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# The effect of green finance on environmental performance: Mediating role of green innovation

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**ABSTRACT**

**Purpose-** The purpose of this study is to assess the impact of green finance on environmental performance, using green innovation as a mediating variable. Environmental performance is an important indicator in assessing how companies can reduce negative impacts on the environment through environmentally friendly policies, practices, and innovations. Green finance is a factor that can encourage an improvement in environmental performance by implementing more sustainable business practices.

**Methodology-**This study's population was private bank employees, with a sample size of 100. It employed a quantitative methodology, utilizing partial least squares structural equation modeling with Smart PLS to investigate the relationships among variables.

**Findings-**The findings showed a positive relationship between environmental performance and green finance. It was shown, though, that green finance does not positively influence green innovation; conversely, green innovation does have a positive effect on environmental performance. It was also shown that green innovation does not serve as a mediator between green finance and environmental performance.

**Research Limitations-**This study's limitation is that the number of respondents is still relatively small, so it does not represent all private banking employees in Jawa Tengah, Indonesia. Thus, further studies can involve more respondents or focus on a specific region in Indonesia.

**Novelty-**It is expected that this research will serve as a reference for banking institutions in the development of policies aimed at sustainable performance. It is anticipated that companies will highlight the significance of green finance in encouraging a more environmentally responsible business context.



## 1. Introduction

As the significance of sustainable business practices becomes more widely acknowledged, the age of globalization is being felt ever more acutely. Various corporate sectors, including the banking sector, are facing pressure to pay attention to the impact of their operational activities (Guo & Liang, 2016). As such, researchers worldwide have become aware of the consequences

of corporate operations that generate pollution and harmful environmental effects on the environment.

As financial institutions that play a role in the economy, banks are expected to implement green finance practices (Sule et al., 2024). Banks are strategically positioned to foster sustainable economic development, which encompasses the adoption of green finance (Fu et al., 2023). Green finance is crucial for steering companies toward more sustainable practices. According to Han (2024), the adoption of green finance serves not only to bolster corporate reputation but also to aid in enhancing environmental performance. A company's environmental performance is a significant measure of its accountability for the effects it has on the environment. Green finance can enhance a company's reputation and is crucial for mitigating adverse environmental effects by promoting more sustainable business practices.

Green finance has a significant effect on the rise of green innovation (Dong et al., 2022; Irfan et al., 2022). As a result, green innovation encompasses technical banking innovations such as green banking, Internet banking, remote deposits, and paper reduction initiatives, all designed to improve environmental performance. Green finance is instrumental in promoting the development of green innovation by facilitating funding for innovations in green products. Green finance aids companies in funding the creation of green products that utilize environmentally friendly resources more efficiently, thereby boosting green innovation. An established green financial system fosters green innovation (Xing et al., 2020). A vital aspect that sets green finance apart from conventional finance is that it is not conventional. Green finance takes potential environmental effects into account when making decisions about investments and financing. As a result, green innovations trying to secure funding from the conventional financial system can gain backing from the green financial system, thus increasing the probability of businesses participating in green innovation endeavors (X. Wang & Wang, 2021). Green finance includes financial services that provide funding for projects aimed at safeguarding the environment.

According to Albort-Morant et al. (2016), green innovation motivates companies to adopt practices that enhance the efficiency of energy resources and utilize environmentally friendly technology. Green innovation and environmental performance are connected, encompassing the environmental results of a company's operations (Dubey et al., 2015). The types of raw materials, energy sources, and technologies employed in a company's operational and administrative activities determine its environmental performance (Y. Chen et al., 2015). Therefore, a mechanism that supports corporate goals and maintains environmental performance is required. Green innovation is the foundation of a company and is related to its environmental plan. In addition, green innovation helps accelerate a company's environmental performance and achieve its goals efficiently. Green innovation products, processes, and activities that are environmentally friendly help to reduce environmental impact and enhance corporate performance (Weng et al., 2015). According to El-Kassar and Singh (2019), green innovation serves as a strategic resource that enhances a company's environmental performance and generates competitiveness for reaching its environmental objectives.

