

Building Sustainability in Higher Education through Green Management and Innovation: A Case Study of Private Universities in Jakarta

Ahmad Hidayat Sutawaidjaya¹, Muhammad Yusuf², Edi Hamdi³

Abstract

This study analyzes the causal relationship between green management, supply chain management, and organizational culture on the sustainability of higher education institutions, with green innovation as a mediating factor. Data were collected from private universities in Jakarta and compared with global benchmarks such as the Times Higher Education Impact Rankings and the UI GreenMetric World University Rankings. Using SEM-PLS for analysis, the results show that green management, supply chain management, and organizational culture each positively influence the sustainability of higher education institutions. The study demonstrates how green management practices and organizational culture affect sustainability in higher education. International comparisons reveal similar trends globally, with green innovation playing a crucial mediating role.

Keywords: *Green Management, Supply Chain Management, Organizational Culture, Green Innovation, Higher Education Sustainability, Private Universities.*

Introduction

A green campus represents the efforts of the academic community to synergize goals, objectives, and work productivity to achieve maximum collective results in terms of health (Novianti et al., 2020). It encompasses the management of green building dimensions, water strength, food, transportation, waste, education, and environmental research (Calder & Dautremont-Smith, 2020). This commitment from the higher education sector aims to prioritize sustainability and promote improved living and learning environments (Tamiami, 2020; Vázquez-Brust et al., 2023). Essentially, a green campus environment is characterized by a harmonious coexistence between eco-conscious practices and education, where the implementation reflects environmental protection principles (Zaidi & Jamshed, 2021).

Sustainable higher education institutions refer to universities' concern for the environment, economy, and society, including the health impacts of resource use (Velazquez et al., 2020). Therefore, organizations must invest in, exploit, and use eco-friendly technologies and innovations that aim to efficiently use resources while enhancing ecological activities and productivity (Galdeano-Gómez et al., 2020).

Private universities in Indonesia participate in rankings based on the greenest and most sustainable campuses, such as the UI Green Metric World University Rankings (UIGM) 2023. UIGM is a Universitas Indonesia (UI) program that ranks world universities to assess their greening and sustainability efforts. The ranking criteria include Setting & Infrastructure (SI) 15%, Energy & Climate Change (EC) 21%, Waste (WS) 18%, Water (WR) 10%, Transportation (TR) 18%, and Education & Research (ED) 18%. These six criteria serve as indicators to measure green space levels, university zoning profiles, setting and infrastructure, water usage, transportation, waste management, energy and climate change, and impactful education and research. The top 10 private universities in Indonesia according to UI Green Metric 2023 are Telkom University (Tel-U), Universitas Islam Indonesia (UII), Universitas Muhammadiyah Yogyakarta (UMY), Universitas Multimedia Nusantara (UMN), Universitas Medan Area (UMA), Universitas Muhammadiyah Malang (UMM), Universitas Budi Luhur (UBL), Universitas Pancasila (UP), Universitas Esa Unggul (UEU), and Universitas Teknokrat Indonesia (UTI).

¹ Faculty Economics and Business, University of Esa Unggul, Indonesia, Email: ahmad.hidayat@esaunggul.ac.id, (Corresponding Author), ORCID: 0000-0001-8310-2528

² University of Cyber, Indonesia, Email: muhhammad.yusuf@cyber-univ.ac.id

³ Faculty Economics and Business, University of Esa Unggul, Indonesia, Email: edi.hamdi@esaunggul.ac.id

Green innovation is a determinant of higher education sustainability, which Faucheux & Nicolai (2020) describe as new solutions to minimize environmental challenges while promoting sustainability goals. According to Albort-Morant et al. (2020), green technology provides two main benefits for organizations: commercial rewards from creating eco-friendly products and financial benefits that can enhance competitiveness.

Antecedents of green innovation and higher education sustainability include green management, which focuses on the voluntary prevention or reduction of pollution, waste, and emissions sustainably (Hart, 2020); green supply chain management practices used by businesses in their daily operations to help the environment (Laari et al., 2020); and organizational culture, which can be understood as an opportunity for a company to shape human behavior according to the company's desires (Esha & Dwipayani, 2021).

This research aims to analyze the impact of green management, supply chain management, and organizational culture on higher education sustainability, mediated by green innovation.

