

Green Innovation Tools and Performance of Selected Pharmaceutical Firms in Ilorin Metropolis: Quantitative Approach

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Abstract

This paper investigated the effect of green innovation tools on performance of selected pharmaceutical firms in Ilorin Metropolis, Nigeria. A descriptive survey research design was used in the study. Target population comprised 284 managerial staff, regular staff and factory workers of the selected pharmaceutical firms Taro Yamane formula was used to determine a sample size. Stratified random sampling and proportionate sampling techniques were used to group the sample to definite categories of managerial staff, regular staff and factory workers and for adequate representation. A validated questionnaire was administered and a total of 257 retrieved for analysis. The data collected were analyzed using PLS-CEM. The findings revealed that green innovation tools had a positive and significant effect on organizational performance. The study recommended that the pharmaceutical firms need invest in research and development to develop new green technologies and products: this could help them to remain competitive in the industry while also contributing to the development of sustainable practices.

Keywords: Green Innovation, Green Product, Green Process, Organization Performance, Pharmaceutical Firms.

Introduction

Environmental issues have received substantial attention all over the world. Some of these issues such as global warming, deforestation, flood, earthquakes, and some other natural disasters have affected the lives of millions of people, and the negative effect of these issues cannot be overemphasized either on international, national, or individual level. Businesses are an important aspect of the environment and contribute towards the development of the quality of life, as well as play a major role in the welfare and being of the environment. However, companies and business activities are engaging in actions and practices that continue to have severe negative effects on the quality of the environment (Chen et al., 2018; Bawa et al., 2022).

Bawa et al. (2022), opines that there is a high concentration or presence of total volatile organic compounds in the production environment of pharmaceutical factories in Nigeria, due to the chemicals and washing areas that are always present in their waste release, and suggests that there is a need for increased air velocity and airflow to dissolve and flush the harmful gaseous presence to keep the total organic compounds concentration within acceptable environmental limits. Also, apart from direct effects of pharmaceutical factories

on the environment, the excessive use of sophisticated equipment and machineries coupled with the high energy consumption necessary to run the activities of pharmaceuticals places much economic burden on the firms, and this inevitably affects profitability (Bawa et al., 2022).

The actions of pharmaceutical firms which include the release of unhealthy pollutants into the atmosphere, deforestation, and other forms of unhealthy practice has raised concerns like overly usage of synthetic chemicals in the production of consumables and drugs. These activities by pharmaceuticals and human food and cosmetic manufacturing firms are capable of affecting the health of the consumers over a prolonged usage has consistently called for attention. The pharmaceutical firms need to adopt cleaner sources of energy and safer sources of production in order to protect the firm in terms of profitability, as well as consider the ecofriendly impact of the human and organization behavior is a constantly growing global concern for people, policy makers, countries, and organizations (Chen et al., 2018).

From the foregoing, there exist a wide literature gap in examining the interrelationship between green innovation tools and performance of pharmaceutical firms Ilorin metropolis, hence the purpose of this study is to fill this gap, an attempt at the effects of green innovation on organizational performance.

Statement of the Problem

Pharmaceutical firms are regulated to manufacture their products in a perfectly hygienic environment which is free from all forms of contaminants (Bawa et al., 2022). To achieve this kind of setting, the firms invest a lot in technology inclined processes and equipment which constitute a large amount of their budgeted capital.

Pharmaceutical firms are faced with challenges of powering their technologies and processes. Most of pharmaceuticals in Nigeria especially, Ilorin Metropolis are not conscious of environmental issues, as they power their machineries and processes using high grade power generators which not only increases their cost of production, but also produce high pollutions into the environment, thus leading to environmental challenges, as well as profitability and business performance constraints.

As a result of the continued campaign of the United Nations for sustainable development goals (SDG) to ensure a green environment and green economy, there has been increasing agitation for pharmaceutical firms to adopt and implement green innovation by adopting greener resources and raw materials in product development, as well as greener production processes in factories and offices (Yam et al., 2019). Pharmaceutical firms are foremost in that their activities affect the environment more directly, and their products are essentials in human health management, thus implementing green innovation product and process is not only a matter of local regulation importance, but a global concern that pharmaceutical firms conform to international policies in green process innovation.

