Government support, eco-regulation and eco-innovation adoption in SMEs: The mediating role of eco-environmental

Gusti Noorlitaria Achmad [a],[*], Rizky Yudaruddin [a], Bramantyo Adi Nugroho [b], Zhikry Fitrian [b], Suharsono Suharsono [b], Ari Sasmoko Adi [b], Pebiansyah Hafsari [b], Fitriansyah Fitriansyah [c]

[a] *Mulawarman University Faculty of Economy and Business, Indonesia*
[b] *Research and Innovation Agency, East Kalimantan, Indonesia*
[c] *Muhammadiyah University of East Kalimantan, Indonesia*

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ABSTRACT

Small and medium-sized enterprises (SMEs) play a vital role in economic development and sustainability. In Indonesia, SMEs account for a significant portion of the economy but face challenges in adapting to eco-innovation practices. To address this issue, this study examines the role of eco-regulation and government support in promoting eco-innovation adaptation among SMEs in Indonesia. We also explore the moderating effect of eco-environmental factors, including eco-customers, eco-managerial, eco-competition, and eco-process innovation. We collect data from 859 SMEs in Indonesia and use the Structural Equal Modeling-Partial Least Square (SEM-PLS) method to analyze the data. We measure eco-regulation and government support as independent variables and eco-environmental factors as moderating variables. We use eco-innovation adaptation as the dependent variable. Our results show that eco-regulation and government support have a positive effect on eco-environmental factors, except for eco-customers. We also find that eco-environmental factors have a positive impact on eco-innovation adaptation. Furthermore, we find that eco-regulation and government support indirectly influence eco-innovation adaptation through the mediation of eco-environmental factors. In conclusion, our study highlights the importance of eco-regulation and government support in promoting eco-innovation adaptation among SMEs in Indonesia. We find that eco-environmental factors mediate the relationship between eco-regulation and government support and eco-innovation adaptation. Our study provides valuable insights for policymakers and practitioners seeking to enhance SMEs' eco-innovation practices and promote sustainable development.

1. Introduction

Over the years, the relationship between economic activity and the environment has become increasingly intertwined. Economic policies have been implemented to increase productivity, but these policies have negatively impacted the environment, particularly in the excessive use of natural resources. Meanwhile, environmental policies are necessary to maintain environmental sustainability, given the increasing issues related to the environment, such as the reduction of biodiversity, climate change, and depletion of natural resources (Dogaru, 2020).

Numerous studies have suggested that eco-innovation can provide a solution to global environmental problems (Afshari et al., 2020; Bitencourt et al., 2019; Zubeltzu-Jaka et al., 2018; Han and Chen, 2021; García-Granero et al., 2020; Arranz et al., 2021; Al-Hanakta et al., 2021). According to García-Granero et al. (2020) and Arranz et al. (2021), companies need to focus on the negative impacts of environmental pollution by adopting environmentally friendly innovations. Similarly, Bitencourt et al. (2020) stated that companies that prioritize the environment will positively impact long-term economic growth. Recently, companies have begun to pay more attention to environmental issues such as pollution, global warming, and climate change (Muhammad et al., 2020).

Several studies have identified factors that influence eco-innovation adaptation, such as regulation (Han and Chen, 2021; Wasiq et al., 2023), government support (Wang et al., 2020), managerial pressure (Wang et al., 2020; Long et al., 2019), market pressure (Chen and Liu, 2019; Wasiq et al., 2023), and technological factors (Wasiq et al., 2023; Andersson et al., 2020; Kousar et al., 2017). Yurdakul and Kazan (2020)

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and Geng et al. (2021) found that companies that adopt eco-innovation will improve their performance. However, previous studies have not explored the role of eco-environmental mediation in the influence of government regulations and support for eco-innovation adaptation. According to Han and Chen (2021), government regulations force companies to follow rules, thereby changing their business systems, from production processes to services. Similarly, Wasiq et al. (2023) and Wang et al. (2020) stated that government support can encourage competition and promote innovative technologies to be implemented by SMEs.

In addition, taking Indonesia as a sample, our study highlights the regulations issued by the government of the Republic of Indonesia through Law of the Republic of Indonesia No. 40 of 2007 article 74 concerning Social and Environmental Responsibility. This regulation mandates that companies that conduct business activities related to natural resources must be socially and environmentally responsible. Then, we discuss several government support efforts to assist SMEs in achieving sustainable economic growth. According to Suminah et al. (2022), SMEs are the main focus of the government to recover from the COVID-19 pandemic, given their crucial role in the economy. However, increasing competition between large companies and SMEs makes SMEs vulnerable, which is why it is essential to implement open innovation (Hamdani, 2012). Finally, our research provides an in-depth understanding for policymakers and managers in implementing measures to maintain their productivity without harming their environment.

Our investigation has uncovered numerous significant findings. Firstly, we have documented that eco-regulation and government support are effective in encouraging eco-environmental practices. Secondly, we have demonstrated that eco-environmental practices can increase the likelihood of SMEs adopting eco-innovation, with the exception of eco-customers. In addition, our research has revealed that the influence of government regulation and support on eco-innovation is moderated by eco-environmental factors. These findings have significant implications for policymakers, who can use this knowledge to create regulations and support programs that promote competition, increase knowledge and awareness among corporate executives, and encourage the use of innovative, environmentally friendly technologies that benefit SMEs.

Our paper contributes to the literature in several significant ways. Firstly, this research complements prior studies that have examined the topic of eco-innovation adaptation (Achmad et al., 2023; Han and Chen, 2021; Wasiq et al., 2023; Wang et al., 2020; Long et al., 2019; Chen and Liu, 2019; Andersson et al., 2020; Kousar et al., 2017; Yurdakul and Kazan, 2020; Geng et al., 2021). Secondly, this study extends the discourse on the determinants influencing eco-innovation adaptation. We identify the mediating role of eco-environmental factors in this research. Han and Chen (2021) as well as Wang et al. (2020) have emphasized the significant influence exerted by stakeholders, including government bodies, in shaping consumer behavior, executive decisions, competitive dynamics, and the overall innovation process. Thirdly, our study further advances the discussion on the impact of eco-regulation and governmental support on eco-innovation adaptation. This research centers on the governmental role through regulatory frameworks and supportive measures aimed at incentivizing small and medium-sized enterprises (SMEs) to adopt eco-innovations. Eco-regulation and government support emerge as key drivers of eco-innovation adaptation (Han and Chen, 2021; Kousar et al., 2017; Wang et al., 2020; Chen and Liu, 2019).

2. Literature review

2.1. Eco-innovation adaption

The COVID-19 pandemic forced many businesses to reevaluate their operations and strategies (Lestari et al., 2021; Maria et al., 2022; Riadi et al., 2022; Yudaruddin, 2023). As supply chains were disrupted and consumer behaviors shifted, businesses had to adapt quickly to new circumstances. This period of adaptation also presented an opportunity to reconsider environmental practices. Some businesses chose to integrate eco-friendly practices during their operational changes, recognizing the importance of sustainability in building resilience.

In recent years, the topic of eco-innovation adaptation has gained significant attention from academics and researchers. Various studies, including Fernandez et al. (2021), Han and Chen (2021), Wang et al. (2020), Yurdakul and Kazan (2020), Anderson et al. (2020), Chen and Liu (2019), Geng et al. (2021), Mercado-Caruso et al. (2020), Zhang et al. (2020), and Kousar et al. (2017), have discussed eco-innovation. Kemp and Pearson (2008) define eco-innovation as a sustainable innovative production method implemented by companies aimed at reducing negative environmental impacts such as pollution and other environmental risks caused by the use of natural resources. Eco-innovation can be categorized as innovation related to the environment, including products, services, and marketing strategies (Ch'ng et al., 2021; Wang et al., 2020). While previous studies have shown that eco-innovation has a positive impact on company performance, such as profitability (Kraus et al., 2020; Achmad et al., 2023), social performance (Wang et al., 2020), and environmental performance (Singh et al., 2020; Al-Hanakta et al., 2023), the role of stakeholders, particularly the government, in encouraging SMEs to adopt eco-innovation is not widely discussed.

