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AI-enhanced human resource and green accounting: for achieving sustainable development performance in sharia bank industry

Satria Avianda Nurcahyo[1]*, Anisa Dewi Arismaya,[2] Fitri Dwi Jayanti,[1] Anis Malik Thoha[3]

[1] Universitas Ngudi Waluyo, Ungaran, Indonesia; [2] Universitas Islam Negeri Salatiga, Indonesia; [3] Universiti Islam Sultan Sharif Ali, Bandar Seri Begawan, Brunei Darussalam

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Abstract

Purpose - The purpose This study investigates the role of AI-enhanced human resources in environmental innovation strategy, green accounting, and sustainable development performance within the state-owned sharia banking sector.

Method - Using a quantitative approach and Structural Equation Modeling (SEM) Partial Least Squares (PLS), the research involves a sample of 250 employees from various state-owned sharia banks in Central Java.

Result - The results showed indicate that the implementation of AI in human resource management significantly contributes to environmental innovation strategy and green accounting, which in turn supports sustainable development performance. Additionally, green accounting is found to play a critical role in enhancing organizational sustainability performance.

Implication - These findings offer valuable insights for strategic policies in the sharia banking sector, aiming to achieve sustainable development goals through the integration of intelligent technology and eco-friendly practices in organizational operations.

Originality - This research provides the first insights that serve as a foundation for academics and policymakers to develop more comprehensive models for sustainable development in the sharia banking.

Keywords: AI-enhanced human resource; environmental innovation strategy; organizational sustainability; green accounting; sustainable development performance

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* Corresponding Author. Email: satriaavianda@unw.ac.id

Introduction

Sustainable development has become a pressing global issue as the strong impact of economic activities on the environment and social welfare continues to rise (Burhan, 2012; Zvesdov, 2012; Suraifi, 2022). In addressing this challenge, the business sector, especially banking, is urged to integrate sustainability principles into its operations (Moraes et al., 2019; Masruki et al., 2020; Biswas, 2021). One way to achieve this is by leveraging intelligent technologies, such as artificial intelligence (AI), which can enhance human resource effectiveness and support the implementation of more efficient, environmentally friendly strategies (Cui & Yasseri, 2024).

AI-enhanced human resources (AI-Enhanced Human Resources) have emerged as a key element in supporting organizational sustainability (Nurcahyo, 2024). The application of AI in human resource management allows for improved productivity, faster decision-making, and better talent management (Kumar & Yanamala, 2023). In this context, AI can help organizations not only maximize the potential of their human resources but also introduce more optimizations and integrated sustainability practices across various aspects of their operations.

On the other hand, green accounting has increasingly been recognized as an essential tool in measuring and reporting the environmental impact of corporate activities (llina, N. S., & Aris, 2022). Green accounting focuses on recording and reporting costs and benefits related to environmental aspects such as energy use, waste management, and conservation of natural resources. The implementation of green accounting provides higher transparency and accountability regarding the company's efforts to reduce its environmental footprint and contributes to sustainable development goals (Rehman et al., 2021). The relationship between AI-enhanced human resources and green accounting creates a new paradigm that supports sustainable development performance (Awan et al., 2023; Nawangsari & Sutawijaya, 2019). AI used to optimize human resource management can assist companies in implementing environmental innovation strategies more effectively. By enhancing human resources' capabilities in innovation and sustainability, AI plays a crucial role in enabling organizations to achieve more ambitious sustainability goals (Madanchian et al., 2023).

The sharia banking sector in Central Java plays a significant role in supporting the achievement of sustainability goals, both through internal policies and the Corporate Social Responsibility (CSR) programs they implement. In this context, CSR programs focusing on environmental, social, and economic aspects are essential for creating positive impacts on local communities and maintaining the sustainability of the banks' operations (Oktaviana & Miranti, 2023). Based on the data collected, banks in Central

Java have demonstrated a strong commitment to sustainability through the implementation of various CSR programs.

