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IMPACT OF GREEN ECONOMY AND INNOVATION ON SUSTAINABLE DEVELOPMENT WITH REGULATORY QUALITY MEDIATION: INDONESIA CASE

Elmira Siska[*)1], Rini Larasati Irawan[*)], Tri Lestari[*)], Dorris Yadewani[**)]

[*)] Management Department, Universitas Bina Sarana Informatika
Jl. Kramat Raya No.98, RT.2/RW.9, Kwitang, Senen, Central Jakarta, Jakarta 10450, Indonesia
[**)]Management Department, Universitas Sumatera Barat
Jl. By Pass Padang, Kp. Gadang, East Pariaman, Padang Pariaman, West Sumatra 25522, Indonesia

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Abstract:

Background: Green economy and innovation are key drivers of sustainable development; however, their effectiveness depends on the regulatory quality that governs their implementation. In Indonesia, regulatory challenges often hinder efforts to promote a green economy and innovation, raising concerns about their direct and mediated impact on sustainable development.
Purpose: To examine how the green economy and innovation affect sustainable development in Indonesia, using regulatory quality as a mediating variable.
Design/methodology/approach: This study used a quantitative technique with annual time-series data from 2011 to 2020. The variables analyzed included Green Economy (X1), innovation (X2), Regulatory Quality (Z), and Sustainable Development (Y). Data analysis was performed using OLS regression, starting with classical assumption tests followed by hypothesis testing. The data were processed using EViews-12.
Findings/Result: The findings prove that the green economy does not significantly impact regulatory quality, while innovation negatively impacts it. However, a green economy directly enhances sustainable development, whereas innovation does not. Regulatory quality significantly influences sustainable development and mediates the effects of both the green economy and innovation.
Conclusion: This study underscores the importance of regulatory quality in enhancing green economic policies and mitigating the negative effects of innovation. Strengthening regulatory frameworks is necessary to optimize the benefits of green economic endeavors and foster sustainable innovation.
Originality/value (State of the art): This research adds value by highlighting the mediating role of regulatory quality, offering a more comprehensive perspective on sustainability governance in Indonesia.

Keywords: economy policies, green economy, innovation, regulatory quality, sustainable development

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[1] Corresponding author:
Email: elmira.ems@bsi.ac.id

INTRODUCTION

Green economy and innovation have been discussed in relation to sustainable development in recent decades. The term 'green economy' describes an economy that minimizes adverse environmental effects and uses resources effectively to support sustainable economic growth (Loiseau et al.2016); (Hickel & Kallis, 2020). Additionally, a green economy is defined as an economic structure with minimal carbon emissions, resource efficiency, and social inclusion (Jänicke, 2012); (Georgeson et al.2017). On the other hand, innovation is the process of developing something that already exists and making it more useful and more meaningful value (Adams et al.2016); (Midgley & Lindhult, 2021). As part of the green economy framework, innovation is considered an essential element for developing more effective and ecologically sustainable solutions.

To achieve the objectives of sustainable development, countries around the world have been attempting to implement the principles of a green economy and innovation within their economic policies. In Indonesia, the 2020–2024 National Medium-Term Development Plan (RPJMN) includes the green economy as one of its three priority programs: improving the quality of the environment, mitigating climate change and resilience to disasters, and promoting low-carbon development (Halimatussadiah, 2020); (Rohmy & Nihayaty, 2023). The Indonesian government is actively contributing to the advancement of sustainable ecosystems through policies (Budiman et al.2025). The Indonesian government has implemented a number of regulations to encourage a green economy, encompassing carbon taxes, renewable energy initiatives, and green investment regulations (Liebman et al.2019). Innovation is increasingly fueled by sustainable development. Policies focused on innovation have been explained in the ninth Sustainable Development Goals target point, namely, building durable infrastructure, supporting industrialization and sustainability, and fostering innovation. Nevertheless, there are still a number of barriers to the implementation of these policies, such as insufficient high-quality regulations that guarantee the efficacy of green economic programs and innovation policies (Anderson et al.2016).