The sustainable finance roadmap released by the financial services authority in Indonesia aims to motivate financial institutions to increase their involvement in funding sustainable finance initiatives, thereby exacerbating challenges associated with green finance. Nevertheless, the execution of green finance within the banking sector, particularly in private banks has not reached its full potential (Akomea-Frimpong et al., 2022). Green finance has yet to be fully integrated into banking companies' strategies for enhancing environmental performance. Current measures remain at the basic operational level, such as cutting back on paper use and launching energy-saving initiatives in offices.

While numerous studies have examined the connection between green finance and environmental performance, the majority have concentrated on large companies and the manufacturing sector (Bakry et al., 2023; Ha et al., 2024). In contrast, green finance provides important support for driving green innovation. Investments in green projects not only improve environmental performance but also offer firms significant economic benefits. This confirms that allocating financial resources to sustainable projects accelerates the adoption of better technologies and practices. With proper financial support, companies can implement the

innovations needed to achieve their sustainability goals. This study aims to fill this gap by analyzing the effect of green finance on environmental performance through green innovation as a mediating variable. This study aims to contribute to the development of sustainability theory and encourage environmentally friendly banking practices in the banking sector.

## 2. Literature Review and Hypothesis Development

As indicated by Indriastuti and Chariri (2021), green finance can enhance corporate sustainability through the funding of eco-friendly initiatives and can lead to a substantial enhancement of environmental performance. Recent studies have demonstrated that green finance has a significant positive impact on corporate environmental performance. It can thus be concluded that an organization's environmental performance and corporate accountability can be enhanced by investing in diverse green projects. Green finance is acknowledged as a key element of sustainable funding within the banking sector, thereby aiding organizational sustainability (Zheng et al., 2021). Environmental issues cannot be overlooked by the banking industry; it must assume environmental responsibility to achieve economic objectives, improve its image, and function more effectively (Gallego-Álvarez & Pucheta-Martínez, 2020). Measures taken by the financial sector to protect the environment can provide a competitive edge (Carnevale & Mazzuca, 2014). Kala (2020) recognized a range of green innovations implemented by the banking sector to enhance their environmental performance. Recent studies have demonstrated that green finance enhances environmental performance within the banking sector (Zheng et al., 2021). This indicates that green finance is crucial for enhancing banks' environmental performance, as it tackles matters that contribute to sustainable economic growth and competitive edge. **$H_1$: Green Finance has A Positive Effect on Environmental Performance.**

Green finance has a significant impact on the increase of green innovation (Dong et al., 2022; Irfan et al., 2022). Green innovation can be defined as technical banking innovations that include green banking, internet banking, remote deposits, and paper reduction, all aimed at enhancing environmental performance. By enabling financing for green product innovation, green finance plays a vital role in the expansion of green innovation. Green finance assists companies in funding the creation of green products that utilize eco-friendly resources more efficiently, thus fostering innovation. The established green financial system fosters green innovation (Xing et al., 2020). Greening is a crucial characteristic that sets green finance apart from traditional finance. Investment and financing decisions in green finance take into account potential environmental impacts. As a result, green innovations that are challenging to fund through traditional financing can obtain financial backing from the green financial system, thereby enhancing the likelihood of businesses engaging in green innovation activities (X. Wang & Wang, 2021). Green finance refers to financial services that support projects aimed at protecting the environment. **$H_2$: Green Finance has A Positive Effect on Green Innovation.**

Green innovation enhances environmental performance through the improvement of stakeholder relationships, which has a positive effect on environmental outcomes (Weng et al., 2015). Green innovation encompasses technological advancements across all operational facets that enable a company to excel while enhancing its environmental performance. According to Aftab et al. (2023), green innovation serves as a means to change systems, products, and processes for enhanced and sustainable environmental performance. According to Tang et al. (2018), green innovation includes process innovation as well as green products. According to Albort-Morant et al. (2017), businesses that adopt green innovation outperform their competitors in terms of overall performance. According to Albort-Morant et al. (2018), green innovation raises intangible value, and companies that effectively adopt eco-friendly practices and resource use gain a competitive edge over their rivals. **$H_3$: Green Innovation has A Positive Effect on Environmental Performance.**