For instance, Bank A achieved impressive results with 85% in environmental programs, 90% in social programs, and 80% in economic programs. This achievement reflects their efforts to integrate sustainability principles into every aspect of their operations. Bank A's environmental programs, such as carbon emission reduction and efficient waste management, have successfully minimized its carbon footprint. In addition, they have been actively involved in social empowerment programs that provide direct benefits to local communities. Furthermore, Bank A's economic programs demonstrate their strategic approach in ensuring that financial growth goes hand in hand with sustainability values.

Through initiatives such as providing green financing for environmentally friendly projects, supporting entrepreneurs engaged in sustainable businesses, and offering innovative financial products aligned with sharia and ethical principles, Bank A not only contributes to national economic development but also fosters a culture of responsible investment (Hikmah & Yazid, 2025). These efforts highlight the importance of aligning financial performance with environmental stewardship and social responsibility, thereby creating a holistic impact that transcends profit orientation. By consistently applying sustainability principles, Bank A has managed to build stronger trust among stakeholders, attract environmentally and socially conscious investors, and ensure long-term business resilience in the face of global challenges such as climate change and economic inequality (Nurcahyo, Ferdianto, & Arismaya, 2025; Isa et al., 2021; Nurcahyo, Ferdianto, & Ayu, 2025). Their achievements serve as a benchmark for other financial institutions aiming to balance profitability with meaningful contributions to society and the environment.

On the other hand, Bank B has experienced lower CSR achievements. With 70% in environmental programs, 75% in social programs, and 65% in economic programs, Bank B still faces challenges in implementing certain aspects of sustainability. However, they are continuously working to improve their performance, especially in the areas of natural resource management and economic empowerment of local communities, which are two important aspects of achieving sustainability goals. Bank C, one of the top-performing banks, has achieved 95% in environmental programs, 90% in social programs, and 92% in economic programs. This success demonstrates that Bank C is not only focusing on environmental management but is also actively working to improve social welfare and economic empowerment. Their CSR programs include a range of activities such as environmental education, health outreach, and community-based economic empowerment that support local SMEs.

Meanwhile, other banks such as Bank D and Bank E show more moderate achievements, with total CSR performance ranging from 60% to 80%. Bank D, with a 77% achievement, and Bank E, with 61%, are still working to improve the quality of their CSR programs. Their initiatives have been more focused on social and economic sectors, but there is still room for improvement in environmental programs and better natural resource management. This indicates that while there is good awareness of sustainability, further strengthening of environmental programs is necessary for better resource management. The novelty of this research lies in integrating AI-enhanced human resource management with green accounting practices to achieve sustainable development performance in the Sharia banking industry. While previous studies have typically examined these aspects separately, focusing either on digital transformation in human resources or on environmental accounting, this study uniquely combines both dimensions within the framework of Islamic finance.

Moreover, green accounting can serve as a precise measurement tool to assess the impact of sustainability policies implemented by the company (Jermsittiparsert, 2021). With AI, the process of reporting and analyzing in green accounting can be conducted more accurately and efficiently. AI enables companies to process environmental data more intelligently and present relevant information faster, thus facilitating quicker and more informed decisions in sustainability management. The simultaneous application of these two concepts provides an opportunity for companies to enhance sustainable development performance comprehensively (Herder, 2024). Technology-driven management can create positive impacts not only in terms of operational efficiency and resource management but also in broader social and environmental effects (Agit & Muharram, 2024). Therefore, it is essential to further explore how AI-enhanced human resources and green accounting can mutually support the achievement of sustainable development goals.

Literature Review

AI-Enhanced Human Resources

AI-Enhanced Human Resources (HR) refers to the integration of artificial intelligence technologies in the management and optimization of human resources within an organization. By leveraging AI, HR departments can enhance various aspects of workforce management, including recruitment, training, performance evaluation, and employee engagement (Kumar & Yanamala, 2023). The use of AI in HR enables organizations to streamline administrative tasks, improve decision-making, and create a more efficient and data-driven approach to managing human capital (Wikaningrum & Kartikasari, 2023).