Several previous studies have examined green economy, innovation, and sustainable development. Research by (Zhang et al.2019) and with (Ammar et al.2024) demonstrates that a green economy encourages sustainable development. They also emphasize that a green economy transition will encounter a number of challenges in the absence of precise and efficient laws, such as rejection from conventional industrial sectors and challenges in attracting green investment. Another study by (Barbier, 2016) shows that the transformation to a green economy necessitates robust policy support to ensure the simultaneous sustainability of the economy and environment.

According to studies by (Zhou et al.2023) and (Sharif et al.2023), green technological innovation is essential for improving resource efficiency and lowering environmental effects. The study conducted by (Mainelli & Mills, 2016) conclude that innovation in financial technology is an essential factor in achieving sustainable development. Another study by (Usman & Hammar, 2021) confirmed that an increase in technological innovation activities and economic growth has a long-term beneficial effect on environmental quality. Recent research by (Herdian et al.2025) emphasizes that green innovation is essential for optimizing operations, promoting ecologically friendly business practices, and enhancing sustainability.

Innovation can encourage policymakers to review and modify laws in line with economic and technological advancements, leading to improvements in the quality of regulations. An essential aspect that influences corporate green innovation is the strength of environmental laws and regulations. Environmental policies view innovation as a way to enhance the standards of green transition and economic development (Li & Hu, 2021). His research, which was conducted in China on 34 industries between 2007 and 2015, suggests that businesses may be encouraged to innovate more in environmental technologies while creating suitable environmental regulations. Then, research by (Chang et al.2023), highlight that countries with stronger regulations regarding the environment are more likely to have innovative green technology because they are incentivized to develop more ecologically friendly solutions.

The quality of regulations plays a major role in fostering an atmosphere that supports innovation and a green economy. Regulations can also be used to help achieve development objectives. However, regulatory quality remains a significant obstacle in Indonesia. Issues such as overlapping rules, regulations that are in conflict with one another, too many regulations, lack of

coordination across related sectors, and inadequate law enforcement (Yudanti & Setiadi, 2022).

The other research conducted in Indonesia by (Sari & Setiyono, 2022) and (Rusmayadi et al.2023) highlight that regulatory uncertainty and a lack of incentives for organizations to implement more environmentally friendly business models continue to be barriers to investment in Indonesia's green economy. Another study by (Raihan et al.2023) demonstrates the necessity of innovation in reducing carbon emissions but also emphasizes that without strong regulations, the positive impacts of such innovation are difficult to realize. Additionally, Galuh et al. (Galuh et al.2024) showed that although government policies are starting to move towards incentives for green industries, there are still gaps in the implementation of regulations that can hinder the effectiveness of these policies.

Despite the fact that the issues of sustainable development, the green economy, and innovation have been examined in a number of studies, understanding the function of regulatory quality as a mediating variable is still lacking. Most previous studies have only focused on the direct interaction links between the green economy and sustainable development or between innovations and sustainable development, without considering how regulation can moderate or mediate the relationship.

To bridge this gap, the current study examines how regulatory quality mediates the green economy and innovation in relation to sustainable development in Indonesia. This study offers more thorough insights into how improved regulatory policies might bolster the beneficial effects of both a green economy and innovation on sustainable development by comprehending this mechanism.

This study employs secondary data analysis techniques using a quantitative approach. The data were obtained from a number of sources, such as scholarly publications and statistics from international institutions, such as the United Nations Environment Programme (UNEP), the World Bank, and the Global Innovation Index of Indonesia.