Literature Review

Higher Education Sustainability

Universities have a responsibility to protect the "health and well-being of humans and ecosystems" and use knowledge to "address current and future ecological and social challenges" (Cole, 2020). Efforts in energy and resource conservation, waste reduction, advancement of social justice, and ideas of equity must be transferred to society (Alshuwaikhat & Abubakar, 2020). Cortese (2020) defines universities as a four-dimensional system: education, research, campus operations, and community outreach. Sebire & Isabeles-Flores (2023) add a fifth dimension, stating that these dimensions need to be assessed and reported (Choi & Ng, 2020; Lozano, 2020). The triple bottom line, encompassing environmental, economic, and social dimensions, is traditionally seen as relevant for sustainability and sustainable development (Choi & Ng, 2020). Institutional sustainability is considered a separate dimension due to its relevance in supporting sustainable development (Pfahl, 2020).

From an environmental perspective in sustainable development, the aim is to reduce negative environmental impacts, such as waste management and utilizing ecological processes (Galdeano-Gómez et al., 2020). The challenges associated with the social dimension of sustainability involve finding a balance between the "needs" of communities and individuals, the capacity of nature, and economic well-being (Choi & Ng, 2020; Galdeano-Gómez et al., 2020). The institutional dimension of sustainability is related to governance aspects in sustainable development (Pfahl, 2020). It includes regulatory elements, policies established at the community level, and political support for development (Lozano, 2020). Economic sustainability can be recognized as the efforts of communities and organizations to manage their own impacts and business networks on life on Earth and its ecosystems (Wagner & Svensson, 2020; Shikalgar et al., 2024; Choi & Ng, 2020).

In summary, sustainability can be understood as development that includes environmental, social, institutional, and economic dimensions. Assessing sustainability and its individual dimensions is seen as a crucial driver of eco-friendly innovation (Kemp & Horbach, 2020).

Green Management

Green management is environmentally conscious business management that focuses on the voluntary prevention or reduction of pollution, waste, and emissions in a sustainable manner (Hart, 2020; Dwyer et al., 2020). This concept is rooted in the theory of sustainable development, which emphasizes the need to balance economic growth, environmental protection, and social equity (Brundtland Commission, 1987). According to the resource-based view (RBV) of the firm, companies that adopt green management practices can gain a competitive advantage by leveraging their unique capabilities to create value in a way that is difficult for competitors to replicate (Barney, 1991). Therefore, a company's green management must address legal issues and involve practices and conceptual tools such as eco-friendly production, green

marketing, eco-friendly design, and integrating environmental considerations into the organization's long-term goals (Lee, 2020). Additionally, stakeholder theory suggests that companies that engage in green management can enhance their relationships with key stakeholders, including customers, employees, and investors, by demonstrating their commitment to environmental stewardship (Freeman, 1984).

Green Supply Management

Green supply chain management is the integration of eco-friendly initiatives into every aspect of the supply chain, from resource design to end-product management services (Agyapong et al., 2023; Laari et al., 2020; Wiredu et al., 2024). Green supply chain management includes product creation, distribution processes to customers, and the initial stages of product design through to product use (Chiu & Hsieh, 2020). It involves internal environmental management, eco-friendly design, external green supply chain practices, eco-friendly practices, and customer collaboration used by businesses to implement green supply chain management (Ahmed et al., 2020; Choi et al., 2020). Some aspects include stakeholder support, legitimacy, and resources, which are more easily obtained when companies focus on green supply chain management strategies (Bu et al., 2020; Choi et al., 2020).

Organizational Culture

Organizational culture is a set of rules that must be collectively understood as a form of behavior within a company (Ardis et al., 2023; Esha & Dwipayani, 2021). There are four dimensions to measure corporate culture: clan culture, which emphasizes intimacy among members; adhocracy culture, which fosters creativity and entrepreneurship; market culture, which creates competitive advantage; and hierarchy culture, which focuses on proper rules desired by an organization (Liu et al., 2020). This research measures organizational culture using clan culture and hierarchy culture. These cultures can create unity across all levels of management (Elkelish & Hassan, 2020).