One of the key applications of AI in HR is the recruitment process. AI-powered tools can analyze resumes, match candidates with job descriptions, and even conduct initial interviews through chatbots or automated systems. These AI-driven processes significantly reduce the time and effort spent on manual screening, allowing HR professionals to focus on more strategic tasks. Moreover, AI can help eliminate bias by relying on objective data to make hiring decisions, promoting a more diverse and inclusive workforce (Uddin et al., 2023).

In addition to recruitment, AI-Enhanced HR also plays a significant role in employee development and performance management. AI algorithms can analyze employee performance data to identify strengths, areas for improvement, and career growth opportunities. This data-driven approach allows for personalized training programs and development plans that are tailored to the specific needs of each employee, fostering growth and enhancing overall productivity (Tirno et al., 2023). Furthermore, AI tools can provide real-time feedback to employees, helping them continuously improve and align their performance with organizational goals.

Another major advantage of AI in HR is its ability to improve employee engagement and retention. AI-driven tools can analyze employee satisfaction surveys, monitor employee sentiment through social media or internal communication channels, and predict potential issues that may lead to turnover (Freixanet et al., 2018). By identifying these issues early, HR can take proactive measures to address employee concerns and create a more positive and supportive work environment. This results in higher employee morale, better retention rates, and ultimately, a more engaged and loyal workforce.

Overall, AI-Enhanced Human Resources represents a significant shift towards a more data-centric and automated approach to managing human capital. By integrating AI technologies into HR processes, organizations can optimize their workforce management, enhance productivity, and foster a work environment that supports both employee and organizational success. As AI technology continues to evolve, its impact on HR practices is likely to increase, creating new opportunities for innovation and improvement in the way businesses approach talent management.

Environmental Innovation Strategy

Environmental Innovation Strategy refers to a proactive approach in which organizations integrate environmental sustainability into their business practices by developing and implementing innovative strategies that reduce environmental impact while improving organizational performance (Gunningham, 1998). This strategy encompasses the creation of new products, services, processes, or business models that

contribute to environmental preservation and enhance the long-term sustainability of the organization (Liu et al., 2020).

One key component of an environmental innovation strategy is the adoption of cleaner technologies. Organizations seek to minimize waste, reduce carbon emissions, and use resources more efficiently. For example, implementing renewable energy solutions, such as solar or wind power, or upgrading to energy-efficient machinery and processes can significantly lower an organization's environmental footprint (Raodatul Jannah, 2022). These initiatives not only reduce environmental harm but also often lead to cost savings over time, creating a win-win scenario for businesses and the planet. Another aspect of environmental innovation is sustainable product design. Companies increasingly focus on creating products that are durable, recyclable, and have minimal environmental impact throughout their life cycle (Hernandez-de-Menendez et al., 2020). This approach involves rethinking traditional product development by considering environmental factors from the early stages of design. It may also include using sustainable materials or packaging and ensuring that products are easy to recycle or reuse at the end of their life cycle.

In addition to product development, environmental innovation strategies also involve fostering a culture of sustainability within the organization (Julia & Kassim, 2020). This includes training employees on sustainable practices, encouraging eco-friendly behavior, and engaging with suppliers and customers to promote sustainable choices. By embedding sustainability into the organizational culture, businesses can create an environment where innovation thrives, and sustainable practices become a fundamental part of day-to-day operations.

In conclusion, an Environmental Innovation Strategy enables organizations to innovate while making a positive contribution to environmental sustainability (Majeed, 2022). By integrating sustainable practices into core business operations, companies can not only reduce their environmental impact but also create new growth opportunities, improve brand reputation, and meet the rising consumer demand for environmentally responsible products and services.

Organizational Sustainability

Organizational sustainability refers to an organization's ability to operate in a manner that meets present needs without compromising its ability to meet future needs (Achim, 2015). It encompasses a holistic approach that integrates environmental, social, and economic considerations into decision-making processes, ensuring long-term success while contributing to the well-being of the planet, people, and communities (SA Nurcahyo; BK Nurani; AM Thoha; FD Jayanti, 2024). Organizational sustainability is

about creating value for stakeholders, balancing profit generation with environmental stewardship and social responsibility (Draaisma et al., 2017).