However, recent studies by Han and Chen (2021) and Chen and Liu (2019) suggest that government regulations and support can encourage SMEs to adopt eco-innovations, which can drive their performance. Several factors can be influenced by the government's role, including consumer needs (Fernandez et al., 2021), competitors (Wang et al., 2020; Mercado-Caruso et al., 2020), executives (Song et al., 2020), and innovation processes (Yurdakul and Kazan, 2020; Ulfah et al., 2021). Therefore, this study aims to examine the impact of the government's role, both from regulation and support, on eco-environmental adoption of eco-innovation. By exploring the relationship between government intervention and eco-innovation adoption, this study provides a better understanding of how to create regulations and support that encourage the use of innovative environmentally friendly technologies in SMEs.

2.2. Eco-regulation and Eco-Environmental

The relationship between environmental regulation and eco-innovation has been explored by several studies (Han and Chen, 2021; Liao and Tsai, 2019; Wang et al., 2020; Frigon et al., 2020; Leenders and Chandra, 2013). As Sanni (2018) noted, many countries have imposed regulations on individuals, companies, and organizations to safeguard ecosystems from damage. The enforcement of such environmental regulations has compelled companies to seek innovative solutions to preserve the environment (Wang et al., 2020; Leenders and Chandra, 2013). Similarly, Liao and Tsai (2019) and Frigon et al. (2020) have emphasized that environmental policies oblige businesses to implement eco-innovation, and investors tend to prefer pollution-free industries. Recently, Han and Chen (2021) reported that environmental policies have had a positive impact on eco-innovation in Myanmar.

Drawing upon the theoretical framework of the Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975), which emphasizes the role of perception and behavior in shaping individual, group, and organizational intentions and actions, recent research has sought to apply TRA to the environmental domain, focusing on topics such as energy conservation (Lo et al., 2014), green consumption (Khare and Pandey, 2017), waste reduction (Sumrin et al., 2021), and small and medium-sized enterprise (SME) green adoption (Han and Chen, 2021). A key driver of eco-innovation adoption by companies is the growing consumer interest in green products, which is linked to the desire to express identity through green purchases (Khare and Pandey, 2017; Kautish and Khare, 2022; Rana and Solaiman, 2022; Fernandez et al., 2021). This trend in turn incentivizes companies to implement eco-innovation practices to enhance the sustainability of their products,

processes, and systems in developing countries (Fernandez et al., 2021; Afshari et al., 2020; Ch'ng et al., 2021).

Environmental regulations can play a crucial role in stimulating public concern and driving shifts in consumption patterns towards more eco-friendly alternatives, thus driving demand for eco-innovations by companies (Han and Chen, 2021). Competition has been identified as a significant factor that drives companies to implement eco-innovation, as evidenced by various studies. Regulations imposed on companies to protect the environment, coupled with the rising demand for eco-friendly products, have spurred the development of innovative techniques to improve environmental performance (Wang et al., 2020; Fernandez et al., 2021). In the same vein, pressure from competitors implementing new environmental strategies in the same industry has also played a critical role in motivating companies to pursue eco-innovation (Geng et al., 2021).

Several studies have highlighted the importance of competition in driving environmentally friendly innovation strategies, including those by Wang et al. (2020), Mercado-Caruso et al. (2020), Amalia et al. (2022), and Han and Chen (2021). Stringent environmental regulations can influence the behavior and preferences of environmentally conscious consumers. When governments implement and enforce eco-friendly regulations, it often leads to increased awareness among the public regarding environmental issues. This heightened awareness can, in turn, prompt eco-customers to prioritize products and services that adhere to these regulations and are designed with sustainability in mind. Such regulations can provide a level of assurance that products meet specific environmental standards, making eco-customers more inclined to choose these eco-friendly options. Additionally, the regulations can drive companies to innovate and produce environmentally responsible products, further aligning with the preferences of eco-conscious consumers.

In addition, eco-regulation plays a significant role in the innovation process. As stated by Yurdakul and Kazan (2020), eco-innovation is necessary to transform pro-environmental business systems. Stringent environmental regulations can foster a more competitive environment among businesses with a focus on sustainability. When governments impose and enforce eco-friendly regulations, companies are compelled to innovate and improve their environmental practices to remain compliant. This heightened competition can lead to a race among businesses to develop and market greener products and services, driving advancements in eco-competition. As companies vie to outperform each other in sustainability, consumers are presented with a wider range of eco-friendly choices, ultimately benefitting the environment.

Stringent environmental regulations can positively impact the managerial practices within companies, particularly with regard to sustainability and environmental management. When governments implement eco-friendly regulations and standards, businesses are often prompted to adopt more comprehensive environmental management strategies. This includes better resource management, reduced waste generation, and the integration of sustainable principles into their corporate culture and decision-making processes. In essence, eco-regulations can encourage companies to embrace eco-managerial practices, ultimately leading to more responsible and sustainable business operations.

Furthermore, stringent environmental regulations can stimulate innovation in eco-friendly processes within businesses. When governments impose and enforce environmental regulations that demand cleaner, more sustainable production methods and reduced environmental impact, companies are incentivized to invest in research and development to meet these requirements. This often results in the development of innovative processes, technologies, and practices that are more environmentally friendly. In this way, eco-regulations can serve as a catalyst for eco-process innovation, driving improvements in sustainability across various industries and benefiting both businesses and the environment.

One of the primary objectives of eco-innovation is to optimize

resources, increase productivity, and reduce greenhouse gas emissions (Kemp and Arundel, 2023; Sehnem et al., 2016). Similarly, Horbach et al. (2012) emphasized that the main goal of an environmentally friendly process is to conserve energy and minimize costs. Moreover, government regulations on the environment have a considerable impact on the eco-innovation process, thereby encouraging companies to reduce greenhouse gas emissions. Han and Chen (2021) have highlighted that company technology significantly influences the implementation of eco-innovation. This comprehensive overview of the relationship between environmental regulation and eco-innovation underscores its significance in the context of sustainable development.

H1a. *Eco Regulation has a positive effect on eco-customers.*

H1b. *Eco Regulation has a positive effect on Eco-competition.*

H1c. *Eco Regulation has a positive effect on Eco-managerial.*

H1d. *Eco Regulation has a positive effect on Eco-process innovation.*

2.3. Government support and Eco-Environmental

The theoretical framework of DiMaggio and Powell (1983) underscores the impact of external environmental factors on company behavior. Institutional pressure stemming from the external environment, such as government, industry associations, media, and society, has been found to play a significant role in eco-innovation implementation (Caprar and Neville, 2012; Kasim, 2007). Research by Wang et al. (2020) revealed that stakeholder pressure motivates companies to implement eco-innovation beyond regulatory requirements, and this pressure can create a competitive advantage that drives performance. Similarly, Chen and Liu (2019) have argued that involving stakeholders can increase businesspeople's knowledge and creativity, thereby promoting eco-innovation implementation. The greater the involvement of stakeholders in promoting environmentally friendly innovative products, the higher stakeholder awareness can be in developing environmental strategies (Bos-Brouwers, 2010; Lepoutre and Heene, 2006). These findings underscore the importance of external factors in shaping eco-innovation practices, highlighting the need for businesses to pay attention to stakeholders' expectations and institutional pressures to succeed in their eco-innovation initiatives.