Green Innovation

Green innovation is related to sustainable performance including environmental and social dimensions (Ramus, 2020). This perspective is supported by (Asadi et al., 2020) in the business context developing a framework that assesses the relationship between green innovation and sustainable performance (Faucheux & Nicolai, 2020) describing green innovation as a new solution to minimize environmental challenges while driving sustainability goals. (Shahzad et al., 2020)

Hypothesis Development

Green Management and Sustainability of Higher Education

Strategies and competitive advantages are likely to be based on qualities that enable eco-friendly economic activities (Raut et al., 2020). According to the triple bottom line (TBL) approach, a company's sustainable performance is measured through three key indicators: social, environmental, and economic (Hourneaux et al., 2020). Economic performance is evaluated based on operational and financial indicators, which are operationally linked to the organization's capacity to reduce input costs, energy consumption, and waste processing and disposal (Afum et al., 2020). Environmental performance relates to a business's ability to conserve energy, reduce waste, and minimize the use of harmful inputs (Yang et al., 2020). Social performance evaluates the extent to which an organization contributes to society beyond economic interests, ensuring that industries generate profit without harming the community (Huo et al., 2020).

However, some investigations have found no relationship between eco-friendly management and financial performance (Link & Naveh, 2020). Novianty (2024) found that green management positively impacts financial and operational performance through reduced production costs, minimized environmental damage, energy consumption efficiency, and the potential to open new green market opportunities. Additionally, it enhances corporate image and eco-friendly technology, improves competitive strategies,

and increases social and health benefits (Shrivastava, 2020), ultimately positively affecting economic performance. Therefore, the following hypothesis can be proposed:

H1 = Green Management Positively Affects Higher Education Sustainability

The implementation of Green Supply Chain Management (GSCM) practices has been linked to various organizational benefits, such as cost reduction, enhanced environmental sustainability, improved corporate image, and increased customer loyalty (Mohanty & Prakash, 2020). Therefore, Green Supply Chain Management has attracted significant attention from both academic researchers and industry professionals as a strategy to achieve sustainability goals and comply with environmental mandates (Lin et al., 2020).

The adoption of Green Supply Chain Management (GSCM) practices is influenced by various factors. The impact of environmental regulations and policies on organizational environmental initiatives and the implementation of Green Supply Chain Management is considered significant (Bolaji et al., 2024). The regulatory framework sets guidelines and incentives that encourage businesses to adopt sustainable practices throughout their supply chains. Complying with environmental regulations not only helps to avoid legal consequences but also contributes to the advancement of corporate social responsibility (CSR) and reputation (Türkeş et al., 2024). The implementation of Green Supply Chain Management (GSCM) has been shown to be significantly influenced by consumer demand for eco-friendly products and services (Lin et al., 2020).

H2 = Supply Chain Management Positively Affects Higher Education Sustainability

A good corporate culture can enhance the company's value. Research by Savić et al. (2023) states that a superior organizational culture has built investor confidence and positively impacted the company's value. It is emphasized that the goal is to encourage the creation, acquisition, dissemination, and use of knowledge (Durmus, 2024). Therefore, it can be assumed that different types of organizational culture influence how employees understand and implement corporate sustainability (Linnenluecke & Griffiths, 2020).

H3 = Organizational Culture Positively Affects Higher Education Sustainability

Eco-friendly innovation is often classified into eco-friendly product innovation and eco-friendly process innovation (Chang & Chen, 2020). Ismail et al. (2020) categorize eco-friendly innovation into product design and manufacturing process aspects. Senior management support is one of the main drivers of successful innovation implementation (Kola, 2020; Zhu & Sarkis, 2020). Therefore, this study defines eco-friendly innovation as comprising eco-friendly product innovation, eco-friendly process innovation, and eco-friendly managerial innovation (Rao & Holt, 2020). They identify that supplier greening initiatives indeed result in greener suppliers and more eco-friendly innovations. Finally, research shows that internal managerial support for eco-friendly initiatives is one of the main drivers of successful implementation of environmental management systems and practices (Zhu & Sarkis, 2020).

H4: The Effect of Green Innovation Mediates Green Management on Higher Education Sustainability

Environmental issues have become a part of strategic planning within organizations due to increasing customer concerns about environmental issues (Handfield et al., 2020). As a result, long-term strategic advantages can be developed through close collaboration with suppliers (Chan, 2020). Partnership and evaluation systems are necessary to ensure that appropriate quality levels of products and services can be achieved (Sarkis, 2020). This involves significant changes in the attitudes of companies that wish to form closer relationships with suppliers, which require time and resource investment from both parties (Lettice et al., 2020). These companies need to work with their suppliers to provide adequate guidance, advice, and assistance, and to share knowledge and skills to help them become more 'eco-friendly'. To achieve this, many large companies have established their own environmental standards for their suppliers (Rao & Holt, 2020).