The objective of this study is to investigate the effect of green innovation tools on organizational performance of pharmaceutical firms in Ilorin metropolis. To achieve this, the researcher outlined the following research objectives are to:

- i. determine the relationship between green process innovation and organizational performance.
- ii. examine the impact of green product innovation on organizational performance.

The following research questions are also proposed

- i. What is the relationship between green process innovation and organizational performance?
- ii. Does green product innovation have an impact on organizational performance?

From the foregoing research questions, the following propositions are made;

H₀₁: There is no significant relationship between green process innovation and organizational performance.

H₀₂: There is no significant impact of green product innovation and organizational performance.

Literature Review

Green Innovation

According to Kammerer (2019), green innovation (which could either be green product innovation or green process innovation) refers novel products and processes that are conscious of its effects on the environment. Green product innovation refers to a firm's innovative offerings either in tangible or intangible products, while green process innovation refers to the firm's practices and medium of operations in consideration of environmental issues and cases (Chiou et al., 2021; Kammerer, 2019). Lin and Ho (2021) explicate that green innovation entails the totality of technical improvements or new administrative practices that improve the environmental performance and the competitive advantage of an organization in the face of the customers. Other scholars suggest that green innovation consists of new or modified processes, practices, systems, and products that benefit the environment and contribute to environmental sustainability (Lin & Ho, 2021; Chang, 2021).

Green innovations are categorized into technology, management functions, product design and production process aspects. Green innovations during the product's life cycle assessment include the process of modifying an existing product design in order to reduce the negative impact on the environment (Klassen & Whybark, 2017). Zhu and Sarkis (2018) found that getting a commitment from top or middle level managers has a significant influence on the implementation of successful internal environmental management. Fergusson and Langford presented that firms are more likely to adopt an environmental innovation strategy if their managers place a high value and are concerned for the environment and its protection.

Green Process Innovation

Green process innovation is purposefully focused on the production process. Although it is novel to the focal firm, it can be exploited or applied to reduce environmental risk, pollution emission, and other negative impacts. Studies have identified some forms of green process technology such as clean production, pollution control, pollution prevention, eco-efficiency, and recirculation (Rao, 2022; Klassen & Vachon, 2021). Although performance, including economic performance and environmental performance, is widely used by most prominent literature to measure the business outcome derived from firms' green innovation, an improved eco environment cannot be appropriated by the green innovators completely considering the externality feature of environmental issues.

Green Product Innovation

Green product innovation aims to change or modify product designs by using nontoxic compounds or biodegradable materials during the production process in order to reduce the disposal impact on the environment and to improve energy efficiency (Lin et al., 2018). Green product innovation requires a fresh view of the product lifecycle, from the manufacturing process to distribution, and from use to disposal or reuse/recycling—in other words, a “cradle to grave” approach (Noci & Verganti, 2019).

More specifically, green product innovation includes improvements in the durability or recyclability of products, the reduction of raw materials, the selection of environmentally healthier raw materials, and the removal of hazardous substances (Kivimaa & Kautto, 2019).

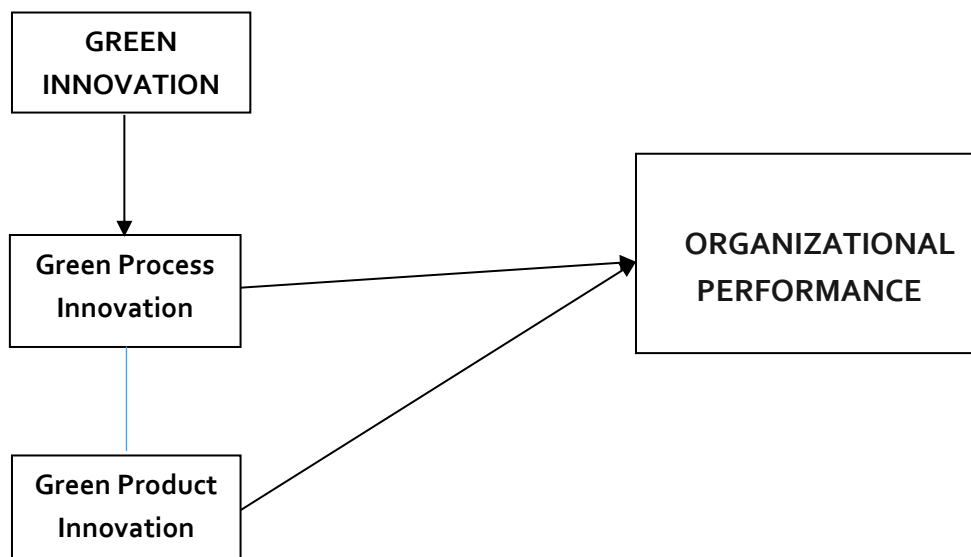
Green product innovation or the introduction of new or improved products, such as improvements in technical components or materials (Pujari, 2016; Cheng et al., 2018), aims to reduce environmental impacts during a product's life cycle (Christensen, 2018), and satisfy market needs by creating new products (Cheng et al., 2017).