A key aspect of organizational sustainability is environmental responsibility. Sustainable organizations actively work to reduce their environmental impact by adopting eco-friendly practices such as energy efficiency, waste reduction, and resource conservation (Jelli & Dura, 2023). This includes implementing initiatives like using renewable energy sources, minimizing carbon emissions, and ensuring sustainable sourcing of materials. By doing so, they contribute to the preservation of natural resources and help mitigate climate change, while also improving operational efficiency and reducing costs.

Social sustainability is equally important, focusing on the well-being and empowerment of employees, customers, and communities. An organization that prioritizes social sustainability fosters a fair, inclusive, and supportive work environment (Hermawati & Mas, 2017). This includes offering fair wages, providing professional development opportunities, and promoting diversity and inclusion within the workplace. Furthermore, socially responsible organizations engage with local communities through initiatives such as philanthropy, volunteering, and supporting educational or health programs that contribute to the overall social good.

Economic sustainability ensures that the organization remains financially viable and can continue to operate and grow over time. This involves making strategic decisions that support long-term profitability while considering the broader impacts on stakeholders, such as employees, customers, investors, and the community (Han et al., 2020). Companies with strong economic sustainability are not solely focused on short-term profits but also invest in innovative business practices, efficient operations, and ethical practices that ensure long-term success and resilience in an ever-changing market. In conclusion, organizational sustainability is a comprehensive approach that ensures a company can thrive over the long term while contributing positively to the environment, society, and economy. By balancing these three pillars environmental, social, and economic sustainability organizations can achieve not only financial success but also a positive impact on the world, creating lasting value for all stakeholders involved.

Green Accounting

Green accounting, also known as environmental accounting, is an accounting approach that incorporates environmental costs and benefits into financial decision-making (Khusnah, H., & Kirana, 2023). Traditional accounting focuses primarily on financial performance, while green accounting extends this scope by considering the impact of business activities on natural resources and ecological systems. This approach

enables organizations to assess their environmental footprint, comply with regulatory standards, and integrate sustainability into their long-term strategies (llina, N. S., & Aris, 2022).

The core principle of green accounting is to measure and report environmental costs associated with business operations. These costs may include pollution control, waste management, resource conservation, and carbon emissions (Yulianingsih, N. M., & Wahyuni, 2023). By quantifying these factors, companies can make informed decisions about resource allocation, investment in eco-friendly technologies, and compliance with environmental regulations. This system also promotes corporate social responsibility (CSR) by encouraging businesses to adopt sustainable practices.

One of the primary objectives of green accounting is to provide a comprehensive view of an organization's financial and environmental performance (Oktaviana & Miranti, 2023). Companies that incorporate this approach can improve their risk management strategies by identifying potential environmental liabilities. For example, industries with high pollution risks, such as manufacturing and mining, can use green accounting to track their environmental impact and implement mitigation measures before legal or financial consequences arise.

Green accounting also plays a crucial role in policy-making and economic planning. Governments and regulatory bodies use environmental accounting data to develop policies that promote sustainable economic growth. By integrating environmental factors into national accounts, policymakers can assess the long-term viability of economic activities and design incentive programs for businesses that adopt green initiatives (Kim et al., 2020). This approach aligns with global sustainability goals, including the United Nations Sustainable Development Goals (SDGs). Moreover, green accounting enhances transparency and accountability in corporate financial reporting (Bouteraa et al., 2020). Stakeholders, including investors, customers, and regulatory agencies, increasingly demand information about a company's environmental performance. Businesses that disclose their environmental costs and sustainability efforts can enhance their reputation, attract environmentally conscious investors, and gain a competitive advantage in the market.

Sustainable Development Performance

Sustainable Development Performance (SDP) refers to the ability of organizations, industries, and governments to achieve economic growth while ensuring environmental protection and social well-being (Sarkar, 2019). It measures how well a company or institution integrates sustainability principles into its operations, balancing profit generation with environmental responsibility and social equity. This concept aligns with

the United Nations Sustainable Development Goals (SDGs), which emphasize long-term economic, environmental, and social sustainability (Burhan, 2012).