H5: The Effect of Green Innovation Mediates Supply Chain Management on Higher Education Sustainability

Savić et al. (2023) state that organizational culture encompasses values and behaviors that contribute to an organization's unique social and psychological environment. Organizational culture is also linked to performance. Ardis et al. (2023) found that a positive organizational culture is significantly related to company performance. In addition to creating an innovative eco-friendly culture, it is essential for every company to manage green innovation. According to Linnenluecke & Griffiths (2020), a green organizational culture influences business performance by enhancing the company's value image and increasing green innovation, which also positively impacts company performance.

H6: The Effect of Green Innovation Mediates Organizational Culture on Higher Education Sustainability

Research reveals that knowledge management processes drive eco-friendly innovation, which in turn impacts a company's sustainable performance, including environmental, economic, and social dimensions (Burki et al., 2020). In the education sector, Gu (2023) shows a significant positive impact of eco-friendly innovation on economic performance. Saunila et al. (2020) found that eco-friendly innovation effectively reduces environmental pollution and resource consumption. Li et al. (2020) and Huong et al. (2021) propose that the interaction between eco-friendly innovation and company performance is moderated by environmental management. Research combining the terms innovation and sustainability (Franceschini et al., 2020) has promoted four key terms: environmental innovation, eco-innovation, green innovation, and sustainable innovation (Schiederig et al., 2020). Chen et al. (2020) state that green innovation can refer to eco-friendly products and eco-friendly processes. Green innovation refers to innovations in products, processes, and organizations to achieve sustainable competitive advantage in an eco-friendly manner (Schiederig et al., 2020). According to Albort-Morant et al. (2020), green technology provides two main benefits for organizations: commercial rewards from creating eco-friendly products and financial benefits that can enhance competitiveness. Regarding company performance, the achievement of green innovation in the fields of environment, market, finance, and knowledge is crucial at all stages of green innovation implementation (Huang et al., 2021).

H7: Green Innovation Positively Affects Higher Education Sustainability

The Methodology

The research methodology employs Structural Equation Modeling (SEM-PLS) to analyze data collected from tenured lecturers at private universities in Jakarta. SEM-PLS was chosen for its ability to evaluate both direct and indirect effects of independent variables on dependent variables.

To broaden the study's global relevance, future research could expand data collection to include universities from regions such as Europe, North America, and Asia. Comparative analysis using global frameworks like the Times Higher Education Impact Rankings will provide a clearer understanding of how different regions approach sustainability in higher education.

This study aims to analyze the causal relationship between green management, supply chain management, and organizational culture on green innovation and sustainability in higher education institutions. Data was collected from 100 tenured lecturers at various private universities in Jakarta, all of which have superior accreditation from the National Accreditation Board for Higher Education (BAN-PT). The universities involved in this study include Esa Unggul University (UEU), Atma Jaya Catholic University of Indonesia (Unika Atma Jaya), Bina Nusantara University (BINUS), Pelita Harapan University (UPH), Tarumanagara University (UNTAR), Trisakti University, Gunadarma University, and Mercu Buana University (UMB). Data collection was conducted through questionnaires distributed to the tenured lecturers at these universities.

Using this methodology, the study hopes to provide better insights into how green management, supply chain management, and organizational culture can promote green innovation and sustainability in higher

education institutions. The results of this research are expected to offer practical recommendations for other universities in implementing sustainability and green innovation strategies.

Operationalization of Variables

The indicators for Green Management (X1) include Environmental Policy, Resource Management, and Emission and Waste Reduction (Dwyer et al., 2020). For Supply Chain Management (X2), the indicators are Process Efficiency, Quality and Customer Satisfaction, and Collaboration with Suppliers and Partners (Agyapong et al., 2023). Organizational Culture (X3) is measured by Organizational Values, Internal Communication, and Employee Involvement and Participation (Linnenluecke & Griffiths, 2020). Indicators for Green Innovation (Z) are Green Product Development, Green Production Processes, and the Use of Renewable Energy (Shahzad et al., 2020). Lastly, the indicators for Higher Education Sustainability (Y) include Policy and Governance, Resource Management, and Education and Curriculum (Velazquez et al., 2020).