Organizational Performance

A firm's performance can be measured both financially and non-financially (Chen, 2018). With respect to financial performance, companies can cover their environmental costs by increasing resource productivity through green innovation (Rusinko, 2017; Hillestad et al., 2020). In addition, companies can develop new markets and increase their market share through implementing environmental practices (Chen, 2018). As a long-term operational objective, improved non-financial performance may be manifested by increased customer loyalty, new customers, and an enhanced image and reputation of a firm (Hillestad et al., 2020). Chen (2018) proposed that companies who are pioneers in green innovation will gain the “first-mover advantage,” i.e., higher product prices, an improved corporate image, new market opportunities, and competitive advantages. Organizational performance can also be measured by the success rate of the firm's product in the marketplace. Green innovation has continually accounted for the development of highly effective products especially in the

field of medicine, cosmetology, and environmental production. A popular marketing response in this changing market landscape has been to modify existing or introduce new product and production practices to reduce ecological impact and enhance environmental performance (Cronin et al. 2021). Although accounting for product effectiveness and development effects on the natural environment adds complexity to firm processes, such practices are visible, can easily be communicated to stakeholders, and contribute to the firm's environmental image (Dangelico & Pujari, 2020). Given that the introduction of eco-friendly products enables firms to meet environmental imperatives, build competitive advantage, and propel future growth (Nidumolu et al. 2009), sustainable product development activities are expected to receive a growing importance in the near future as environmental challenges heightens (Varadarajan, 2018).

Green Innovation



Source: Author's Conceptualization, 2023

Figure 1 presents a summary diagram of the proposed causal model for the prediction of organizational performance. The basis of the conceptual framework is presented and the hypotheses regarding the relationships between variables are specified.

Theoretical Review

In explaining the concept of green innovation and organizational performance of pharmaceutical firms, there were some theoretical reviews developed from previous work. This section takes a look at some of these frameworks as they relate to this study.

Stakeholder Theory

In 1984, Freeman was the first to bring the stakeholder concept into a strategic discipline, which not only distinguished stakeholders from the shareholders in corporations but also showed the impacts of various stakeholders on companies' decision-making processes

(Donaldson & Preston, 2019; Mitchell et al., 2019). Based in four key academic areas—strategic planning, systems theory, corporate social responsibility, and organizational theory—the stakeholder theory has a different view of a company and therefore provides a different explanation of an organization's structure and daily operations (Mainardes et al., 2021). The domain of the theory, based on four essential premises Jones and Wicks (2019), indicates first that companies have relationships with several stakeholder groups, all of which affect or are affected by the companies' decisions. Second, these relationships are established in the processes and outcomes for the company and its stakeholders. Third, stakeholders' interests have intrinsic value, and each stakeholder's interests cannot be allowed to overshadow the interests of other stakeholders (Mitchell et al., 2019). Fourth, decision making of the company is the focal point (Mitchell et al., 2019). The stakeholder theory has been adopted for several environmental studies such that stakeholders have been instrumental in influencing both corporate ecological responsiveness (Mainardes et al., 2021) and environmental strategies (Friedman & Miles, 2018). However, the results have been mixed, and the influence of stakeholders on environmental management has been inconsistent.

Institutional Theory

The institutional theory examines how external pressures influence firm strategies. By addressing the institutional requirements, firms can better adapt to the external environment. 'Institution' refers to the regulatory complex that consists of political and social agencies which dominate other firms through the enforcement of laws, rules, and norms (Krajnovic, 2019). Institutional pressures on the environmental management of a firm increase the constraints of business operations. Firms inevitably have to allocate resources for green initiatives and measures to improve their environmental performance, as well as to address institutional pressures. Failure to conform to institutional pressures can threaten their legitimacy, resources, and survival (DiMaggio & Powell, 2014; Scott, 2017). The institutional theory is relevant to green innovation adoption since the adoption of green innovation is reflective of the mandates of the institutional environment in which they operate, in order to pursue legitimacy. Legitimacy is "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, 2019).