Stakeholder support plays a vital role in promoting knowledge and driving changes in consumer behavior towards environmentally friendly products (Arfi et al., 2018). According to Chen and Liu (2019), external pressures, including consumer demand, can motivate companies to adopt eco-innovation practices. Recently, Han and Chen (2021) have identified a growing trend of consumer concern, supported by external parties, which has led to an increased demand for eco-friendly products, consequently pressuring companies to implement eco-innovation. Market forces have also played a significant role in driving the adoption of eco-innovation practices. Fernandez et al. (2021) found that increased consumer demand for environmentally friendly products has prompted companies to accelerate the eco-innovation shift, particularly in developing countries. These findings underscore the crucial role of stakeholder support and external pressures in promoting eco-innovation practices, thereby contributing to sustainable development.

In addition, support from the government has become another significant factor in motivating executives to adopt environmentally friendly strategies (Han and Chen, 2021). Government support for pro-environment initiatives has a far-reaching and systematic impact on consumer behavior, eco-competition, eco-managerial practices, and eco-process innovation within businesses. This support serves as a catalyst for positive changes across these domains, ultimately advancing environmental sustainability and responsible business practices. Government support for pro-environment initiatives plays a crucial role in fostering positive changes across various aspects of business and consumer behavior. Firstly, when the government actively endorses and promotes environmentally friendly policies and programs, it effectively

raises awareness among consumers about environmental concerns. This heightened awareness encourages consumers to select products and services aligned with sustainability principles. Such government support often takes the form of incentives, subsidies, and environmental awareness campaigns, which motivate consumers to make more sustainable choices. Consequently, this contributes to the development of a supportive environment for eco-conscious consumers, ultimately promoting the growth of the market for environmentally friendly products and services.

Additionally, government support also influences the dynamics of eco-competition among businesses. As governments actively incentivize and endorse environmentally responsible practices within companies, a competitive landscape emerges where businesses strive to excel in sustainability. This competition often leads to a race among businesses to develop and offer greener products and services that meet government-endorsed standards and criteria. As companies compete to outperform each other in terms of environmental performance and innovation, consumers benefit from a broader range of eco-friendly choices. Essentially, government support serves as a catalyst for eco-competition by encouraging companies to embrace sustainability, resulting in the expansion of environmentally conscious industries and markets. The role of executives in implementing eco-innovation is crucial for both product and process development (Long et al., 2019; Zhang et al., 2020; Qi et al., 2010). Similarly, Wang et al. (2020) have found that external pressure enhances managerial attention toward the environment.

Furthermore, government support extends its positive impact to eco-managerial practices within businesses. When governments actively endorse and incentivize environmentally responsible management strategies, companies are more inclined to adopt comprehensive eco-managerial approaches. These approaches encompass efficient resource management, waste reduction, and the integration of sustainable principles into corporate culture and decision-making processes. Government support may manifest through tax incentives, grants, or regulatory frameworks that promote eco-managerial best practices. Consequently, businesses become motivated to prioritize environmental sustainability in their operations, leading to more responsible and sustainable managerial practices that align with both government regulations and broader ecological conservation goals. Coercive pressure is one form of external pressure created by the government through regulations, sanctions, threats, or incentives (Campbell, 2007). According to Wang et al. (2020), coercive pressure is significantly related to the implementation of eco-innovation.

Lastly, government support significantly contributes to fostering eco-process innovation within businesses. Governments often use a variety of incentives, such as research grants, subsidies, and regulatory measures, to encourage companies to invest in developing cleaner and more sustainable production methods and technologies. This encouragement prompts businesses to create innovative processes, materials, and technologies that are not only environmentally responsible but also economically advantageous. Government support plays a pivotal role in driving eco-process innovation by creating an environment in which companies are incentivized to reduce their environmental footprint while maintaining competitiveness. This, in turn, contributes to overall ecological sustainability.

Moreover, government support in protecting the environment not only encourages companies to implement eco-innovation but also leads to the emergence of new competitors in the market (Fernandez et al., 2021). Horbach et al. (2012) emphasize that the presence of government regulations that promote competition is a crucial factor that influences the implementation of eco-innovation. The government can also enhance companies' performance by providing knowledge and technological advancements (Wang et al., 2020). Furthermore, Li-Ying et al. (2018) and Lin and Ho (2011) highlight the critical role of the government in promoting and encouraging SMEs to adopt eco-innovation. Recently, Wasiq et al. (2023) revealed that the Saudi Arabian government incentivized research and actively promoted environmental

preservation, which motivated companies to compete in adopting eco-innovation. In previous studies, incentives, green innovation training programs, and pilot projects were identified as significant motivating factors for SMEs to adopt eco-innovation (Su et al., 2021; Kemp, 2010; Singh et al., 2020; Tamvada, 2020; Ullah et al., 2022).

In addition, government support has the potential to play a crucial role in the eco-innovation process. As noted by Han and Chen (2021), the government is an important stakeholder in facilitating eco-innovation adaptation. One way in which the government can support this process is by increasing the human resource capacity for knowledge and technology improvement. As Anderson et al. (2020) argue, the greater the application of environmentally friendly technology, the greater the potential for improved company performance.

H2a. *Government support has a positive effect on eco-customers.*

H2b. *Government support has a positive effect on Eco-competition.*

H2c. *Government support has a positive effect on Eco-managerial.*

H2d. *Government support has a positive effect on Eco-process innovation.*

2.4. Eco-environmental and eco-innovation adaptation

The relationship between eco-customers, eco-competition, eco-managerial practices, and eco-process innovation significantly shapes the landscape of eco-innovation adaptation within businesses. These relationships showcase how various factors converge to influence the integration of environmentally conscious innovations. Eco-customers, driven by a preference for sustainable products, spark demand for eco-innovations, while eco-competition fosters a culture of continuous improvement. Eco-managerial practices highlight the role of environmentally responsible leadership in driving adaptation, and eco-process innovation serves as a foundation for broader eco-innovation adoption.

Businesses are more likely to adopt eco-innovations when customers care about the environment. This is shown by the link between eco-customers and eco-innovation adaptation. Customers who care about the environment and want eco-friendly goods and services create a need for long-lasting and new ideas. For example, as people become more aware of the environment, they choose goods that are better for it and are willing to pay more for them (Kautish and Sharma, 2020). Because of this, businesses have changed their products, methods, and ways of doing things to include eco-innovations. A lot of the time, these eco-innovations include green tools, cleaner ways to make things, and materials that last. Clearly, Fernandez et al. (2021) showed that companies' choices about environmental practices are affected by the fact that more and more people want items that are good for the environment. Han and Cheng (2021) showed that customer needs and eco-innovation are linked in a good way. Furthermore, Ch'ng et al. (2021) looked into Malaysia's tech industry and found that businesses use eco-friendly methods because customers want more green goods. In a way, eco-customers push companies to adopt eco-innovation because companies want to meet their needs and meet their sustainable goals in order to stay competitive in the market.

The relationship between Eco-competition and Eco-Innovation Adaptation highlights how competition among businesses with a focus on sustainability can drive the adaptation and integration of eco-innovations. Wang et al. (2020) found that eco-competition is one of the things that leads to eco-innovation in China's emerging economies. In a competitive environment where companies vie to outperform each other in terms of eco-friendly practices and products, there is a strong incentive to continuously innovate and adapt. Businesses adapt by incorporating eco-friendly technologies, sustainable processes, and green materials into their operations to gain a competitive edge. Cornejo-Canamares et al. (2021) investigated whether the competitiveness of Spanish manufacturing SME firms is correlated with their adoption of eco-innovation practices. Shahzad et al. (2020) observed that competitive rivalry exerts pressure on firms as they develop their innovation

capabilities in response to the actions of competitors. This dynamic eco-competition fosters a culture of continuous improvement and encourages the swift adoption of eco-innovations to meet consumer demands and regulatory requirements. Han and Cheng (2021) documented that eco-competition encourages increased eco-innovation Adaptation of SMEs. As a result, the positive effects of eco-competition can lead to the widespread adoption and integration of eco-innovations across various industries, contributing to sustainability goals and a greener marketplace.

