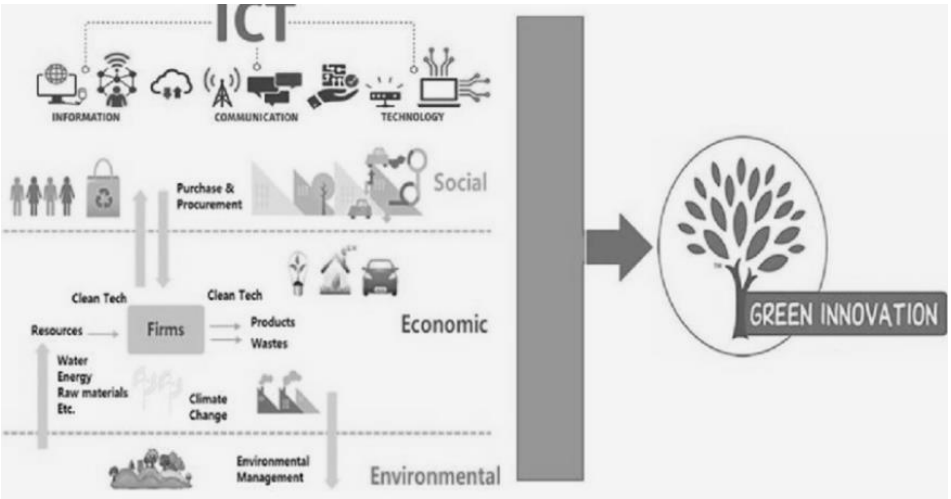

Figure 1. The conceptual framework for green innovation.

Source : Cheng, Mohsin and Abaid (2023)

The procedure is environmentally friendly and can help reduce environmental dangers. If SMEs adopt green innovation practices, they decrease the consumption of natural resources, follow recycle, reuse, and remanufacture policies, use renewable technologies, produce environmentally friendly products through design and innovation, and use less

toxic materials that are harmful to the environment (Mazhar, Jam, & Anwar, 2012; Sanni, Ngah, Karim, Abdullah, & Waheed, 2013; Wang et al., 2020). How the adoption of green innovation practices convinces consumers that it improves environmental quality is a gray area of research. Marketing scholars have paid little attention to this issue. Thus, when marketing green innovation products designed by SMEs, it is vital to explain new features with benefits to consumer utility and their utility to the environment, to create and develop.

3. Method

Based on a detailed assessment of the literature and the diffusion of innovation theory and expectation theory, the study's conceptual framework is proposed, and the not-hypotheses were considered for empirical problems in the context of SMEs, because it evaluates existing research (literature review), The literature reviews have an important role in writing a scientific article or essay, because they can provide ideas and objectives regarding the research topic to be carried out;

1. Help researchers to better understand the problem being researched correctly according to the scientific framework of thinking, so that researchers understand how the research was carried out.

2. Know about theoretical descriptions, findings and other research materials obtained from reference material to be used as a basis for research activities.

3. Develop a framework for thinking in solving problems.

4. Get an overview of what other people have done previously, where this description was related to the researcher's research.

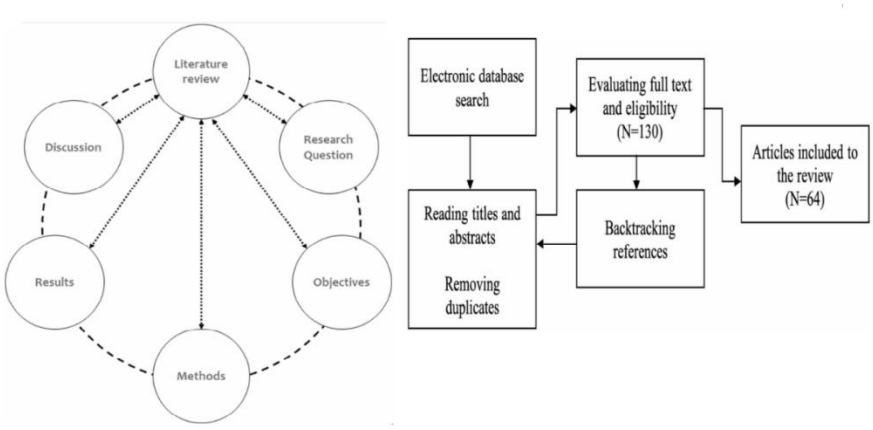

Figure 2. Literature review of thought patterns and analysis

Source: theoretical study and research results, 2023

Literature reviews have an important role in writing or writing Scientific essays, because they can provide ideas and objectives regarding the topic of research that will be conducted done. Generally contains reviews, summaries & the author's thoughts about several literature (books, journals, magazines) related to the topic discussed. All statements and/or research results that do not come from the author must state the source