A key component of SDP is economic sustainability, which ensures that businesses generate long-term financial growth without depleting natural resources. Companies that adopt sustainable business models focus on efficiency, innovation, and responsible resource management (van Assen, 2020). This includes investing in renewable energy, reducing waste, and optimizing production processes to minimize environmental harm while maintaining profitability. Environmental sustainability is another crucial aspect of SDP, as organizations must mitigate their ecological impact by reducing carbon emissions, conserving biodiversity, and implementing eco-friendly practices (Dewaelheyns et al., 2023). Many companies now incorporate green accounting principles and environmental performance metrics to track their sustainability efforts. These measures not only help reduce pollution but also enhance compliance with environmental regulations and global sustainability standards (Choiriah Siti, 2022).

Social sustainability is equally important, focusing on fair labor practices, community engagement, and ethical business conduct. Companies that prioritize social responsibility ensure fair wages, safe working conditions, and equal opportunities for employees (Manzoor et al., 2019). Additionally, businesses that contribute to local communities through corporate social responsibility (CSR) initiatives can improve their brand reputation and foster long-term relationships with stakeholders.

Measuring Sustainable Development Performance requires using sustainability indicators such as the Global Reporting Initiative (GRI), Environmental, Social, and Governance (ESG) criteria, and carbon footprint assessments (Jillani et al., 2024). These tools help organizations evaluate their sustainability impact and identify areas for improvement. Transparent sustainability reporting also strengthens stakeholder trust and enhances a company's competitive advantage in the market.In conclusion, Sustainable Development Performance is essential for businesses and institutions aiming for long-term success in a rapidly evolving global economy (AlNuaimi et al., 2021). By integrating sustainability into financial, environmental, and social practices, organizations can contribute to a more sustainable future while maintaining competitiveness and regulatory compliance. As global sustainability concerns increase, companies that embrace sustainable development will be better positioned for long-term resilience and growth.

Hypotheses Development

AI-Enhanced Human Resource and Green Accounting

The rapid development of Artificial Intelligence (AI) has reshaped how organizations manage their human resources, shifting from traditional administrative functions toward data-driven, predictive, and sustainable approaches (Agit & Muharram, 2024). AI-enhanced human resource practices are not only designed to improve efficiency and productivity but also to ensure that employees are aligned with the principles of sustainability (Herder, 2024). By applying advanced algorithms and predictive analytics, organizations can monitor employee performance in relation to environmental goals, promote eco-friendly workplace behaviors, and identify human resource policies that contribute to long-term organizational resilience. Furthermore, AI facilitates the collection and management of accurate data, which is essential for adopting green accounting practices (Masduqie et al., 2021). When human resources are optimized through AI, organizations significantly enhance their ability to systematically account for environmental costs and benefits. Therefore, it is hypothesized that:

H1: AI-Enhanced Human Resource has a positive effect on Green Accounting.

Environmental Innovation Strategy and Green Accounting

In addition to technological support, organizational sustainability also relies heavily on the innovation strategies undertaken by companies (Rr Dian Anggraeni et al., 2023). Environmental innovation strategy is widely recognized as a cornerstone for organizations seeking to maintain competitiveness while simultaneously reducing ecological footprints (Dewaelheyns et al., 2023). Such strategies involve the development of environmentally friendly products, cleaner production processes, efficient waste management systems, and the utilization of renewable resources. The literature suggests that organizations that pursue environmental innovation are more likely to adopt advanced environmental reporting and accounting mechanisms, including green accounting, as both practices are complementary in addressing sustainability challenges (Awan et al., 2023). By fostering a culture of innovation, organizations create a pathway for transparent and responsible environmental management. Hence, the following hypothesis is proposed:

H2: Environmental Innovation Strategy has a positive effect on Green Accounting.