Theory Adopted for the Study

Based on theoretical review, the study anchored on the resource based view because the research is conducted with the aim of evaluating how green innovation adoption can affect the performance of an organization, and which outcome is determined by how well a firm manages and utilized resources. This study considers green innovation as a strategy for harnessing available and potential resources of the organization in ways that are environmentally conscious, and thus the maximization of the mentioned resources.

Empirical Review

Adeyemi et al., (2020) examined the “level of green innovation adoption in chemical manufacturing firms in Ogun state, Nigeria”. They discussed that the quest to balance between an environmental sustainability and firm economic indices has generated a growing concern in the chemical industry. According to them, this is the basis for the emergent of green innovations to eliminate such notion. Nevertheless, studies have posited that regulation push from the government formed the main reason for this drive. Thus, if these pushes are substantial in the developing countries such as in Nigeria that remains scarcely documented, the resultant effect should be noticeable in their level of adoption. The focus of the article was to contribute to the debate by examining the status of green innovations in chemical firms in Ogun state, Nigeria. The study was descriptively setup, with a quantitative data collection component in the form of a survey retrieving 223 questionnaires from staff of chemical companies as listed in the directory of Ministry of Commerce and Industry, Abeokuta, Ogun state. The results showed that to 'educate, train, and motivate employees in good housekeeping methods, operation, environmental training programs and maintenance of recovery technologies' was the utmost indicator towards the adoption of green innovation in the chemical firms. Furthermore, the industry is more committed to green managerial innovation, followed by the product and lastly was the process green innovation. The study concludes as well as offers implications as inferred from the obtained results.

Sanni (2017) carried out research to determine the “Drivers of eco-innovation in the manufacturing sector of Nigeria”. This research study explored the dynamics of the determinants of eco-innovation in the manufacturing sector of Nigeria. According to his research, virtually all the major manufacturing firms in Nigeria generate electricity through diesel-powered plants with implications for cost of production and greenhouse gas emissions. Meanwhile, eco-innovative manufacturing firms have the potentials to decouple economic growth from excessive resource use and environmental pressure. The paper investigated the determinants of eco-innovation in the manufacturing sector of Nigeria based on empirical data from the Nigerian innovation survey. The econometric estimations find strong support for innovative organizational strategies, the need to meet regulatory standards and access to formal sources of knowledge as drivers of eco-innovation. While eco-innovative manufacturing firms are usually more technical and highly innovative, determinants of both products and process eco-innovations are heterogeneous. The paper highlights policy recommendations for enhancing firm's green competitive advantage in a latecomer economy.

Chukwa et al., (2018) published a research paper on the Effects of green business practices on organizational performance of selected manufacturing firms in Nigeria. This study presents an empirical investigation of the green business practices on organizational performance of selected manufacturing firms in Nigeria. This study was also motivated by the urgent need to solve the environmental problems caused by the activities of profits driven entrepreneurs in developing economy as well as exploring the benefits to

organizations. The study was guided by one key objective, from which appropriate research question and hypothesis were formulated. The specific objective of this study was to determine the extent to which green business practices affects the productivity of manufacturing firms in Nigeria. Their research concluded that the implementation of green business practices, principles and processes will lead to very positive outcome that will be visibly manifested in the organization and the environment.

Mohsin Shahzad, Ying Qu, and Abaid Ullah Zafar (2022) published a research paper on the "adoption of green innovation technology to accelerate sustainable development among manufacturing industry". They discovered that recent advancements in green and innovative technologies have resulted in a number of innovations in manufacturing operations to accelerate sustainable development (SD). According to them, despite several benefits of green innovation adoption (GIA), the adoption rate of these initiatives is still abysmal in manufacturing organizations. To fill this gap, they developed and validated the GIA model grounded on the unified theory of acceptance and use of technology (UTAUT), which compels organizations to implement these novel technologies. For the purpose of their research work, they collected data through a survey of 516 respondents from Pakistani manufacturing industries and analyzed using structural equation modeling (SEM) and the artificial neural network (ANN) approach.