The link between eco-managerial and eco-innovation adaptation shows how environmentally friendly management practices in companies can have a big impact on how eco-innovations are adopted and used. According to Song et al. (2020), the higher the level of managerial concern for environmental issues, the more management support for eco-innovation. Han and Cheng (2021) also found an eco-managerial impact on increasing Eco-Innovation Adaptation. Sumrin et al. (2021) discovered that one of the main factors that determines the use of eco-innovation methods for waste prevention is the environmental responsibility of managers. When companies prioritize eco-managerial practices, such as efficient resource management, waste reduction, and the incorporation of sustainability principles into decision-making processes, it creates an organizational culture that is conducive to eco-innovation adaptation. If their executives place a high value on the environment and its safety, businesses are more likely to adopt an eco-innovation practice (Zhang et al., 2020). Eco-managers are more likely to seek and implement innovative solutions that align with their sustainability goals, including the adoption of eco-friendly technologies and practices. This commitment to eco-managerial excellence fosters an environment where businesses are more inclined to adapt and integrate eco-innovations as part of their core operations, contributing to their overall sustainability efforts and responsiveness to environmental challenges.

The relationship between Eco-process innovation and Eco-Innovation Adaptation underscores how the development and implementation of environmentally friendly processes can facilitate the adaptation and integration of broader eco-innovations within businesses. Han and Cheng (2021) showed a positive relationship between Eco-process innovation and Eco-Innovation Adaptation. Another study by Andersson et al. (2020) discovered a connection between how well small businesses do at eco-innovation and their ability to come up with new products, processes, and services. When companies invest in eco-process innovation, which includes the creation of cleaner, more sustainable production methods and technologies, it sets a precedent for adopting a culture of continuous improvement and innovation with respect to environmental sustainability. These eco-friendly processes often serve as a foundation upon which other eco-innovations can be built. They demonstrate a company's commitment to sustainable practices and can inspire further eco-innovation adaptations in areas such as product design, materials, and energy efficiency. In this way, eco-process innovation acts as a catalyst, encouraging businesses to embrace a broader spectrum of eco-innovations, ultimately contributing to their overall ecological sustainability and competitive advantage.

H3a. *Eco-customer has a positive effect on Eco-Innovation Adaptation.*

H3b. *Eco-competition has a positive effect on Eco-Innovation Adaptation.*

H3c. *Eco-managerial has a positive effect on Eco-Innovation Adaptation.*

H3d. *Eco-process innovation has a positive effect on Eco-Innovation Adaptation.*

2.5. The role of eco-environmental as mediation variable

Eco-customers mediate the relationship between Eco-Regulation and Eco-Innovation Adaptation. Multiple studies (Fernandez et al., 2021; Han and Chen, 2021; Ch'ng et al., 2021) have demonstrated that consumers who prioritize eco-friendly products and services generate a

demand for environmentally conscious innovations. Eco-Regulation which includes environmental standards and policies imposed by the government, can significantly affect consumer awareness and preferences. Frequently, government regulations increase public awareness of environmental concerns and the significance of sustainability. Consequently, eco-customers are more likely to choose products and services that comply with these regulations and align with their environmentally conscious values. This heightened demand, in turn, motivates businesses to adapt and integrate eco-innovations into their operations to meet the expectations of eco-customers.

The relationship between Eco-Regulation and Eco-Innovation Adaptation is mediated by eco-competition. Wang et al. (2020) and Fernandez et al. (2021) have demonstrated that regulatory pressures imposed by governments frequently motivate businesses to excel in sustainability and environmental performance. When governments implement and enforce environmentally friendly regulations, they create a competitive environment in which businesses strive to outperform one another in terms of environmentally friendly practices and products. This competition not only encourages businesses to adapt, but it also promotes a culture of continuous improvement and innovation in the field of eco-innovations. Companies are incentivized to develop and offer greener products and services that meet government-backed standards, thereby promoting the widespread adoption of eco-innovations.

The influence of Eco-Regulation on Eco-Innovation Adaptation is significantly moderated by eco-management practices within businesses. Song et al. (2020) and Zhang et al. (2020) demonstrate that when government regulations encourage eco-friendly practices, businesses are more likely to prioritize environmental responsibility in their managerial strategies. Frequently, eco-regulation encourages businesses to adopt comprehensive eco-management strategies, such as resource management and waste reduction. These practices foster an organizational culture that facilitates the adoption and incorporation of eco-innovations. Companies that place a premium on eco-managerial excellence are more likely to seek and implement innovative solutions aligned with sustainability objectives, thereby contributing to their overall eco-innovation adaptation.

Eco-process innovation is a crucial intermediary in the relationship between Eco-Regulation and Eco-Innovation Adaptation. According to Han and Cheng (2021) and Andersson et al. (2020), when governments impose and enforce environmental regulations that demand cleaner and more sustainable production methods, businesses are incentivized to invest in R&D to meet these requirements. This frequently leads to the development of innovative environmentally friendly processes, technologies, and practices. Therefore, Eco-Regulation serves as a catalyst for eco-process innovation. These innovative processes not only enhance an organization's environmental performance but also serve as a model for the adoption and incorporation of additional eco-innovations. Eco-process innovation promotes an environment in which businesses are more likely to adapt and adopt a diverse array of eco-innovations, thereby contributing to their overall eco-innovation adaptation.

H4a. *Eco-customer mediates the influence of Eco - Regulation on Eco-Innovation Adaptation.*

H4b. *Eco-competition mediates the influence of Eco - Regulation on Eco-Innovation Adaptation.*

H4c. *Eco- managerial mediates the influence of Eco - Regulation on Eco-Innovation Adaptation.*

H4d. *Eco-process innovation mediates the influence of Eco - Regulation on Eco-Innovation Adaptation.*

Eco-customers play a crucial mediating role in the relationship between government support and adaptation of eco-innovation. According to Arfi et al. (2018) and Han and Cheng (2021), government support frequently consists of incentives, subsidies, and awareness campaigns

designed to encourage consumers to make more sustainable decisions. When the government endorses and promotes environmentally friendly policies and programs, it increases consumer awareness of environmental concerns and the significance of eco-friendly products and services. This increased demand from eco-customers motivates businesses to adopt and incorporate eco-innovations into their operations in order to meet the expectations of a more environmentally conscious consumer base.

The relationship between Government Support and Eco-Innovation Adaptation is significantly moderated by eco-competition. Government support, including incentives and regulatory frameworks, creates an environment that incentivizes companies to invest in developing cleaner and more sustainable production methods and technologies. This encouragement motivates businesses to engage in a race for environmental performance and innovation excellence. As businesses strive to outperform one another in terms of sustainability, they are compelled to adopt and integrate eco-innovations into their operations, ultimately contributing to their widespread adoption. This relationship is supported by studies such as those conducted by Wang et al. (2020) and Fernandez et al. (2021), which emphasize the role of government incentives in fostering eco-competition and driving eco-innovation adaptation.

Companies' eco-managerial practices are a crucial mediator of the effect of government support on eco-innovation adaptation. Typically, government support includes tax incentives, grants, and regulatory frameworks that promote eco-management best practices. Businesses are more likely to prioritize environmental sustainability when the government supports their environmentally responsible management strategies. This commitment to eco-managerial excellence creates an organizational culture conducive to the adaptation and integration of eco-innovations. Companies that prioritize eco-management practices are more likely to seek and implement innovative solutions aligned with sustainability objectives, thereby contributing to their overall eco-innovation adaptation. This relationship is consistent with the findings of studies such as Song et al. (2020) and Zhang et al. (2020), which highlight the role of government incentives in promoting eco-management practices and eco-innovation.