Environmental Innovation Strategy and Sustainable Development Performance

Beyond its influence on accounting practices, environmental innovation also plays a direct role in advancing sustainable development performance (Harsanto et al., 2024; Lai et al., 2021; Nurwitono & Silvianita, 2023). Sustainable development performance, which encompasses environmental, social, and economic dimensions, cannot be achieved

without innovative strategies that reduce pollution, promote energy efficiency, and improve community well-being. Empirical studies highlight that companies adopting strong environmental innovation strategies tend to achieve better results in terms of corporate reputation, stakeholder satisfaction, and long-term profitability, all of which contribute to the achievement of Sustainable Development Goals (SDGs) (Rehman et al., 2021). Therefore, organizations that embed environmental innovation in their operations are better positioned to achieve superior sustainable performance outcomes. Consequently, it is hypothesized that:

H3: Environmental Innovation Strategy has a positive effect on Sustainable Development Performance.

Organizational Sustainability and Sustainable Development Performance

Moreover, organizational sustainability refers to the long-term capacity of a company to integrate environmental stewardship, social responsibility, and economic growth into its overall strategy (Hussain, 2020). An organization that commits to sustainability is not only concerned with short-term profit but also with creating value for future generations. Practices such as adopting clean technologies, maintaining ethical labor policies, and ensuring corporate governance compliance contribute to stronger development performance (Agha, 2014). Organizational sustainability also reflects the internal capacity of a company to adapt to external pressures such as climate change, regulatory requirements, and shifting stakeholder expectations. This resilience, in turn, improves the likelihood of achieving consistent sustainable development performance (López-Nicolás & Meroño-Cerdán, 2011). Thus, it is reasonable to assume the following:

H4: Organizational Sustainability has a positive effect on Sustainable Development Performance.

Green Accounting and Sustainable Development Performance

Finally, green accounting serves as a critical bridge between sustainability practices and measurable outcomes. Unlike traditional accounting systems that focus solely on financial metrics, green accounting integrates environmental costs, ecological impacts, and social benefits into financial statements (llina, N. S., & Aris, 2022). This provides stakeholders with transparent and comprehensive information regarding the true performance of an organization. The adoption of green accounting not only enhances accountability but also guides decision-makers in aligning financial growth with sustainability principles (Uddin et al., 2023). Through systematic reporting, organizations can better evaluate the effectiveness of their sustainability initiatives and demonstrate commitment to global sustainability standards. In summary, these five

hypotheses build upon the theoretical foundations of sustainability, innovation, and accountability.

The framework highlights the interconnection between human resource management, environmental innovation, organizational sustainability, and accounting practices as integral drivers of sustainable development performance (Dakhan et al., 2020). Specifically, the model suggests that AI-Enhanced Human Resource and Environmental Innovation Strategy contribute to the adoption of Green Accounting, which in turn enhances Sustainable Development Performance. Simultaneously, Environmental Innovation Strategy and Organizational Sustainability directly influence development outcomes, thereby underscoring the multidimensional pathways through which organizations can achieve sustainable excellence (Jillani et al., 2024).

Therefore, green accounting is expected to directly strengthen sustainable development performance. Hence, the following hypothesis is developed:

H5: Green Accounting has a positive effect on Sustainable Development Performance.

Research Methods

This study employs a quantitative research approach using Structural Equation Modeling (SEM) and Partial Least Squares (PLS) to analyze the relationships between key variables. SEM-PLS is chosen due to its effectiveness in handling complex models and its ability to evaluate both direct and indirect effects among constructs (Hair, 2017). This approach enables a comprehensive assessment of how AI-enhanced human resources, environmental innovation strategy, organizational sustainability, green accounting, and sustainable development performance interact within the banking sector. The research involves a sample of 250 employees from various state-owned banks in Central Java. The sampling technique follows a purposive sampling method, selecting respondents based on their expertise and involvement in sustainable banking practices. Data collection is conducted through structured questionnaires, designed to measure each variable using validated indicators. Respondents' perceptions and experiences are quantified using a Likert scale, ensuring consistency and comparability in responses.