4. Result and Discussion

Works of Green Innovation (GI) are commonly divided into two types. The first describes GI as a firm's abilities (Gluch et al., 2009), whereas the second defines GI as an organization's environmental practices (Lin and Ho, 2008; Ho et al., 2009). When it

comes to organizational practices, GI is described as "the hardware or software innovation related to green products or processes" (Song and Yu, 2018); it is proposed that GI comprises management practices and technological advancements that expand the environmental and organizational performance (OP) and provide a competitive edge to the firms (Rennings, 2000). Other researchers recommend that GI consists of unique or altered systems, processes, products, and practices that provide an advantage to the environment and subsidize firms' sustainability (Xie et al., 2019).

The concept of the innovation system stresses that the flow of technology and information among people, enterprises, and institutions is key to an innovative process. It contains the interactions between the actors needed in order to turn an idea into a process, product, or service on the market. The International Standards Organisation published their standard ISO 56002, which contains all of the elements that is required to set up a structured management system for innovation. It builds on the overarching standard for management systems and follows the directives of all standard management systems. This standard was standardised into the European Norms and British Standards, and is known in the UK as BS EN ISO 56002:2019.

Sustainable development was first institutionalized with the Rio Process initiated at the 1992 Earth Summit in Rio de Janeiro. In 2015 the United Nations General Assembly (UNGA) adopted the Sustainable Development Goals (2015 to 2030) and explained how the goals are integrated and indivisible to achieve sustainable development at the global level. The UNGA's 17 goals address the global challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice. The company is one that creates waste and has a negative impact to the environment, requires awareness that the company's activities are not only concerned with profits for the company itself, but also pay attention to the surrounding environment. Legitimacy theory explains about It is important for companies to pay attention to people's lives so that everything company activities and activities are in line with their expectations, including when the current condition is to pay attention to the environment.

One way for companies to develop business with competition A healthy business is based on innovation and is linked to conditions environment, the best innovation is innovation to create environmental friendliness in all its activities, which is usually called green innovation. An innovation is an investment that requires a lot of money and time, but it can be achieved provide a positive impact on the company in the long term.

"Green innovation" is a hot topic that has attracted much attention in recent years. When scholars describe innovation that is helpful in reducing the impact on the natural environment, the following terms still exist: ecological innovation, environment innovation, and sustainable innovation. The former two terms and green innovation are synonyms, while the concept of the latter is extended to the social level (Schiederig et al., 2012). Because of the different disciplines, academic opinions, and preferences of researchers, there is still some argument about the expression and understanding of the concept of "green innovation." Blättel-Mink (1998) noted that green innovation introduces ecological ideas into the development of new products, markets and systems, or even economic strategies. Beise and Rennings (2005) proposed that green innovation is a series of applications in newly developed or improved processes about technologies, practices, systems, and products.

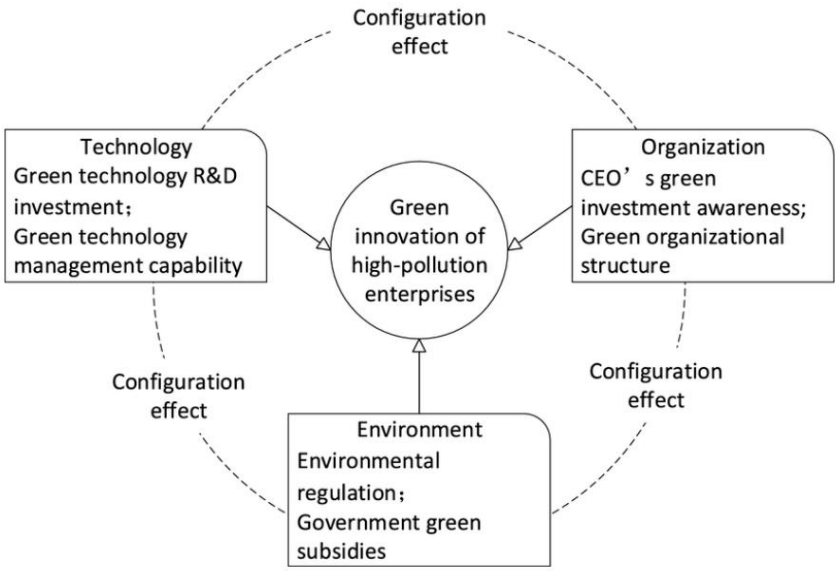

Figure 3: The Green Innovation Cycle Policy for sustainability

Source: theoretical study and research results, 2023

Halila and Rundquist (2011) indicated that green innovation is a general term for a series of innovative activities. It helps improve the quality of the ecological environment and contributes to sustainable development. Through comprehensive comparison of these concepts, different scholars have formed a consensus of ideas on the definition of green innovation, including the following: (a) the whole life cycle of products; (b) innovative objects are products, processes, services and methods; and (c) the purpose of innovation is to reduce or eliminate the impact on the environment.