Green finance promotes the advancement of green innovations by supplying companies with the necessary funds (Agrawal et al., 2024). Firms that depend on green finance can more

readily invest in innovations that promote sustainability, such as renewable energy and eco-friendly production methods (Falcone & Sica, 2019). Green finance acts as a financing mechanism that allows companies to take advantage of and put into action innovations. Companies can devise and put into practice green innovations that enhance their environmental performance with the help of green finance. The fierce competition of today impacts a company's success and sustainability, with customer perceptions significantly influencing its image. Consequently, resources, production methods, and efficiency play a vital role in tackling environmental problems, compelling companies to adopt green innovations. Nonetheless, corporate assets by themselves do not suffice for the implementation of green innovation (Pacheco & Newell, 2018). According to Zhu et al. (2017), the long-term environmental performance is significantly affected by green innovation. According to findings from earlier investigations conducted by Seman et al. (2019) and Asadi et al. (2021), a mediation effect exists in the connection between green finance and environmental performance due to green innovation. **$H_4$: Green Finance positively affects Environmental Performance through Green Innovation.**

Figure 1 illustrates the framework of the research model and the factors influencing environmental performance. These factors include green finance, which positively affects environmental performance, and green innovation, which is a mediating variable in this study.

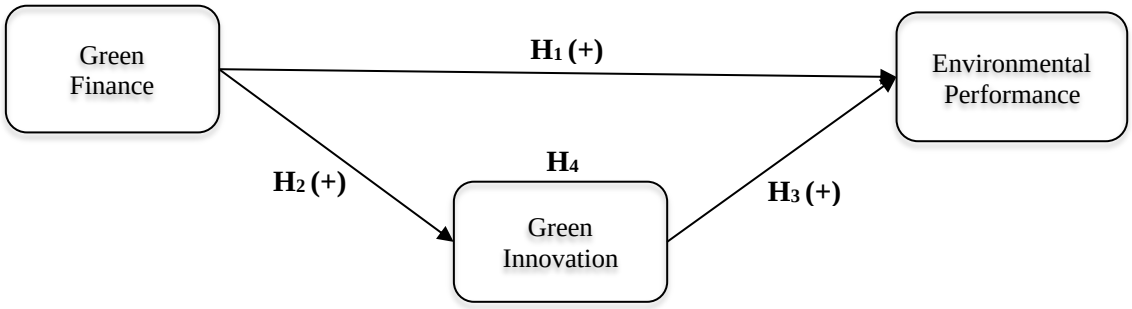


**Figure 1. Research Model**

## 3. Research Methodology

The population in this study was the employees of a Private Bank in Jawa Tengah, Indonesia, with a sample size of 100 people. The selection of samples through purposive sampling included establishing multiple criteria for the respondents. The criteria comprised a minimum age range of 20 to 40 years, knowledge and work experience of at least 1 year, and participation in training programs or seminars on financial management. To gather data, the questionnaires were distributed online via Google Forms. Each variable was indicated by items rated on a Likert scale. To assess green finance (GF), two indicator items were utilized, adapted from Liu et al. (2022), environmental performance (EP), consisting of six indicator items and adapted from Wang et al. (2022), and green innovation (GI), which consists of five indicator items adapted from Khan et al. (2021).

The research data were evaluated for validity, reliability, and regression tests using Smart PLS software. To carry out a validity test, the loading factor value for every indicator item of each variable was analyzed. According to Hair et al. (2020), an indicator item can be considered valid if the loading factor value exceeds 0.6, and the opposite is also true. A validation test should be conducted if there are invalid indicator items, which will then be excluded from the data analysis. Subsequent to the validity test, a reliability test was carried out. The assessment of variable reliability was conducted using Cronbach's alpha alongside composite reliability values. If Cronbach's alpha exceeds 0.6 and composite reliability surpasses 0.7, the research variable can be deemed reliable (Hair et al., 2020). Hypothesis testing was conducted to determine whether the hypotheses that had been formulated were accepted or rejected. The p-value of each hypothesis was the basis for the regression testing. The hypothesis can be accepted if the p-value is less than 0.05 (Hair et al., 2020).