By clearly defining these indicators, the study ensures that each variable is measured accurately and consistently. This operationalization allows for a more precise analysis of how green management, supply chain management, and organizational culture impact green innovation and sustainability in higher education institutions. Each indicator is grounded in previous research, providing a solid foundation for the study's methodology and contributing to the reliability and validity of the findings.

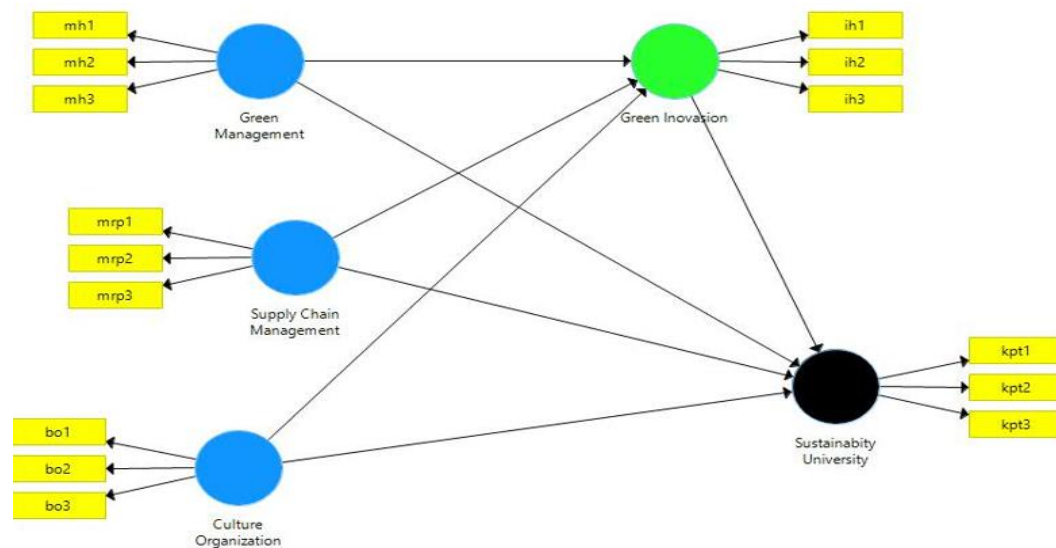


Figure 1. Model of Green Management, Supply Chain Management and Culture Organization and Sustainability University

Source: developed by Author, 2024

Results

Below are the results of statistical test processing as follows:

Tables 1. Outer Loadings

Below are the results of statistical test processing as follows:

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ((O/STDEV))	P Values
bo2 <- Culture Organization	0.821	0.817	0.054	15.276	0.000
bo3 <- Culture Organization	0.841	0.842	0.041	20.753	0.000
ih1 <- Green Inovasion	0.709	0.707	0.070	10.095	0.000
ih2 <- Green Inovasion	0.806	0.807	0.036	22.292	0.000
ih3 <- Green Inovasion	0.864	0.864	0.027	31.906	0.000
kpt1 <- Sustainability University	0.778	0.775	0.049	15.906	0.000
kpt2 <- Sustainability University	0.758	0.765	0.056	13.450	0.000
kpt3 <- Sustainability University	0.795	0.794	0.041	19.491	0.000
mh1 <- Green Management	1.000	1.000	0.000		
mrp1 <- Supply Chain Management	0.709	0.704	0.100	7.124	0.000
mrp2 <- Supply Chain Management	0.821	0.825	0.040	20.447	0.000
mrp3 <- Supply Chain Management	0.810	0.804	0.065	12.527	0.000

Source: developed by Author, 2024

Based on the outer loading, the Original Sample value is greater than 0.7 with a p value stat of less than 0.05, meaning it is valid.

Quality Criteria

Based on R square, it shows the strength of the model of green innovation of 0.471 and sustainable university of 0.552 which can be explained by the independent variables.