Eco-process innovation plays a crucial role in mediating the relationship between government support and eco-innovation adaptation. Government support often includes incentives and subsidies that encourage companies to invest in research and development for cleaner and more sustainable production methods and technologies. This support acts as a catalyst for eco-process innovation, resulting in the development of environmentally friendly processes, materials, and technologies. Eco-process innovation not only enhances a company's environmental performance but also paves the way for the adoption and incorporation of broader eco-innovations. It fosters an environment in which businesses are more likely to adapt and adopt a variety of eco-innovations, thereby contributing to their eco-innovation adaptation as a whole. This relationship is supported by studies such as those conducted by Han and Cheng (2021) and Andersson et al. (2020), which emphasize the role of government incentives in driving eco-process innovation and eco-innovation adaptation.

H5a. *Eco-customer mediates the influence of Government Support on Eco-Innovation Adaptation.*

H5b. *Eco-competition mediates the influence of Government Support on Eco-Innovation Adaptation.*

H5c. *Eco- managerial mediates the influence of Government Support on Eco-Innovation Adaptation.*

H5d. *Eco-process innovation mediates the influence of Government Support on Eco-Innovation Adaptation.*

Based on the description of the literature review, the relevant concept models of eco-government (regulation, support), eco-

environmental (eco-consumer, eco-competition, eco-managerial, Eco-Process Innovation), and eco-innovation adaptation are presented in Figure 1.

3. Methodology

This study uses independent, mediation, and dependent variables which consist of eco-regulation following Han and Chen (2021) and Government Support following Wang et al. (2020) as the independent variable. Then, the eco-environmental that we use as a mediating variable consists of eco-customer, eco-competition, eco-managerial, and eco-process innovation developed by Fernandez et al. (2021), Mercado-Caruso et al. (2020), Sumrin et al. (2021), Andersson et al. (2020) and Yurdakul and Kazan (2020). Furthermore, eco-innovation adaptation as the dependent variable in this study follows Han and Chen (2021). All variables were measured using a 5-point Likert scale (strongly disagree to strongly agree).

In this study, 859 SMEs were selected in Indonesia in 2021 using a purposive sampling technique. Agribusiness (17.6%), Decorative/craft/furniture (48.3%), and Fashion and Accessories (34.1%) were among the SMEs sampled in this study. In addition, preliminary processing was performed to check if the respondent's entries were incorrect or insufficient. Finally, a questionnaire divided into two sections was uploaded and distributed to participants using Google Forms. The first section consists of profile information, including gender, age, education, length of business operations, and employees. while the second contains all variables' values.

Following Ch'ng (2021), Yurdakul and Kazan (2020), Zhang et al. (2020), Wang et al. (2020), and Wasiq et al. (2023), data were evaluated using a variance-based analysis method using Structure Equation Modeling (SEM), specifically Partial Least Squares (PLS) using the Smart PLS 3.0 software. The PLS is an analytical technique that overcomes restrictions because it does not require a significant number of assumptions during the evaluation and theoretical underpinning (Hair et al., 2016). Data were analyzed using the outer and the inner models. The first outer model evaluates the reliability and validity variables. This model is evaluated using multiple criteria, including convergent and discriminant validity, as well as composite reliability. Next, the inner or structural method is tested to discover the relationship between the study concept, significant value, and R-square. Table 1.

4. Result

The demographic sample results of this study are presented in Table 2. The findings reveal that out of the 859 SMEs surveyed, 42.6% or 366 were male while 57.4% or 493 were female. The majority of the participants were aged between 25 and under 50 years old, comprising 50.1% or 430 respondents. This was followed by those aged between 18 and under 25 years old, which constituted 33.1% or 284 respondents, and those above 50 years old, which accounted for 16.9% or 145 respondents. In terms of education level, the majority of the respondents held a university/college degree (56.3% or 484), followed by Senior Secondary School (33.8% or 290), and Junior Secondary School (9.9% or 85). Regarding the length of business operation, the majority had been in operation for 3 to under 5 years (43.2% or 371), followed by 5–10 years (33.2% or 285), and over 10 years (23.2% or 203). Finally, the number of employees in the SMEs was predominantly under 10 (50.5% or 434), followed by 10 to under 25 (26% or 223), 25 to under 50 (14.4% or 124), and over 50 employees (9.1% or 78).

Table 3 presents the outcomes of the outer model, which is utilized to examine the connection between latent variables by determining construct validity and reliability. As pointed out by Zainurossalamia et al. (2022), validity is assessed through convergence and discriminant values, while reliability is determined via composite reliability and Average Variance Extracted (AVE). The study's findings reveal that each latent variable's item loading value is highest at 0.935, indicating very
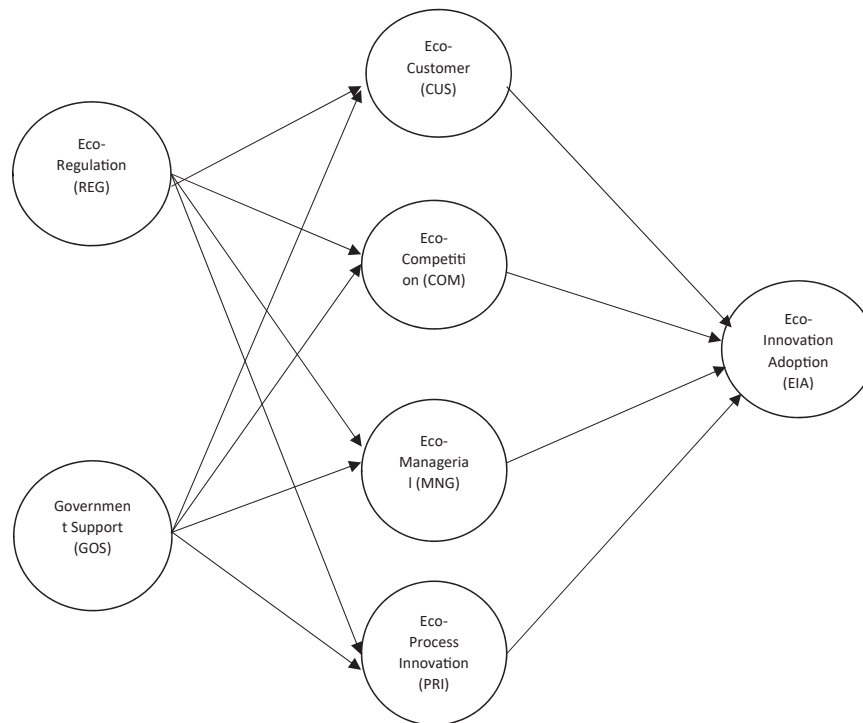
Fig. 1. Conceptual framework.

high construct validity.

Additionally, Table 3 demonstrates the reliability assessment results using cronbach alpha, composite reliability, and AVE. The results show that all Cronbach's Alpha and Composite Reliability values for Eco-Regulation, Government Support, Eco-customer, Eco-competition, Eco-managerial, Eco-process innovation, Eco-innovation adaptation are greater than 0.70, with values of 0.962, 0.972, 0.962, 0.957, 0.973, 0.965, and 0.969, respectively. Moreover, composite reliability values for the same variables are 0.975, 0.979, 0.976, 0.972, 0.980, 0.977, and 0.977. Finally, AVE values for Eco-Regulation, Government Support, Eco-customer, Eco-competition, Eco-managerial, Eco-process innovation, and Eco-innovation adaptation are 0.929, 0.923, 0.930, 0.921, 0.924, 0.934, and 0.915, respectively. Therefore, this study is deemed reliable as all Cronbach's Alpha and Composite Reliability values are greater than 0.70 and AVE values are greater than 0.50.