## 4. Results and Discussion

### Characteristics of Respondents

The characteristics of the respondents are shown in Table 1. Overall, 53 responses, or the majority, were men. 52 responders, or the majority, were between the ages of 20 and 35. The features of the respondents can be observed based on their work experience and educational attainment in addition to their gender and age categories. Seventy respondents had a diploma as their greatest level of education, and forty respondents had two to five years of job experience.

**Table 1. Characteristics of Respondents**

| Classification | Description | Frequency |
|---|---|---|
| Gender | Male | 53 |
| | Female | 47 |
| Age | 20 – 25 years old | 52 |
| | 26 – 30 years old | 22 |
| | 31 – 40 years old | 18 |
| | > 40 years old | 8 |
| Education Level | Senior/Vocational High School | 18 |
| | Diploma | 70 |
| | Bachelor | 11 |
| | Postgraduate | 1 |
| Work Experience | < 2 years | 30 |
| | 2 – 5 years | 40 |
| | 6 – 10 years | 20 |
| | > 10 years | 10 |

### Validity Test

The loading factor values for each indicator item that reflects each research variable in the validity test are tabulated in Table 2. Due to their loading factor value of 0.6, all of the study variables' indicator items were found to be valid.

**Table 2. Validity Test Result**

| Indicator | Green Finance | Green Innovation | Environmental Performance |
|---|---|---|---|
| GF 1 | 0.929 | | |
| GF 2 | 0.917 | | |
| GI 1 | | 0.905 | |
| GI 2 | | 0.935 | |
| GI 3 | | 0.947 | |
| GI 4 | | 0.868 | |
| GI 5 | | 0.731 | |
| EP 1 | | | 0.807 |
| EP 2 | | | 0.820 |
| EP 3 | | | 0.831 |
| EP 4 | | | 0.864 |
| EP 5 | | | 0.872 |
| EP 6 | | | 0.721 |

### Reliability Test

All of the research variables are dependable, according to the reliability test findings displayed in Table 3. The green finance, green innovation, and environmental performance variables' Cronbach's alpha and composite reliability scores are more than 0.6 and 0.7.

**Table 3. Reliability Test Result**

| Variable | Cronbach's Alpha | Composite Reliability |
|---|---|---|
| Green Finance | 0.827 | 0.920 |
| Green Innovation | 0.926 | 0.945 |
| Environmental Performance | 0.902 | 0.925 |

## Hypothesis Test

The outcomes of the hypothesis test are shown in Table 4. Two of the four research hypotheses that were created have been shown to be accepted or supported by these findings. Environmental performance has been demonstrated to be positively impacted by green finance and innovation. Green innovation does not, however, mediate the relationship between green finance and environmental performance, nor has it been demonstrated that green finance has a positive impact on green innovation.

**Table 4. Hypothesis Test Result**

| | Original Sample | Sample Mean | Standard Deviation | T Statistics | P Value |
|---|---|---|---|---|---|
| Green Finance → Environmental Performance | 0.503 | 0.494 | 0.111 | 4.548 | 0.000 |
| Green Finance → Green Innovation | -0.027 | -0.023 | 0.101 | 0.266 | 0.790 |
| Green Innovation → Environmental Performance | 0.371 | 0.358 | 0.127 | 2.942 | 0.003 |
| Green Finance → Green Innovation → Environmental Performance | -0.010 | -0.010 | 0.039 | 0.253 | 0.801 |

## Discussion

### The Effect of Green Finance on Environmental Performance

This study proves that green finance has a positive effect on environmental performance. Therefore, it can be concluded that the first hypothesis in this study is accepted. Green finance plays an important role in helping companies implement sustainable performance practices and reduce the impact of environmental risks from their activities. This implies that when companies implement green finance, and encourage sustainable practices to reduce environmental impact. Green finance techniques have a negative impact on social and environmental responsibilities (Sinha et al., 2021). According to Abbas et al. (2019), green financing is a way for businesses to answer to stakeholders while promoting social and environmental success. By funding eco-friendly projects and enhancing environmental performance, green finance can increase company sustainability (Indriastuti & Chariri, 2021; Chen et al., 2022). Green financing dramatically enhances environmental performance (Chen et al., 2022; Zhang et al., 2022). Consequently, an organization's environmental performance can be enhanced by funding a variety of green initiatives.