The main objectives of this research are: 1) to analyze the influence of the green economy on the quality of regulation; 2) to analyze the influence of innovation on the quality of regulation; 3) to examine the influence of the green economy on sustainable development; 4) to examine the influence of the green economy on sustainable development; 5) to examine the influence of regulatory quality on sustainable development; 6) to evaluate how well regulatory quality is a mediator in the relationship between the green economy and sustainable development; and 7) to test regulatory quality's function as a mediator in the association between innovation and sustainable development. We hope that the current research can provide more effective policy recommendations for the Indonesian government to improve the quality of regulations and encourage the adoption of a green economy and innovation in the direction of sustainable development.

METHODS

The present study was conducted in Indonesia. Annual time-series data from 2011 to 2020 were used in this study. The time duration is determined by the data accessibility. This study used a quantitative design with an explanatory research strategy. This investigation had four main variables: independent, dependent, and mediator. The independent variables include Green Economy (X1), which is measured based on the green economy index, and innovation (X2), which is measured using the Global Innovation Index. The dependent variable was Sustainable Development (Y), which was measured using the sustainable development index. The mediator variable was Regulatory Quality (Z), measured based on the regulatory quality index.

The data collection technique used in this study is documentation by taking secondary data from reputable international databases. All variables were collected from publicly accessible sources. The data source for the Green Economy is from the United Nations Environment Programme (UNEP). Innovation data were sourced from the Global Innovation Index (GII) database. Data on Sustainable Development were obtained from the Sustainable Development Report. Regulatory Quality data were sourced from the World Bank database.

Data processing begins with a classical assumption test to ensure that the regression model satisfies the standards of the Best Linear Unbiased Estimator (BLUE). These tests include a normality test using the Jarque-Bera test to ensure normal data distribution. The interpretation of the results in the Jarque–Bera test is

that if the p-value is smaller than 0.05, the data are said to be non-normally distributed, and vice versa if the p-value is more than 0.05, then a normal distribution of the data exists. To determine whether there is a strong correlation among the independent variables, the multicollinearity test employs Variance Inflation Factor (VIF) analysis. Multicollinearity was deemed absent if the VIF score was < 10. The heteroscedasticity test uses the Breusch-Pagan-Godfrey test to ensure constant residual variance. Heteroscedasticity was considered absent if the probability value was greater than 0.05, but it could be detected if the probability value was less than 0.05. The Breusch-Godfrey Serial correlation LM test was used in the Autocorrelation Test to detect autocorrelation in time series data. It is clarified that there is no autocorrelation if the probability value is greater than 0.05, whereas the probability value is smaller than 0.05, which indicates that there is autocorrelation (Winarno, 2017). Software EViews-12 was used for data processing.

The estimation model uses a regression model with Ordinary Least Squares (OLS). To test this hypothesis, we structured the equations as follows:

Direct effect models:
1. Testing H1: $RQt = \alpha 1 + \beta 1GEt + \varepsilon t$
2. Testing H2: $RQt = \alpha 2 + \beta 2INNt + \varepsilon t$
3. Testing H3: $SDt = \alpha 3 + \beta 3GEt + \varepsilon t$
4. Testing H4: $SDt = \alpha 4 + \beta 4INNt + \varepsilon t$
5. Testing H5: $SDt = \alpha 5 + \beta 5RQt + \varepsilon t$

Mediation models:
To test for mediation effects, we used the (Baron & Kenny, 1986) approach.
6. Testing H6: $SDt = \alpha 6 + \beta 6GEt + \gamma 6RQt + \varepsilon t$
7. Testing H7: $SDt = \alpha 7 + \beta 7INNt + \gamma 7RQt + \varepsilon t$

Variable notations: SD_t (Sustainable Development Index at time t); GE_t (Green Economy Index at time t); INN_t (Innovation Index at time t); RQ_t (Regulatory Quality Index at time t); α (Intercept); β (Regression coefficients); ε_t (Error term)

Green Economy and Regulatory Quality

The transition toward a green economy that encompasses the adoption of renewable energy, resource efficiency, and fiscal incentives often necessitates a more sophisticated and well-structured regulatory framework. As highlighted in the UNEP Green Economy Report (UNEP, 2011), such a transformation requires enabling conditions, which include robust, adaptive policies, institutions, and regulations. This implies that when a country embarks on implementing green economy initiatives, policymakers are compelled to enhance the quality of regulatory systems to ensure effective and transparent execution.