The characteristics of green innovation in companies are the concentrated reflection of enterprise green innovation strategy. If these characteristics are grasped and summarized, firms in different industries with different characteristics can refer to the corresponding green ideas to implement green innovation practices; save time, resources, and capital; and improve the efficiency of green innovation. ustainable development reports include the actions of managing and improving economic, environmental, and social performances by companies, the results of these actions, and future improvements (Zhong & Gan, 2006). The content of social responsibility reports usually involves various aspects of economic responsibility, environmental responsibility, and social responsibility (Xu & Xu, 2011). The green development strategy we focus on is the important part of the company reports.

Table 4. Green Innovation Measures for Companies.

Category	Industry	Measures
1	Energy-related industries	Carry out green innovation programs, apply for green patents; conserve water, improve the utilization of water resources; address waste and focus on the protection of natural and biological diversity
2	Finance-related industries	Implement green offices, save paper; use clean renewable energy, and develop an environmental strategy; focus on waste recycling as well as the protection of nature and biodiversity
3	Diet and pharmaceutical industries	Cooperate with suppliers; conserve water and increase water use efficiency; use clean renewable energy and recycle waste materials; protect nature and biodiversity
4	Machinery manufacturing industries	Conserve water, increase water use efficiency; carry out green innovation programs and develop or introduce various green technologies; pay attention to the disposal of waste and protect the diversity of nature and biology
5	Electronic information and high-tech industries	Use clean renewable energy; conserve water and increase water use efficiency; cooperate with suppliers and implement green offices; protect the diversity of nature and biology
6	Retail and material supply industries	Engage with communities; establish a green data center; carry out energy-saving reform; improve the transportation mode

Source; Lu Zhang, et., all (2023)

Companies exploring or intending to carry out green innovation, they can locate themselves into their own industry and make their own green innovation and development path by referring to the corresponding green innovation measures. For instance, companies in the energy industry can implement green innovation by actively developing green innovation programs, applying green patents and improving water use efficiency. firms have begun to pay more attention to the impact of their decision-making and management behaviors on the environment and to promote green innovation (Cui, 2017; Safari et al., 2018). Some firms focus on the green design of products, some focus on raw materials and clean energy, and others are interested in the innovation of production processes.

The retail and material supply industry can carry out green innovation through energy-saving reform, improving the transportation mode, establishing a green data center, engaging with communities, and so on. In addition, the industry generally pays attention to water conservation and the protection of nature and species diversity and reflects the social responsibility of the companies and actively generates a good image of consciousness in the process of green innovation. In addition, some companies of an industry are distributed discretely, or the number in a group is small; they cannot present a certain trend, such as the communication industry, mineral industry, and entertainment industry, so we do not give a unified proposal for these types of companies, but we can search for similar business companies as references in the relevant industry. With the increase in the number of people and the consumption of resource-based companies, coal, oil, natural gas, and other nonrenewable energy sources are gradually decreasing or even being depleted. The use of these nonclean energy sources exacerbates the deterioration of the environment. Firms that do not increase their environmental sensitivity will face the risk of losing their upside opportunities in a market shaped by environmental factors (Esty & Winston, 2006).

Achieving green innovation for sustainable development requires attention to Green Techlogoies, “play a crucial role in protecting the environment by reducing greenhouse gas emissions, promoting renewable energy sources, and minimizing the use of fossil fuels. We can significantly reduce our carbon footprint and lessen our dependence on non-renewable energy sources by harnessing renewable energy sources like solar and wind power”. There are numerous examples of green technologies that are making a positive impact on the environment. One of the most well-known examples is solar energy, which utilizes photovoltaic cells to convert sunlight into electricity. Electric vehicles are another prominent example, helping to reduce carbon emissions and decrease the reliance on fossil fuels (Chomesky, 2019).