### The Effect of Green Finance on Green Innovation

The hypothesis in this study is rejected since it demonstrates that green finance has a detrimental impact on green innovation. This study builds on the findings of Li et al. (2023), who discovered that the use of green funding did not result in the expected level of green innovation. Market uncertainty and financial risks can inhibit innovation investment. Green finance is crucial for promoting green innovation as it facilitates funding innovations in green products. Green finance supports businesses in financing the development of green products that use eco-friendly resources, thereby enhancing green innovation. An established green financial system promotes green innovation (Xing et al., 2020). A crucial element that distinguishes green finance from conventional finance is its focus on sustainability. Green finance factors consider potential environmental effects when making decisions about investments and financing. Therefore, the green financial system can promote green innovations that compete for funding from the conventional banking system, improving the probability that enterprises will engage in green innovation activities (Wang & Wang, 2021).

**The Effect of Green Innovation on Environmental Performance**

This study proves that green innovation has a positive effect on environmental performance. Therefore, it can be concluded that the hypothesis in this study is accepted. The results of this study are consistent with those of research conducted by Seman et al. (2019) and Asadi et al. (2021). A company's environmental performance is impacted by green management and the use of green finance strategies to enhance corporate performance (Dubey et al., 2015; Ardiza et al., 2021). Green operating procedures also lessen their impact on the environment and may improve business performance by using resources more efficiently (Weng et al., 2015). Accordingly, green innovation is viewed as a procedure that seeks to enhance environmental performance rather than merely a business's reaction to client concerns (Kuo et al., 2022). Corporate assets that can be utilized to enhance environmental performance and build trust include the creation of new green products and green processes (Dubey et al., 2015). Product development is a subset of green innovation and is anticipated to have a direct impact on an organization's environmental performance. Green innovation is important for sustainable development strategies, including minimizing pollution and improving resource efficiency (Lin & Ullah, 2023). This means that when companies implement green innovation, it affects environmental performance because it encourages environmentally friendly behavior.

**The Effect of Green Finance on Environmental Performance through Green Innovation**

The fourth hypothesis is disproved since this study demonstrates that green innovation does not mediate the relationship between green finance and environmental performance. The findings of this study run counter to those of earlier research by Dai et al. (2022) and Guang-Wen and Siddik (2023), which discovered that green innovation mediates the effects of green finance on environmental performance. Green financial policies often inhibit green innovation, and have no impact on the environmental performance of companies. According to Umar and Safi (2023), green finance negatively impacts environmental performance. Although green finance policies aim to encourage environmentally friendly business practices, their implementation indirectly hinders environmental, social, and corporate governance performance. To guarantee that these regulations successfully spur innovation without impeding businesses' capacity to develop and adapt to ecologically friendly activities, changes must be made to the conception and application of green finance. Strict financial access limitations may be the cause of this, and limit businesses' capacity to invest in green innovation (Liu et al., 2024). Green innovation and environmental performance are often inadvertently hampered by the use of green finance. Businesses must create green financing policies that take into account the requirements and difficulties may encounter in order to enhance environmental performance through green innovation.

## 5. Conclusion

Environmental performance is positively impacted by green finance, but green innovation is not. Environmental performance is positively impacted by green innovation, but the relationship between green financing and environmental performance is not mediated by it. This study has some limitations, including the limited research area, which was only carried out in one region; therefore, the results are not necessarily the same as in other regions, because conditions and consumer opinions in each region may differ. The number of respondents is still relatively limited; therefore, the results cannot represent the respondents' answers in various regions. The research variables are limited to only two factors (green finance and green innovation) to predict environmental performance, although many other variables can be analyzed for their influence on environmental performance.

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