Research Methodology

The research design used for this study was descriptive survey design. The essence was an attempt to investigate the green innovation tools and organizational performance of pharmaceutical firms in Kwara State and also find the relationship between green innovation and organizational performance of pharmaceutical firms in Kwara State. The population for this study includes managerial staff, regular staff and factory workers of the pharmaceutical firms in Ilorin Metropolis. The descriptive survey was utilized in this study. The sample consisted of 284 participants. A structured questionnaire consisting of sections A, B, and C developed by the researchers was used to collect information from the participants. Five point rating scale was used to measure the responses. The scale ranged from 5 (strongly agree) to 1 (strongly disagree).

Data Analysis and Research Findings

Table 1.1: Response rate of the Questionnaire

Responses	Frequency	Percentage (%)
Distributed Questionnaire	284	100
Received Questionnaire	258	90.8
Rejected Questionnaire	11	3.9
Retained Questionnaire	247	87.0

After respondents' identification, an aggregate of 284 were distributed to managerial, regular and factory workers of pharmaceutical firms in Ilorin metropolis. Some of the respondents answer the questionnaire instantly, others after some few weeks, while some took some months before their responses retrieved. As a result, 258 questionnaires were returned which represent 90.8% response rate. However, out of these 258 questionnaires that were returned, a total of 247 were found usable for data analysis. The remaining 11 were excluded due to large numbers of outliers in the questionnaire. This accounted for 90.8% valid response rate which is higher than 30% suggested by Sekaran (2019).

Test of Hypotheses

H₀₁: There is no significant relationship between green process innovation and organizational performance.

H₀₂: There is no significant impact of green product innovation and organizational performance.

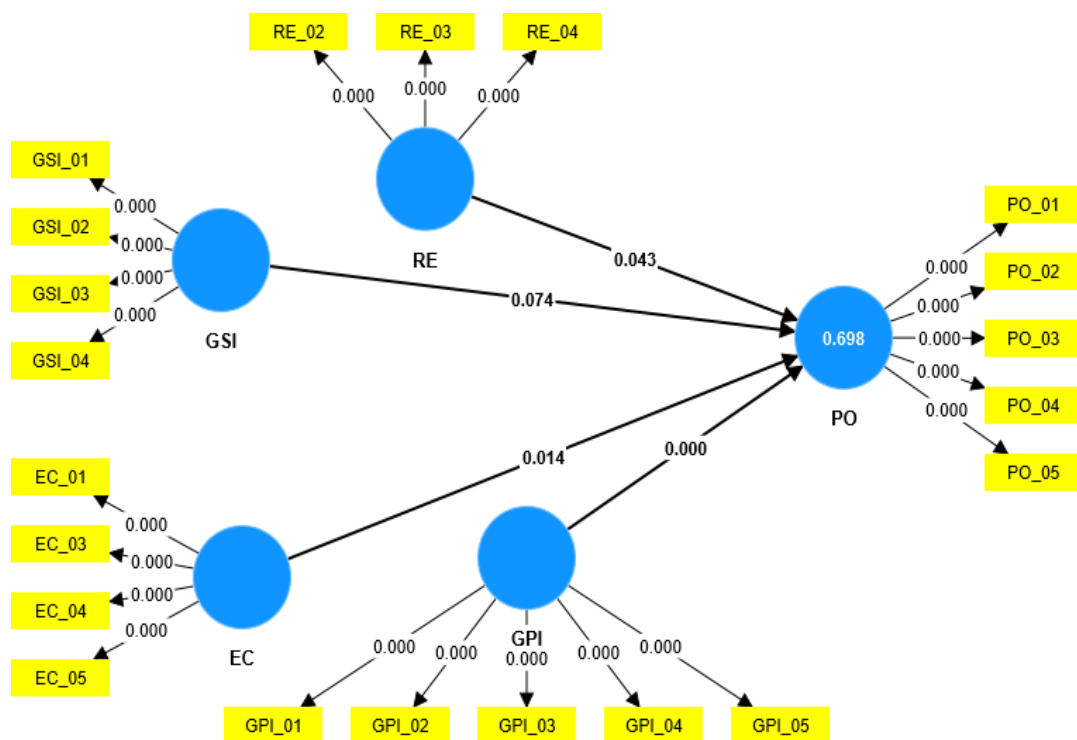


Figure 2: PLS measurement model

Source: Author's Computation, 2023

The figure 2 shows three types of values. The values directed to the long arrow lines denote the path coefficients; values directed to the yellow box represent the item loadings and the value inside the circle represent the average variance extracted (AVE).