To test the proposed hypotheses, SEM-PLS analysis is applied using SmartPLS software. This method is suitable for predictive modeling and hypothesis testing, especially in studies with multiple latent variables. The model's reliability and validity are assessed through composite reliability, average variance extracted (AVE), and discriminant validity tests. Furthermore, bootstrapping techniques are used to evaluate the significance of path coefficients and determine the strength of relationships between variables. The study's findings will provide valuable insights into the role of AI-enhanced human resources and environmental innovation strategies in promoting sustainable banking practices. By integrating green accounting principles and evaluating their impact

on sustainable development performance, the research aims to contribute to both academic literature and practical applications in the banking industry. The results are expected to guide policymakers and financial institutions in implementing sustainability-driven strategies for long-term organizational growth.

Table 1

Questionnaire Item

Latent Variable	Indicator Code	Questionnaire Item (Likert Scale 1–5: strongly disagree – strongly agree)
AI-Enhanced Human Resource (X1)	X1.1	My company uses AI to support the recruitment and selection process.
	X1.2	AI helps improve the accuracy of employee performance evaluation.
	X1.3	The use of AI facilitates planning for employee training and development.
	X1.4	AI supports strategic decision-making in human resource management.
Environmental Innovation Strategy (X2)	X2.1	My company develops environmentally friendly innovation strategies.
	X2.2	The products/services offered consider sustainability aspects.
	X2.3	The company applies green technology in its daily operations.
	X2.4	There are specific policies to reduce negative environmental impacts.
	X2.5	The company regularly evaluates its environmental innovation programs.
Organizational Sustainability (X3)	X3.1	The company has a vision and mission that support sustainability.
	X3.2	The company's operational activities are consistent with sustainability principles.
	X3.3	The company is committed to balancing economic, social, and environmental aspects.
	X3.4	The company actively involves stakeholders in sustainability programs.
Green Accounting (Y1)	Y1.1	The company presents environmental reports as part of its financial statements.
	Y1.2	Environmental costs are recorded and monitored systematically.
	Y1.3	The company uses green accounting to support decision-making.
Sustainable Development Performance (Y2)	Y2.1	The company has improved its economic performance through sustainability principles.
	Y2.2	The company contributes to improving social welfare.
	Y2.3	The company has reduced its negative environmental impacts.
	Y2.4	The company is consistent in supporting the Sustainable Development Goals (SDGs).
	Y2.5	The company's performance aligns with Sharia principles and sustainability.

Source: Authors' work

Results and Discussion

Outer Model

The outer model in this study describes the relationship between latent variables and the indicators that measure them. In the context of SEM PLS, the outer model functions to determine the extent to which the indicators are able to reflect the latent variables studied (Hair, 2017). This study will evaluate the quality of measurement of latent variables by examining the factor loading of each indicator, as well as its validity and reliability. This process involves statistical analysis to ensure that each indicator significantly and consistently represents the latent variable in question, so that the resulting model has high validity and can be relied on to measure the relationship between variables in this study.

Table 2

Measurement Evaluation Models

Latent Variables	Convergent Validity		Internal Composite Reliability			Discriminant Validity
	Indicators	Loading > 0.70	AVE >0.50	CR >0.70	CA >0.70	HTML < 1
AI Enchanced HR	X1.1	0.723	0.735	0.777	0.720	YES
	X1.2	0.711				
	X1.3	0.881				
	X1.4	0.765				
Environtmental Innovation Strategy	X2.1	0.747	0.754	0.885	0.741	YES
	X2.2	0.767				
	X2.3	0.856				
	X2.4	0.814				
	X2.5	0.764				
Organizational Sustainability	X3.1	0.846	0.812	0.832	0.876	YES
	X3.2	0.766				
	X3.3	0.883				
	X3.4	0.937				
Green Accounting	Y1.1	0.854	0.802	0.712	0.833	YES
	Y1.2	0.778				
	Y1.3	0.880				
Sustainable Development Performance	Y2.1	0.746	0.718	0.886	0.830	YES
	Y2.2	0.823				
	Y2.3	0.763				
	Y2.4	0.755				
	Y2.5	0.888				