The Fornell-Larcker Criterion, which demonstrates the validity of a variable when its correlation is greater than the correlation between different variables, is the next validity test. The Fornell-Larcker criterion is determined by comparing the root of the AVE value to the correlation of the latent variable. Table 4 displays the output results according to the criteria. Alternatively, the HTMT (Heterotrait-Monotrait) correlation ratio is also used to evaluate the originality of a construct. This study's model has discriminant validity because all HTMT values are well below the more conservative cut-off value of 0.85.

Table 5 presents the R-square results that examine the relationship between constructs and the significance value. The findings of this study reveal that Eco-Customers are influenced by Eco-Regulation and Government Support with an r-squared value of 0.356 or 35.6%, whereas 0.644 or 64.4% is influenced by external factors. Similarly, Eco-competition, Eco-managerial, and Eco-process innovation have an r-squared value of 0.278 or 27.8%, 0.474 or 47.4%, and 0.323 or 32.3%, respectively, which are influenced by Eco-Regulation and Government Support. However, the remaining percentage is influenced by external factors. Furthermore, Eco-Innovation Adaptation is influenced by Eco-Regulation, Government Support, Eco-customer, Eco-competition, Eco-managerial, and Eco-process innovation with an r-squared value of 0.321 or 32.1%, whereas 0.679 or 67.9% is influenced by external

factors. Within Partial Least Squares (PLS) analysis, the Q-Square measurement gauges the structural component's predictive capacity within the model. Computed as 1 - (1–0.356) (1–0.278) (1–0.474) (1–0.323) (1–0.321) = 0.888, the Q-Square value indicates that the model adeptly elucidates around 88.8% of the variability in CUS, COM, MNG, PRI, and EIA. The remaining 11.2% of the variance is subject to influences from external factors not encompassed within the model's constructs.

The results presented in Table 6 demonstrate the path coefficients in this study. Specifically, Eco Regulation (REG) positively affects Eco-environmental constructs, including Eco-Competition (COM), Eco-customer (CUS), Eco-Process Innovation (INV), and Eco-Managerial (MNG), with path coefficients of 0.422, 0.349, 0.438, and 0.284, respectively, all significant at the 0.05 level. These results confirm that government regulations related to environmental protection have a significant positive impact on eco-competition, eco-customer, eco-process innovation, and eco-managerial, supporting hypotheses H1a, H1b, H1c, and H1d. Additionally, Government Support (GOV) positively influences Eco-environmental constructs, with path coefficients of 0.250, 0.248, 0.194, and 0.359, respectively, and all significant at the 0.05 level. These findings indicate that government support through financial assistance, promotion, human resource capacity building, and easy-to-implement regulations have a significant positive impact on eco-competition, eco-customer, eco-process innovation, and eco-managerial, supporting the hypotheses H2a, H2b, H2c, and H2d. Moreover, the Eco-environmental constructs (i.e., Eco-customer, Eco-competition, Eco-managerial, and Eco-process Innovation) positively influence Eco-Innovation Adaptation, with path coefficients of 0.068, 0.248, 0.299, and 0.254, respectively. The significant levels of these path coefficients are 0.1170, 0.000, 0.000, and 0.000, respectively. These results indicate that Eco-competition, Eco-Managerial, and Eco-process innovation significantly and positively affect Eco-Innovation Adaptation, while Eco-customer has no significant effect. Thus, the hypotheses H3b, H3c, and H3d are accepted, while H3a is rejected.

In addition to our previous findings, we investigated the eco-environmental mediating effect of eco-regulation on eco-innovation adaptation. Our results, presented in Table 7, reveal that Eco-customers partially mediate the effect of eco-regulation on eco-

Table 1

Measurement items.

Variables	Item	References
Eco-Regulation (REG)	Our company is impacted by environmental regulations (REG1) Environmental regulations drive our concern for environmental issues (REG2) Our company strictly adheres to environmental regulations (REG3)	Han and Chen (2021), Kousar et al. (2017);Wang et al. (2020) also
Government Support (GOS)	The government provides financial assistance to encourage adoption of environmentally friendly practices (GOS1) The government promotes businesses to use environmentally friendly products (GOS2) The government conducts training sessions and workshops to help employees develop sustainable environmental skills (GOS3) The government establishes environmental regulations applicable to small and medium-sized enterprises (GOS4)	Chen and Liu (2019),Wang et al. (2020)
Eco-Customer (CUS)	Our customers prioritize environmental issues (CUS1) Our customers have specific expectations related to the environment (CUS2) Our environmental efforts are driven by customer demand (CUS3)	Fernandez et al. (2021);Han and Chen (2021);Chen and Liu (2019)
Eco-Competition (COM)	Competitors are utilizing clean production technology (CUS4) Competitors have implemented Environmental Management Systems (COM1) Competitors have obtained ISO 14001 environmental certification (COM2)	Mercado-Caruso et al. (2020);Han and Chen (2021)
Eco-Managerial (MNG)	Environmental innovation is critical to a business's environmental management strategy (MNG1) Most environmental innovations are beneficial (MNG2) Environmental innovation is an effective approach to environmental management (MNG3) High levels of environmental performance require environmental innovation (MNG4)	Sumrin et al. (2021);Han and Chen (2021)
Eco-Process Innovation (PRI)	Our company constantly experiments with environmentally friendly ideas (PRI1) Our company seeks more environmentally friendly methods to accomplish tasks (PRI2) Our company innovates in terms of green production processes (PRI3)	Han and Chen (2021); Andersson et al. (2020); Yurdakul and Kazan (2020)
Eco-Innovation Adoption (EIA)	Our company designs products using eco-friendly materials (EIA1)	Achmad et al. (2023);Han and Chen (2021);Yurdakul and Kazan (2020)

Table 1 (*continued*)

Variables	Item	References
	Our company is involved in the recovery and recycling of end-of-life products (EIA2) Our company creates products that help reduce waste damage (EIA3) Our company creates products that conserve energy (EIA4)	

Table 2

Sample demographic (n = 859).

Characteristics	Group	Frequency	Percentage
Gender	Male	366	42.6
	Female	493	57.4
Age	18 - < 25 Years	284	33.1
	25 - < 50 Years	430	50.1
	> 50 Years	145	16.9
Education	University/College	484	56.3
	Senior Secondary School	290	33.8
	Junior Secondary School	85	9.9
Length of business operation	3 – < 5 Years	371	43.2
	5 – 10 Years	285	33.2
	> 10 Years	203	23.2
Employee	< 10 Years	434	50.5
	10 - < 25	223	26
	25 - < 50	124	14.4
	> 50	78	9.1

Source: Author Calculation (2023)

Table 3

Validity and Reliability Result.

Variables	Item	Item Loadings	Cronbach's Alpha	Composite Reliability	AVE
Eco-Regulation (REG)	REG1	0.963	0.962	0.975	0.929
	REG2	0.962			
	REG3	0.966			
Government Support (GOS)	GOS1	0.951	0.972	0.979	0.923
	GOS2	0.970			
	GOS3	0.964			
	GOS4	0.957			
Eco-Customer (CUS)	CUS1	0.969	0.962	0.976	0.930
	CUS2	0.964			
	CUS3	0.961			
Eco-Competition (COM)	COM1	0.967	0.957	0.972	0.921
	COM2	0.963			
	COM3	0.949			
Eco-Managerial (MNG)	MNG1	0.954	0.973	0.980	0.924
	MNG2	0.963			
	MNG3	0.962			
	MNG4	0.966			
Eco-Process Innovation (PRI)	PRI1	0.966	0.965	0.977	0.934
	PRI2	0.964			
	PRI3	0.970			
Eco-Innovation Adoption (EIA)	EIA1	0.966	0.969	0.977	0.915
	EIA2	0.935			
	EIA3	0.965			
	EIA4	0.959			

Source: Author Calculation (2023)

innovation adaptation, with a path coefficient of 0.024 and a significance of 0.116 > 0.05. This suggests that H4a is rejected. Conversely, eco-competition mediates the effect of eco-regulation on eco-innovation adaptation with a path coefficient of 0.105 and a significance of 0.000 < 0.05, indicating that H4b is accepted. Furthermore, our analysis reveals that eco-managerial mediates the effect of eco-regulation on eco-innovation adaptation with a path coefficient of 0.085 and a

Table 4
Discriminant validity with Fornell-Larcker Criterion and HTMT.