From a theoretical perspective, the concept of ecological economics reinforces the view that green economy and regulatory policy are inherently interconnected. Some authors, such as (Sari & Setiyono, 2022); (Galuh et al. 2024); and (Jamaledini & Khazaei, 2024) emphasize that a green economy underscores the importance of good governance, which entails consistent, transparent, and predictable regulations as prerequisites for attracting green investment and achieving sustainable development. In the absence of strong regulatory quality, the transition toward a green economic model risks encountering obstacles such as policy uncertainty, weak accountability, and inefficiencies in implementation.
H1: There is a direct influence of green economy on regulatory quality

Innovation and Regulatory Quality

Innovation often moves faster than existing regulations, exposing the gaps that drive institutional change (Ranchordas, 2015); (Webster, 2019). Disruptive innovations, such as fintech or renewable energy, expose outdated frameworks, forcing regulators to refine policies for safety, fairness, and public benefit. As innovation expands, regulatory bodies are encouraged to improve their frameworks, ensuring that governance keeps pace with technological and societal development (Schot & Steinmueller, 2018).
H2: There is a direct influence innovation on regulatory quality.

Green Economy and Sustainable Development

The transition to a green economy encompasses the application of renewable energy, resource efficiency, and fiscal incentives to promote growth while maintaining ecological balance and social justice, in line with the concept of sustainable development (Mikhno et al. 2021); (Raihan et al. 2023). Empirically, these policies have been proven to create green jobs,

increase productivity, and reduce emissions and inequality, with studies demonstrating the positive impacts of green technology and a circular economy on well-being, economic growth, and environmental quality. Theoretically, the green growth and ecological modernization framework emphasizes that natural capital renewal, technological innovation, and environmentally friendly products not only support inclusive growth but also strengthen the environmental carrying capacity (Maier et al. 2020); (Jamaledini & Khazaei, 2024).
H3: There is a direct influence of green economy on sustainable development

Innovation and Sustainable Development

Innovation plays a crucial role in accelerating sustainable development through efficient, environmentally friendly, and inclusive products, processes, and business models (Ghobakhloo et al. 2021). Research by (Usman & Hammar, 2021); (Raihan et al. 2023) shows that innovation, especially environmentally oriented innovation, can increase competitiveness, reduce ecological impacts, and address global challenges such as climate change and inequality.
H4: There is an influence of innovation on sustainable development.

Regulatory Quality and Sustainable Development

Regulatory quality plays a crucial role in supporting sustainable development through clear, consistent, and effective policies, thus creating a conducive environment for efficient and equitable resource management (Rohmy & Nihayaty, 2023). According to (Ashford & Hall, 2011), good regulations encourage private sector growth, maintain economic stability, and guide behavior toward environmentally friendly, inclusive, and sustainable practices. Research by (Galuh et al. 2024); (Ranchordas, 2015) Meuleman and Niestroy (2015) confirms that high-quality, transparent, predictable, and evidence-based regulations can enhance policy effectiveness, build public trust, and reduce the risk of uncertainty, thereby simultaneously strengthening economic, social, and environmental outcomes.
H5: There is a direct effect of regulatory quality on sustainable development.

Mediating Role of Regulatory Quality in the Relationship Between Green Economy and Sustainable Development

The adoption of a green economy depends on effective governance that converts environmental and economic goals into actionable policies, with regulatory quality serving as a key mediator. Strong regulatory frameworks are marked by coherent rules, transparent enforcement, and institutional stability; they enhance policy predictability, foster innovation, and align market incentives with sustainability objectives, enabling green investments to deliver lasting socio-economic and environmental benefits(Chang et al. 2023); (Rohmy & Nihayaty, 2023); (Akpobome, 2024). Without such quality regulation, green economy initiatives risk falling short of their potential in driving sustainable development.
H6: Green economy affects sustainable development through regulatory quality as a mediator.