Tables 2. R Square

	R Square	R Square Adjusted
Green Inovasion	0.471	0.455
Sustainability University	0.552	0.533

Tables 3. Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Culture Organization	0.552	0.553	0.817	0.690
Green Inovasion	0.708	0.724	0.837	0.633
Green Management	1.000	1.000	1.000	1.000
Supply Chain Management	0.680	0.688	0.824	0.611

Sustainability University	0.674	0.678	0.820	0.604
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Source: developed by Author, 2024

Composite reliability, Cronbach alpha and AVE values greater than 0.05 mean valid and reliable

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Culture Organization -> Green Inovasion -> Sustainability University	0.360	0.368	0.091	3.950	0.000
Green Management -> Green Inovasion -> Sustainability University	0.099	0.101	0.056	2.764	0.078
Supply Chain Management -> Green Inovasion -> Sustainability University	0.026	0.030	0.058	2.443	0.058

Source: developed by Author, 2024

- Culture Organization -> Green Innovation -> Sustainability University of 0.360 with a p value of t-stat less than 0.10
- Green Management -> Green Innovation -> Sustainability University of 0.099 with a p value of t-stat less than 0.10
- Supply Chain Management -> Green Innovation -> Sustainability University of 0.026 with a p value of tstat less than 0.10

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Culture Organization -> Green Inovasion	0.576	0.583	0.084	6.828	0.000
Culture Organization -> Sustainability University	0.334	0.336	0.123	2.728	0.007
Green Inovasion -> Sustainability University	0.625	0.632	0.126	4.960	0.000

Green Management -> Green Inovasion	0.159	0.159	0.080	2.001	0.046
Green Management -> Sustainability University	0.210	0.210	0.080	2.640	0.009
Supply Chain Management -> Green Inovasion	0.041	0.045	0.092	2.450	0.065
Supply Chain Management -> Sustainability University	0.175	0.187	0.126	2.383	0.016

Source: developed by Author, 2024

- Culture Organization -> Green Innovation of 0.576 with p values t-stat 0.10
- Culture Organization -> Sustainability University of 0.334 with p values t-stat 0.10
- Green Innovation -> Sustainability University of 0.625 with p values t-stat 0.10
- Green Management -> Green Innovation of 0.159 with p values t-stat 0.10
- Green Management -> Sustainability University of 0.210 with p values t-stat 0.10
- Supply Chain Management -> Green Innovation of 0.041 with p values t-stat 0.10
- Supply Chain Management -> Sustainability University of 0.175 with p values t-stat 0.10

Discussion

Green Management Towards Higher Education Sustainability

Green management positively impacts higher education sustainability, supporting the hypothesis and aligning with the views of Hart (2020), Dwyer et al. (2020), Lee (2020), Novianty (2024), and Shrivastava (2020). Green management involves environmentally conscious business practices that focus on the voluntary prevention or reduction of pollution, waste, and emissions in a sustainable manner.

Green management positively influences financial and operational performance by reducing production costs, minimizing environmental damage, improving energy consumption efficiency, and creating opportunities in untapped green markets. Additionally, it enhances corporate image, promotes eco-friendly technologies, strengthens competitive strategies, and provides social and health benefits.

Supply Chain Management Towards Higher Education Sustainability

Supply chain management positively impacts higher education sustainability, supporting the second hypothesis in alignment with Agyapong et al. (2023), Laari et al. (2020), Wiredu et al. (2024), Mohanty & Prakash (2020), and Lin et al. (2020). Green supply chain management (GSCM) integrates internal environmental management initiatives, eco-friendly design, external green supply chain practices, and customer collaboration used by businesses to implement sustainable supply chain management. The implementation of GSCM practices has been linked to various benefits for organizations, such as cost reduction, enhanced environmental conservation, improved corporate image, and increased customer loyalty.

Organizational Culture Towards Higher Education Sustainability

Organizational culture positively impacts higher education sustainability, supporting the views of Ardis et al. (2023), Esha & Dwipayani (2021), Savić et al. (2023), Durmus (2024), and Linnenluecke & Griffiths (2020). Organizational culture is a set of rules collectively understood as a form of behavior within a company. A good corporate culture can enhance the company's value. Superior organizational culture has built investor confidence and positively impacted the company's value. Therefore, it can be assumed that different types of organizational culture influence how employees understand and implement corporate sustainability.

Green Innovation Mediates the Effect of Green Management on Higher Education Sustainability

Green innovation mediates the effect of green management on higher education sustainability, supporting the views of Chang & Chen (2020), Kola (2020), Zhu & Sarkis (2020), and Rao & Holt (2020). Senior management support is one of the main drivers of successful innovation implementation. Therefore, this study defines eco-friendly innovation as comprising eco-friendly product innovation, eco-friendly process innovation, and eco-friendly managerial innovation. Supplier greening initiatives indeed result in greener suppliers and more eco-friendly innovations. Finally, the research indicates that internal managerial support for eco-friendly initiatives is a key driver of successful implementation of environmental management systems and practices.