Table 1.2: Direct Path Coefficients

HYPOTHESES	Paths	Beta	STDEV	T Statistics	P Values	Remark
H1	GPI -> PO	0.656	0.058	11.280	0.000	Accepted
H2	GSI -> PO	-0.182	0.102	1.788	0.074	Accepted

Source: Author's Computation, 2023

Table 1.2 shows the results of the hypothesis testing for the direct relationship as proposed in this study. The discussion for the results on this table is as follows:

Hypothesis 1: Green product innovation positively influences the performance of Peace and Tuyil pharmaceutical company is represented by path linking GPI to PO on table 1.3. The path estimates for this relationship reveals beta ($\beta = 0.656$), t statistics ($t = 11.280$) and p value ($p = 0.000$). The hypothesized relationship between GPI and PO is accepted based on these values, indicating a positive and significant relationship at 5% level of significance.

Hypothesis 2: Green process innovation positively influences the performance of Peace and Tuyil pharmaceutical company is represented by path linking GSI to PO with path estimates of beta ($\beta = -0.182$), t statistics ($t = 1.788$) and p value ($p = 0.074$) as shown in table 1.3. The result signifies a positive and significant relationship between GSI and PO at 1% significance level, thus the proposed hypothesis H2 is accepted. This result indicates that green process innovation significantly influences the performance of Peace and Tuyil pharmaceutical company.

Coefficient of Determination (R-squared)

Coefficient of determination R-squared (R^2) is part of structural model assessment that represent the amount of variance in dependent variable that is jointly accounted for by the independent variables (Hair et al., 2012). This measure explains the variance in dependent variable in percentage that is jointly caused by the independent latent variables, that is, the combine effects of independent latent variables on dependent variable. Among the justifications for using PLS-SEM is its usefulness to maximize the R^2 of a model to account for prediction of endogenous latent variable (Hair et al., 2016; Lei & Chu, 2015).

However, R^2 value ranges from 0 to 1. The greater the value of R^2 , the higher the percentage of the variance in the dependent variable explained by the combination of independent variables. According to Chin (1998), R^2 values of 0.19, 0.33 and 0.67 are regarded weak, moderate and substantial respectively. Thus, from the model of this study, R^2 value of 0.698 (69.8%) was found and indicating that the independent variables (GSI, GPI) treated initially as exogenous variable in the model jointly accounted for 69.8% of variance in the dependent variable (OP). This revealed that a substantial variance explained was obtained (Chin, 1998).

Conclusion

This research work discusses the concept of Green innovation and organizational performance using selected pharmaceutical firms as the case study. It evaluates the impact of green innovation on the performance of pharmaceutical firms and the environment as a whole.

Environmental issues are becoming an important discourse all over the world due to their effect on climate change, global warming, and human existence. Research is being conducted to know the causes of this pollution and come up with solutions on how best to manage it; through findings, it is observed that there is a high concentration of total volatile organic compounds in the production environment of pharmaceutical factories in Nigeria, due to the chemicals that are always present in their waste release, and so it is suggested that there should be an increased air velocity and airflow to dissolve and flush away the harmful gaseous presence, and to also keep the total organic compounds concentration within acceptable environmental limits.

To help combat these environmental issues, the green innovation was presented as a solution. Green process innovation helps to solve environmental problems in the manufacturing process, and it can also increase resource productivity as well as energy usage efficiency and decrease pollution during production.

Recommendations

1. Pharmaceutical firms can organize training programs and workshops to educate their employees on the benefits and potential of green innovation. This will help to improve employee's knowledge and understanding concerning the concept of "Green Innovation", increasing their awareness, and motivate them to adopt sustainable practices.
2. Pharmaceutical firms can invest in research and development to develop new green technologies and products: this helps them to remain competitive in the industry while also contributing to the development of sustainable practices.
3. In implementing green innovation practices, pharmaceutical firms can partner with other organizations and stakeholders, such as universities, research institutes, and government oagencies, to leverage their expertise and resources in developing and implementing green innovation initiatives.

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