Mediating Role Regulatory Quality in the Relationship Between Innovation and Sustainable Development

Innovation can advance sustainable development through cleaner technologies, efficient processes, and new business models; however, its impact depends on a robust regulatory framework. High-quality regulations characterized by clear, consistent, and enforceable rules ensure that innovation supports sustainability (Li & Hu, 2021). Countries with strong regulatory institutions are better able to translate innovation into lasting sustainability gains (Ranchordas, 2015).
H7: Innovation influences sustainable development through regulatory quality as a mediator

The research framework illustrates how a Green Economy and Innovation act as independent variables that influence Sustainable Development both directly and indirectly through Regulatory Quality, which serves as a mediating variable. Hypotheses H1 and H2 examine the direct impact of the Green Economy and Innovation on Regulatory Quality, while H3 and H4 assess their direct effects on Sustainable Development. H5 evaluates the direct relationship between Regulatory Quality and Sustainable Development, and H6 and H7 test the mediating role of Regulatory Quality in the relationship between independent variables and Sustainable Development. Figure 1 provides an overview of the research framework.

RESULTS

Descriptive Statistic

Descriptive statistics is a method used to summarize and describe the main features of a dataset through numerical measures, such as the mean, minimum, maximum, and standard deviation. It provides a quick overview of trends, variations, and patterns in data. Over the past decade, Indonesia has demonstrated gradual but promising progress in its sustainability efforts, as reflected in the dynamics of its green economy, innovation, regulatory quality, and sustainable development indices. The descriptive statistics for these variables are summarized in Table 1.

The Green Economy Index in Indonesia has shown a steady upward trend over the last decade. With an average value of 53.6**,** the index moved from its lowest point of 47.2 in 2011 to its highest point of 59.2 in 2020**.** The standard deviation of 4.1 indicates a moderate but consistent improvement year over year, highlights Indonesia's growing efforts to promote environmentally sustainable policies and practices.

Indonesia's Innovation Index averaged 29.5 during the observed period, reflecting relatively stable innovation performance. The index peaked at 32.0 in 2013, likely marking a period of accelerated digital growth, and dropped to its lowest of 26.5 in 2020**.** Despite this fluctuation, the standard deviation of 1.7 suggests limited variability, meaning innovation efforts were relatively consistent, though slightly declining toward the end of the decade.

Among the four indicators, the Regulatory Quality Index displayed the highest variation. It ranged from a minimum of -0.20 in 2015, to a maximum of 0.22 in 2020**,** with an average value of -0.01. A standard deviation of 0.1 indicates notable fluctuations in the quality of regulatory governance. However, the positive value achieved in 2020 marks a potential shift toward better institutional and regulatory frameworks in Indonesia.

The Sustainable Development Index recorded consistent upward movements throughout the decade. Starting at 61.5 in 2011**,** it reached its highest level of 68.4 in 2020**,** with an overall average of 64.8**.** A standard deviation of 2.4 indicates moderate variation, reinforces the interpretation that Indonesia has made steady progress in aligning its national agenda with long-term sustainability goals.