Green Innovation Mediates the Effect of Supply Chain Management on Higher Education Sustainability

Green innovation mediates the effect of supply chain management on higher education sustainability, aligning with the views of Handfield et al. (2020), Chan (2020), Sarkis (2020), Lettice et al. (2020), and Rao & Holt (2020). Strategic planning within organizations is essential due to increasing customer concerns about environmental issues. As a result, long-term strategic advantages can be developed through close collaboration with suppliers. Partnership and evaluation systems are necessary to ensure that the appropriate quality levels of products and services are achieved. To accomplish this, many large companies have established their own environmental standards for their suppliers (Rao & Holt, 2020).

Green Innovation Mediates the Effect of Organizational Culture on Higher Education Sustainability

Green innovation mediates the effect of organizational culture on higher education sustainability, supporting the views of Savić et al. (2023), Ardis et al. (2023), and Linnenluecke & Griffiths (2020). Organizational culture is also linked to performance, with findings showing that a positive organizational culture is significantly related to company performance. In addition to creating an eco-friendly innovative culture, it is important for each company to manage green innovation. A green organizational culture influences business performance by enhancing the company's value image, and increased green innovation also positively impacts company performance.

Green Innovation Towards Higher Education Sustainability

Innovations such as mobile hospitals and field clinics were also deployed to manage patient overflow in critical regions (Sarjito & Sutawidjaya 2024). Green innovation positively impacts higher education sustainability, supporting the views of Ramus (2020), Asadi et al. (2020), Faucheux & Nicolai (2020), Shahzad et al. (2020), Chen et al. (2020), Schiederig et al. (2020), and Huang et al. (2021). Green innovation offers new solutions to minimize environmental challenges while promoting sustainability goals. Green technology provides two main benefits for organizations: commercial rewards from creating eco-friendly products and financial benefits that can enhance competitiveness.

Conclusion

Green management influences higher education sustainability due to increased environmental policies, while supply chain management contributes by improving quality and customer satisfaction. Additionally, organizational culture impacts higher education sustainability through increased employee involvement and participation. Green innovation plays a mediating role in the effects of green management on higher education sustainability by promoting the use of renewable energy and implementing environmental policies. It also mediates the impact of supply chain management on sustainability by enhancing the use of renewable energy and improving quality and customer satisfaction. Furthermore, green innovation mediates the influence of organizational culture on sustainability by fostering renewable energy use and increasing employee involvement and participation. Overall, green innovation directly influences sustainability in higher education due to the increased use of renewable energy.

A green campus program aims to integrate environmental awareness into the intellectual activities of higher education institutions' three pillars: education, research, and community service. Higher education institutions have the capability and resources to incorporate environmental knowledge and values into their mission and programs. The importance of a green campus program is based on the following considerations:

-The complexity of environmental issues, - The potential for knowledge transfer that can be distributed through formal and non-formal education, involving students actively to foster awareness and concern for environmental management, - The increased interaction of students with their environment.

Implications

Actions Higher Education Institutions Can Take to Support Green Campus Programs in Education and Research.

Higher education institutions can support green campus programs in the education and research categories by implementing the following actions: 1) offering mandatory courses on environmental topics; 2) organizing seminars on green campus initiatives; 3) conducting public lectures on green campus initiatives; 4) running green campus campaigns through posters and stickers; 5) creating a dedicated green campus website; 6) using technology-enhanced learning methods; and 7) encouraging students to undertake environmental research projects. Additionally, higher education institutions should understand the significance of campus features that connect to the past (campus history) with current environmental issues.

Higher education institutions are central to sustainable development, as they play a crucial role in knowledge dissemination and communication through student initiatives. They are key stakeholders in policy-making and have experts who can address environmental issues.

For universities to be sustainable, they must not only teach concepts and philosophies of sustainability to their students but also embrace these concepts in their daily organizational management. Universities have been defined as four-dimensional systems (education, research, community outreach, and campus operations). Therefore, a sustainable university must implement, assess, and report on the three dimensions of sustainability (economic, environmental, and social).

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