Fornell-Larcker Criterion							
	COM	CUS	EIA	GOV	INV	MNG	REG
COM	0.960						
CUS	0.510	0.964					
EIA	0.543	0.470	0.956				
GOV	0.481	0.439	0.566	0.960			
INV	0.486	0.569	0.550	0.434	0.967		
MNG	0.455	0.434	0.558	0.515	0.455	0.961	
REG	0.559	0.485	0.504	0.548	0.544	0.481	0.964
Heterotrait-Monotrait Ratio (HTMT)							
	COM	CUS	EIA	GOV	INV	MNG	REG
COM							
CUS	0.531						
EIA	0.564	0.486					
GOV	0.499	0.454	0.583				
INV	0.506	0.590	0.569	0.448			
MNG	0.471	0.449	0.574	0.529	0.470		
REG	0.582	0.504	0.521	0.567	0.565	0.497	

Table 5
The Results of the R-square.

Structural Model	Dependent Variable	R Square
1	Eco-Customer (CUS)	0.356
2	Eco-Competition (COM)	0.278
3	Eco-Managerial (MNG)	0.474
4	Eco-Process Innovation (PRI)	0.323
5	Eco-Innovation Adoption (EIA)	0.321

Source: Author Calculation (2023)

Table 6
Summary of Path Coefficient.

Hypothesis	Path coefficient	T Statistic	P-Value	Result
H1a: REG -> COM	0.422	11.097	0.0000	Supported
H1b: REG -> CUS	0.349	9.251	0.0000	Supported
H1c: REG -> INV	0.438	11.807	0.0000	Supported
H1d: REG -> MNG	0.284	7.486	0.0000	Supported
H2a: GOV -> COM	0.250	6.279	0.0000	Supported
H2b: GOV -> CUS	0.248	6.627	0.0000	Supported
H2c: GOV -> INV	0.194	4.557	0.0000	Supported
H2d: GOV -> MNG	0.359	9.438	0.0000	Supported
H3a: CUS -> EIA	0.068	1.572	0.1170	Rejected
H3b: COM -> EIA	0.248	6.059	0.0000	Supported
H3c: MNG -> EIA	0.299	7.466	0.0000	Supported
H3d: INV -> EIA	0.254	5.942	0.0000	Supported

Source: Author Calculation (2023)

Table 7
Summary of Mediation Effects.

Hypothesis	Path coefficient	T Statistic	P-Value	Result
H4a: REG -> CUS -> EIA	0.024	1.574	0.116	Rejected
H4b: REG -> COM -> EIA	0.105	5.737	0.000	Supported
H4c: REG -> MNG -> EIA	0.085	5.971	0.000	Supported
H4d: REG -> INV -> EIA	0.111	5.516	0.000	Supported
H5a: GOV -> CUS -> EIA	0.017	1.463	0.144	Rejected
H5b: GOV -> COM -> EIA	0.062	3.751	0.000	Supported
H5c: GOV -> MNG -> EIA	0.107	5.093	0.000	Supported
H5d: GOV -> INV -> EIA	0.049	3.229	0.001	Supported

Source: Author Calculation (2023)

significance of 0.000 < 0.05, confirming the acceptance of H4c. Finally, eco-process innovation mediates eco-regulation of eco-innovation adaptation with a path coefficient of 0.111 and a significance of

0.000 < 0.05, implying that H4d is accepted.

Moreover, we investigate the role of eco-environmental as a variable mediating the effect of government support on eco-innovation adaptation. Our results indicate that eco-customers partially mediate the effect of government support on eco-innovation adaptation, with a path coefficient of 0.017 and a significance of 0.144 > 0.05, indicating the rejection of H5a. On the other hand, eco-competition mediates the effect of government support on eco-innovation adaptation with a path coefficient of 0.062 and a significance of 0.000 < 0.05, confirming the acceptance of H5b. Similarly, eco-managerial mediates the effect of government support on eco-innovation adaptation with a path coefficient of 0.107 and a significance of 0.000 < 0.05, indicating the acceptance of H5c. Finally, eco-process innovation mediates the effect of government support on eco-innovation adaptation with a path coefficient of 0.049 and a significance of 0.001 < 0.05, indicating the acceptance of H5d.

5. Discussion

This study's results demonstrate that eco-regulation has a substantial and positive impact on eco-customers. The findings suggest that government regulations mandating environmental protection foster environmentally conscious consumption patterns. These outcomes are reinforced by Khare and Pandey (2017) and Sumrin et al. (2021), who have found that green consumers are likely to increase in response to environmental regulations. Additionally, the study indicates that eco-regulation has a significant and positive effect on eco-competition. This implies that environmental regulations foster the emergence of new competitors in the same industry. These outcomes are consistent with Wang et al. (2020) and Fernandez et al. (2021), who contend that government regulations promoting eco-innovation pressure other companies to adopt environmental techniques. Furthermore, the study indicates that eco-regulation has a significant and positive effect on eco-management. The results suggest that government regulations provide executives with a heightened sensitivity to environmental issues. These outcomes are aligned with Han and Chen (2021) and Amalia et al. (2022), who assert that regulations can raise managers' awareness of the environment. Finally, the study finds that eco-regulation has a significant and positive effect on eco-process innovation. This implies that regulation has an impact on the innovation process, leading to a reduction in pollution during the production process. These outcomes are supported by Horbach et al. (2012), who state that regulations influence the eco-innovation process aimed at reducing greenhouse gas emissions.

Our study reveals that government support plays a vital role in promoting eco-friendly businesses and increasing the consumption of eco-innovation products. Specifically, we find that government support has a significant positive effect on eco-customers, eco-competition, eco-management, and eco-process innovation. These findings are consistent with the literature, as Han and Chen (2021) have previously highlighted the importance of stakeholders in promoting knowledge about the environment and encouraging people to consume environmentally friendly products. Moreover, our results are supported by Fernandez et al. (2021), Wang et al. (2020), and Wasiq et al. (2023), who have suggested that government incentives can facilitate the development of sustainable industries and foster new competitors. We also found that government support can increase the awareness of managers to create strategies that protect the environment and increase their productivity, which aligns with the findings of Wang et al. (2020), who observed that funding support from stakeholders, especially the government, can enhance executives' environmental awareness. Finally, our results indicate that providing incentives for research and development in eco-innovation can encourage companies to create innovative processes that aim to reduce pollution. This result is consistent with Anderson et al. (2020), Han and Chen (2021), and Horbach et al. (2012), who found that government support for environmentally friendly

technologies can enable companies to use resources more efficiently and ultimately enhance company performance. Overall, our study underscores the importance of government support in promoting eco-friendly businesses and encouraging innovation in environmentally friendly processes. These results have important implications for policymakers and businesses seeking to promote sustainable development.