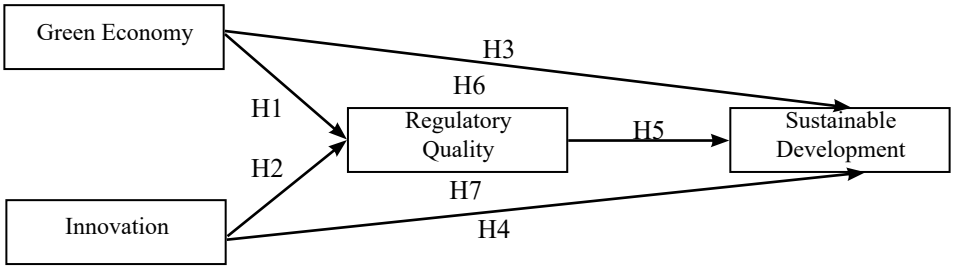

Figure 1. Research framework

Table 1. Descriptive analysis

Variable	Green Economy Index (GEI)	Indonesia's Innovation Index (INN)	Regulatory Quality Index (RQI)	Sustainable Development Index (SDI)
Mean	53.6	29.5	-0.01	64.8
Max.	59.2	32.0	0.22	68.4
Min.	47.2	26.5	-0.15	61.5
Std. Dev.	4.1	1.7	1.10	2.4

Classical Assumption Test

the Jarque-Bera probability value in Figure 2 of the normality test findings was 0.639157 (> 0.05). The data can be characterized as normally distributed. The multicollinearity test was passed, as shown by the results presented in Table 2, which confirmed that the VIF value of the dependent variable was less than 10.

The findings of the Breusch-Pagan-Godfrey method's heteroscedasticity test are shown in Table 3. It can be concluded that the data passed the test because of its Obs*R-squared value of 0.6624 (>0.05).

As shown in the results of the autocorrelation test utilizing the Breusch-Godfrey Serial correlation LM test technique in Table 4, the data passes the autocorrelation test with an Obs*R-squared probability of 0.3506 (>0.05).

Hypotheses Test

The hypothesis regarding the partial influence of each independent variable on the dependent variable was tested using a t-test. When the t-statistic was greater than 1.96, or the p-value was less than 0.05, it was considered significant. On the other hand, t-statistics less than 1.96 or p-value more than 0.05 are regarded as insignificant (Brooks, 2008). Table 5 summarizes the results of the t-tests.

The findings of the regression analysis demonstrated that the Green Economy had no substantial effect on Regulatory Quality (p-value = 0.1071); thus, hypothesis H1 was rejected. These results indicate that the transition to a green economy in Indonesia is not sufficiently strong to encourage improvements in regulatory quality. This is likely due to limitations in policy coordination and high adaptation costs (Khan et al. 2021). The outcome aligns with the research by (Shuai & Fan, 2020) found that there is a "U" shaped relationship between regulation and green economic efficiency. In the early stages, increased regulation hinders green economic efficiency due to high adjustment costs and a lack of policy synergy. This shows that the impact of the green economy on regulation may only be observed after reaching a certain equilibrium point in policy implementation (Zhu et al. 2023).

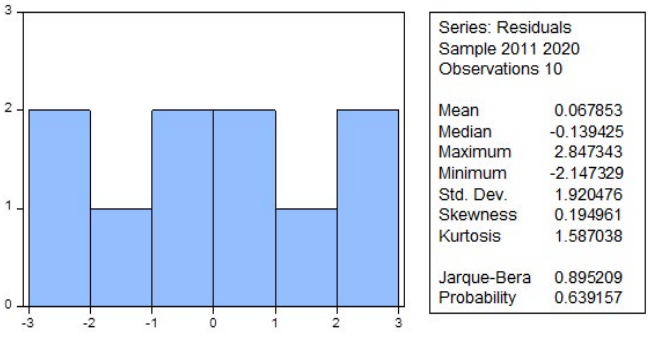

Figure 2. Result of normality test

Table 2. Findings from the Multicollinearity Test

Variable	Coefficient Variance	Uncentered VIF
Green Economy Index (GEI)	48.9060	2.976492
Indonesia's Innovation Index (INN)	16.3990	3,006192
Regulatory Quality Index (RQI)	152.3913	2.629774

Table 3. Findings from Heteroscedasticity Test

F-statistic	5.463066	Prob. F(3,6)	0.3076
Obs*R-squared	7.320136	Prob. Chi-Square(3)	0.6624
Scaled explained SS	1.111764	Prob. Chi-Square(3)	0.7742