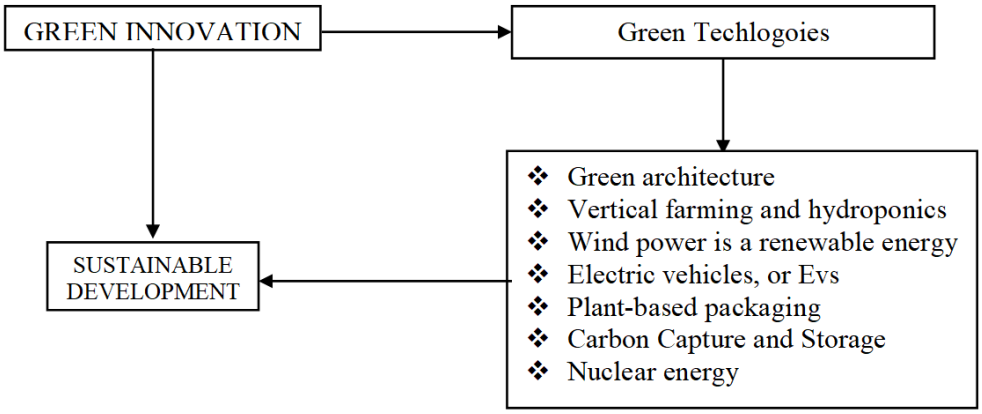

Figure 4. Green Innovation for Sustainable Development

Source: theoretical study and research results, 2023

1. Green architecture, also known as sustainable or eco-friendly architecture, is an approach that focuses on designing buildings with minimal negative impact on the environment. It aims to use resources efficiently, reduce waste, and create energy-efficient, healthy, and comfortable spaces for occupants. By integrating features like proper insulation, energy-efficient lighting, and renewable energy systems, green architecture can significantly reduce energy consumption and carbon emissions associated with buildings.

2. Vertical farming and hydroponics are green technologies revolutionizing agriculture. They enable consistent production of high-quality food in limited spaces and challenging climates. Vertical farming stacks plants in columns or shelves, optimizing space and controlling the climate. Hydroponics uses LED lighting and artificial nutrients to grow plants in water or an inorganic substrate without soil. Combining both methods offers a sustainable solution for urban areas, reducing the need for transportation and supporting local food sources like microgreens for nearby restaurants.

3. Wind power is a renewable energy source that uses the wind to make electricity, and it’s quickly becoming a big part of our clean energy future. As technology improves, wind power is getting more efficient and widespread. It has immense potential as a renewable energy source. With the advancement of wind turbine technology, we can harness the power of the wind to generate clean electricity on a larger scale. Wind farms located in areas with high wind speeds can contribute significantly to the global transition towards a greener energy mix.

4. Electric vehicles, or EVs, are another remarkable green technology innovation. Using electricity as their primary power source instead of gasoline or diesel, EVs produce zero tailpipe emissions, reducing the overall carbon emissions from transportation. With advancements in battery technology, EVs are becoming more accessible and practical for everyday use.

5. Plant-based packaging offers a sustainable alternative to plastic, a significant contributor to plastic waste and microplastics in our oceans. While there have been concerns about using land to grow raw materials for plant-based plastics, new developments focus on using waste rather than specific plants for production.

6. Carbon Capture and Storage (CCS) technology is crucial for reducing carbon dioxide emissions from industrial processes and power plants. It works by capturing CO2 before it is released into the atmosphere, transporting it, and storing it underground to prevent it from contributing to the greenhouse effect and mitigating climate change.

7. Nuclear energy is often considered a controversial topic in discussions about green technologies. While nuclear energy does not produce greenhouse gas emissions during electricity generation, it poses challenges in terms of waste management and potential safety risks. However, with advancements in nuclear technology and proper safety measures, nuclear energy can contribute to a low-carbon energy mix.

The purpose of products to improve environmental stability could be referred to as green product innovation. This study conceptualized green product innovation to influence green product behaviour which has earned a lot of attention among policymakers and researchers. Therefore, it is important to reduce natural resource utilization by implementing both aspects to complement smart technologies

5. Conclusion

As we look ahead to the future, several green technology advancements are expected to shape how we live and interact with the environment. In 2023, we can anticipate further improvements in renewable energy technologies, such as more efficient solar panels and advanced wind turbines. These developments will contribute to greater adoption of clean energy sources and further reduce carbon emissions. In conclusion, the seven Green Technology for application the role of green innovation for suistanable development. Innovations offer promising solutions to address various environmental challenges. From renewable energy sources like solar and wind power to advancements in recycling and sustainable agriculture, these innovations are driving us toward a greener and more sustainable future.

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This original article is a requirement for completing the final dissertation project which must be published and I chose this journal. I am willing to comply with journal regulations and I am responsible for everything made in the manuscript.

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