Our study also explores the impact of eco-environmental factors on eco-innovation adaptation. Firstly, we find that eco-customers do not have a significant effect on eco-innovation adaptation. This implies that consumer pressure alone is insufficient to encourage companies to implement eco-innovation. Secondly, our results indicate that eco-competition has a significant positive effect on eco-innovation adaptation, with the entry of new competitors who prioritize eco-innovation putting pressure on other companies to follow suit. This finding is consistent with prior research suggesting that competition is a key driver of eco-innovation adoption (Fernandez et al., 2021; Horbach et al., 2012; Li et al., 2018; Lin and Ho, 2011; Wasiq et al., 2023; Su et al., 2021; Kemp, 2010; Singh et al., 2020; Tamvada, 2020; Ullah et al., 2022). Thirdly, our study reveals that eco-management also has a significant positive influence on eco-innovation adaptation, highlighting the crucial role of executives in promoting eco-innovation adoption. This result is consistent with the findings of Han and Chen (2021), Zhang et al. (2020), and Song et al. (2020), who suggest that environmentally conscious executives play a pivotal role in driving eco-innovation implementation. Lastly, our analysis shows that eco-process innovation has a significant positive effect on eco-innovation adaptation, indicating that the implementation process itself is the primary driver of changes to business systems that support the environment, including the use of innovative technology. This finding is aligned with Yurdakul and Kazan's (2020) assertion that the eco-innovation process is instrumental in changing a company's business scale for eco-innovation implementation. Overall, our study provides insights into the role of eco-environmental factors in eco-innovation adaptation. These findings have important implications for businesses seeking to implement eco-innovation and policymakers aiming to promote sustainable development.

In addition, our study also investigates the mediating role of eco-environmental factors in the relationship between eco-regulation, government support, and eco-innovation adaptation. Our results show that eco-customers do not significantly mediate the effect of eco-regulation and government support on eco-innovation. However, eco-competition, eco-management, and eco-process innovation partially mediate the effect of eco-regulation and government support on eco-innovation adaptation. This implies that government regulations and support can foster pro-environmental management practices, innovative technologies, and new competitors, which can drive companies to adopt eco-innovation. Our findings corroborate previous research by Sumrin et al. (2021), Ch'ng et al. (2021), Geng et al. (2021), Mercado-Caruso et al. (2020), Amalia et al. (2022), Song et al. (2020), Zhang et al. (2020), Chen and Liu (2019), Horbach et al. (2012), Wang et al. (2020), Wasiq et al. (2023), Han and Chen (2021), Anderson et al. (2020), which emphasize the positive impact of government initiatives on the adoption of eco-innovation.

6. Conclusion

The purpose of this study is to investigate the factors that encourage companies to adopt eco-innovation, specifically the role of the government and eco-environment. The sample consists of 859 SMEs in Indonesia. Our findings suggest that government regulation and support positively impact eco-environmental factors such as eco-competition, eco-managerial, and eco-process innovation. Additionally, eco-environmental factors, with the exception of eco-customers, positively influence eco-innovation adaptation. When eco-environmental factors serve as a mediator between eco-regulation and government support and eco-innovation adaptation, they have a positive impact, again

except for eco-customers.

This study holds at least three theoretical implications for eco-innovation adaptation research. Firstly, it introduces a novel integrated model that predicts the mediating role played by eco-environmental factors between the government's role and SMEs' eco-innovation adaptation. Secondly, it contributes to the body of eco-innovation adaptation research, particularly within the context of SMEs in developing countries, diverging from prior studies that predominantly focused on large corporations. Thirdly, this study reinforces the applicability of the Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen (1975) within the domain of environmental innovation adaptation, elucidating the factors influencing SMEs in adopting environmentally friendly innovations.

This study's results have important implications for policymakers, managers, and small and medium-sized enterprises (SMEs) seeking to promote eco-friendly practices and innovation in line with sustainable development goals: First, for Government. The substantial positive impact of eco-regulation on eco-customers, eco-competition, eco-management, and eco-process innovation underscores the significance of strong environmental regulations. Policymakers should continue to implement and enforce regulations that encourage sustainable consumption patterns, competition among eco-conscious businesses, heightened environmental awareness among managers, and the adoption of innovative, pollution-reducing production processes. Moreover, the study highlights the vital role of government support in driving eco-friendly practices. Policymakers should consider providing incentives, funding, and research and development support to encourage businesses to adopt eco-innovation. These initiatives can foster eco-customers, eco-competition, eco-management, and eco-process innovation, leading to enhanced sustainable development outcomes.

Second for Managers. The findings suggest that managers' heightened sensitivity to environmental issues, driven by eco-regulation and government support, plays a crucial role in promoting eco-innovation adaptation. Managers should actively integrate sustainability principles into their decision-making processes, recognizing the positive impact such practices can have on business performance, innovation, and environmental stewardship. Additionally, managers should recognize the potential benefits of eco-competition and eco-process innovation. The entry of new competitors prioritizing eco-innovation can stimulate innovation and foster a culture of continuous improvement. Implementing innovative, eco-friendly technologies and processes not only reduces pollution but can also enhance operational efficiency and competitiveness.

Finally for SMEs. SMEs should actively seek to utilize the government support available for eco-innovation. Leveraging funding and incentives can help them embrace eco-friendly practices, enhance their appeal to eco-customers, and stay competitive in a rapidly changing market landscape. Furthermore, SMEs should explore eco-innovation strategies that align with their capabilities and industry trends. Adapting environmentally friendly processes, products, and services can open doors to eco-customers, drive eco-competition, improve eco-management practices, and boost eco-process innovation, leading to long-term sustainability and growth.

Despite the significant contributions of our research, it is essential to acknowledge several limitations that can serve as guidelines for future research endeavors. Firstly, given that our study relies on cross-sectional data obtained through questionnaire surveys, further methods such as field studies or experimental approaches should be employed to corroborate our findings. Secondly, our research primarily focuses on eco-innovation in a general sense, whereas future studies could enhance understanding by distinguishing various types of environmentally friendly innovations. Thirdly, although our study provides valuable insights into Indonesia as a developing nation, the selection of our research location may constrain the generalizability of our findings. Therefore, replicating this research in other countries is warranted to extend its applicability.

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Ethical Statement

Hereby, Dr Gusti Noorlitaria Achmad consciously assure that for the manuscript "Government Support, Eco-Regulation and Eco-Innovation Adoption in SMEs: The Mediating Role of Eco-Environmental" the following is fulfilled:

2) This material is the authors' own original work, which has not been previously published elsewhere.
3) The paper is not currently being considered for publication elsewhere.
4) The paper reflects the authors' own research and analysis in a truthful and complete manner.
5) The paper properly credits the meaningful contributions of co-authors and co-researchers.
6) The results are appropriately placed in the context of prior and existing research.
7) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.
8) All authors have been personally and actively involved in substantial work leading to the paper, and will take public responsibility for its content.

The violation of the Ethical Statement rules may result in severe consequences.

To verify originality, your article may be checked by the originality detection software iThenticate. See also http://www.elsevier.com/editors/plagdetect.

I agree with the above statements and declare that this submission follows the policies of Solid State Ionics as outlined in the Guide for Authors and in the Ethical Statement.

CRediT authorship contribution statement

Gusti Noorlitaria Achmad: Conceptualization, Investigation, Methodology, Roles/Writing - original draft, Writing - review & editing. **Rizky Yudaruddin:** Data curation, Resources, Formal analysis, Writing – review & editing. **Bramantyo Adi Nugroho:** Funding acquisition, Project administration, Methodology. **Zhikry Fitrian:** Investigation, Methodology, Software, Visualization. **Suharsono:** Investigation, Methodology, Software, Visualization. **Ari Sasmoko Adi:** Investigation, Methodology, Software, Visualization. **Pebiansyah Hafsari:** Investigation, Methodology, Software, Project administration. Fitriansyah: Investigation, Funding acquisition, Project administration, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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