Table 4. Findings from Autocorrelation Test

F-statistic	5.092344	Prob. F(2,5)	0.6022
Obs*R-squared	6.707209	Prob. Chi-Square(2)	0.3506

Table 5. t-Test Results

Hypotheses	Coefficient	Std. Error	t-Statistic	Prob.	Decision
H1. Green economy → Regulatory Quality	0.012569	0.006925	1.815056	0.1071	Rejected
H2. Innovation → Regulatory Quality	-0.035380	0.015349	-2.305003	0.0501	Accepted
H3. Green economy → Sustainable Development	0.555714	0.073465	7.564292	0.0001	Accepted
H4. Innovation → Sustainable Development	-0.303076	0.493271	-0.614420	0.5560	Rejected
H5. Regulatory Quality → Sustainable Development	15.33299	7.200686	2.129378	0.0001	Accepted
H6. Green economy → Regulatory Quality → Sustainable Development	0.512474	0.088275	5.805395	0.0007	Accepted
H7. Innovation → Regulatory Quality → Sustainable Development	19.82687	9.559400	2.074070	0.0018	Accepted

These findings indicate that green economy implementation in Indonesia still faces challenges when integrating green policies with an effective regulatory framework. Previous studies have shown that, in the early stages, environmental regulations are often not in line with green economic goals because of high adaptation costs and lack of coordination between institutions (Zhu et al. 2023). Therefore, efforts are needed to strengthen the coordination between green economy policies and regulations, for example, through fiscal incentives or pilot programs that link sustainability targets with regulatory reforms.

Innovation has a significant adverse impact on Regulatory Quality (p-value = 0.0501); thus, so that hypothesis H2 is accepted. These results indicate that, despite the potential for innovation to improve efficiency and sustainability without adaptive regulation, innovation can create regulatory uncertainty. Previous studies have shown that innovation that is not accompanied by flexible and adaptive policies can hinder regulation effectiveness of regulation (Grandis et al. 2023); (Akpobome, 2024).

These findings underline the importance of adaptive regulation in dealing with innovation developments, especially in green sectors such as renewable energy and environmentally friendly transportation. Without flexible regulations, innovation can create uncertainty that hinders progress. Therefore, the government must develop a regulatory framework that is responsive to technological development and innovation.

The green Economy has a substantial influence on Sustainable Development (p = 0.0001); therefore, hypothesis H3 is accepted. This finding confirms that the green economy approach plays an essential role in accelerating sustainable development in Indonesia. This result is consistent with earlier research showing that green economy policies can encourage sustainable development through increased energy efficiency and reduced environmental impacts (Söderholm, 2020). However, success is highly dependent on effective policies and regulatory support. Therefore, the government must strengthen green economy policies, such as incentives for renewable energy and emission reduction programs, to accelerate the transition to sustainable development.

The results of the evaluation indicate that innovation does not significantly impact Sustainable Development (p-value = 0.5560); thus, so that hypothesis H4 is rejected. This shows that, although innovation is considered a driver of change, its impact on sustainable development may not always be felt directly or significantly in the short term. This finding indicates that innovation requires adequate policy and infrastructure support to significantly contribute to sustainable development. Prior research has demonstrated that initiatives to increase energy efficiency and innovate green technologies can contribute to a decrease in carbon emissions, but their impact on sustainable development indicators is not always easily detected (Cortés et al. 2021). Therefore, the government must establish an atmosphere that encourages innovation, including adequate incentive policies and infrastructure, to ensure that innovation positively contributes to sustainable development.

Regulatory Quality has a significant effect on Sustainable Development (p = 0.0001); therefore, hypothesis H5 is accepted. This finding is supported by the GRI and USB (2020) study, which shows that good regulation can strengthen sustainable development through more effective policies. This finding confirms that regulatory quality plays an important role in the promotion of sustainable development. Effective regulation can ensure that green economy and innovation policies

are optimally implemented to achieve sustainability goals. Therefore, the government must improve regulatory quality through policy reforms and better law enforcement mechanisms.

Although the Green Economy does not have a significant effect on Regulatory Quality (H1 is rejected), Regulatory Quality still acts as a mediator in the relationship between the Green Economy and Sustainable Development. This is in line with the research of (Setyanto & Pramasha, 2023) who found that effective regulation can strengthen the implementation of green practices. Thus, Hypothesis H6 is accepted. This finding shows that, although the Green Economy does not directly affect Regulatory Quality, effective regulation can strengthen the impact of the green economy on sustainable development. Therefore, the government needs to strengthen the regulatory framework to ensure that green economic initiatives contribute effectively to sustainable development.

Innovation has a significant effect on Regulatory Quality (H2 is accepted) and Regulatory Quality has a significant effect on Sustainable Development (H5 is accepted). Therefore, Regulatory Quality acts as a mediator in this relationship. Thus, hypothesis H7 was partially accepted. This finding is in line with study of (Kasztelan, 2017) which states that effective regulation can be a bridge between innovation and sustainability. This finding underlines the importance of adaptive regulation in ensuring that innovation, especially in green technology, can be effectively adopted and has a positive impact on sustainable development. Without adequate regulation, innovation may not reach its full potential, and may even create uncertainty that hinders progress.

Managerial Implication

This study highlights that while green economy efforts directly foster sustainable development, they fall short in enhancing regulatory quality, meaning that such initiatives need to be backed by institutional reforms to truly drive systemic change. Interestingly, innovation appears to negatively affect regulatory quality but does not directly boost sustainability, suggesting a gap between technological advancement and regulatory readiness. However, regulatory quality emerges as the key enabler that amplifies the impact of both the green economy and innovation on sustainable development. Therefore, policymakers and industry leaders should treat regulatory improvement not as a formality, but as a strategic priority to unlock the full potential of green and innovative growth.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The results of the study in Indonesia show that a green economy has no significant effect on Regulatory Quality, while innovation has a significant negative effect on regulatory quality. This shows that even though a green economy is implemented, the regulations that support it have not developed optimally. In contrast, innovation faces challenges in regulations that are less adaptive to technological changes. However, a green economy has been proven to have a significant effect on sustainable development, which shows that green economic policies can encourage sustainability. Meanwhile, innovation does not have a significant effect on sustainable development, which indicates that the innovation has not been fully directed at sustainability. Regulatory quality has a significant effect on sustainable development and continues to play a role as a mediator in the relationship between the green economy and sustainable development, as well as the relationship between innovation and sustainable development. This indicates that effective regulation is a key factor in ensuring the impact of the green economy and innovation on sustainability.

Recommendations

Based on these conclusions, the author provides several recommendations aimed at ensuring that green economy and innovation policies can develop sustainably within a high-quality regulatory framework in Indonesia. 1). Improving regulations that support the green economy. The government needs to strengthen policies and regulations that better support the implementation of the green economy so that its impact on sustainable development is increasingly optimal. 2) Strengthening innovation policies in line with regulations. Given that innovation has a negative impact on the quality of regulations, alignment is needed between innovation policies and regulations, so that the innovations that develop remain within a framework that supports sustainable development. 3) Improving the quality of regulations is key. As the quality of regulation has been proven to play an important role in sustainable

development, the government needs to improve the effectiveness of policies by ensuring compliance and proper implementation in various sectors. 4). Encouraging synergy between green economy, innovation, and regulation. Coordination is needed between ministries and institutions to design policies that can balance green economic growth and innovation without sacrificing the quality of regulations needed for sustainable development. 5) Strengthening regulatory institutions' capacities The government must improve the capacity of institutions to formulate, supervise, and enforce regulations that support green economic growth and innovation, without hindering sustainable development.

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