Source: Authors' work

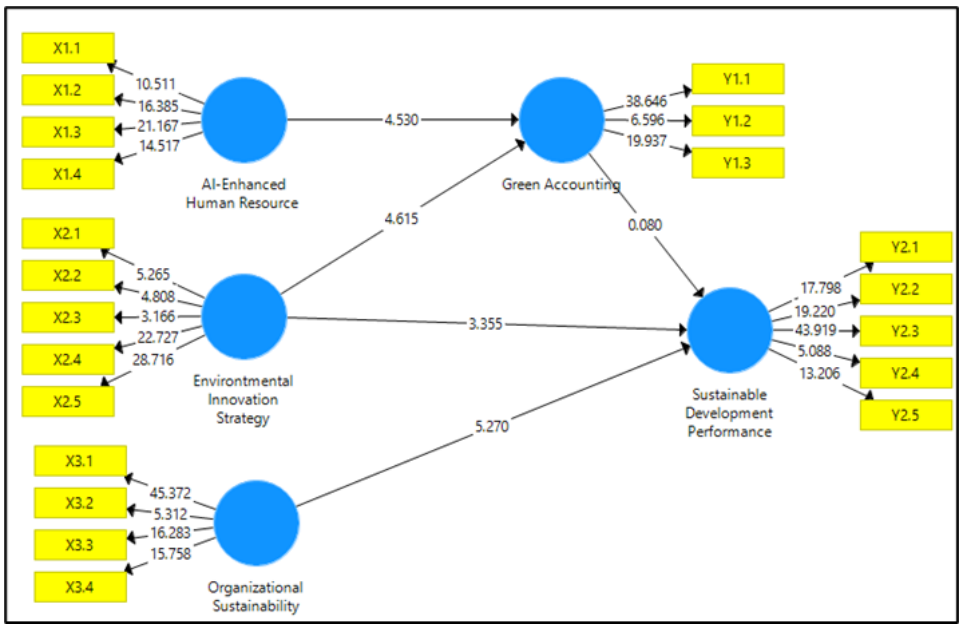
This study uses Partial Least Squares (PLS) to analyze and evaluate the validity and reliability of the model construct using Smart PLS. SmartPLS is used to test the Outer Model and Inner Model of the study. The outer model test is conducted to see the validity and reliability of an indicator and variable in the study (Hair, 2017). This can be seen based on 3 categories, namely (1) Convergent Validity, which consists of an outer loading value with a value> 0.7 and an AVE value> 0.5. (2) Internal Consistency, which is seen based on the Cronbach's alpha value > 0.7 and Composite Reliability with criteria> 0.7. (3) Discriminant Validity, which is seen based on the Fornell-Lacker value, where the root of the AVE square value (diagonal) is greater than all other variable values, and HTMT (heterotrait-monotrait correlation ratio) is less than 1. Based on the provisions, the indicators and variables in this study can be said to be valid and reliable.

Inner Model

The inner model in this study explains the structural relationship between the latent variables studied in the research framework. This model describes how the latent variables interact and influence each other, and identifies the causal pathways in the research model. Using SEM PLS, the inner model analysis will be conducted to test the strength and direction of the relationship between variables, and to measure the direct and indirect effects between these variables.

Figure 1

SEM Model Test



Source: Authors' work

Table 3

Hypothesis Testing

Variables	Original Sample	Sample Mean	Standard Deviation	T-Statistic	P-Value
AI Enchanced HR> Green Accounting	0.424	0.427	0.105	4.530	0.000
Environtmental Innovation Strategy > Green Accounting	0.632	0.639	0.071	4,615	0.000
Environtmental Innovation Strategy > Sustainable Development Performance	0.443	0.439	0.102	3.355	0.000
Green Accounting> Sustainable Development Performance	0.106	0.119	0.119	0.080	0.468
Organizational Sustainability> Sustainable Development Performance	0.185	0.194	0.055	5.270	0.000

Source: Authors' work

Hypothesis 1: AI-Enhanced Human Resources → Green Accounting

The results reveal a significant and positive relationship between AI-enhanced human resources (HR) and green accounting, with a t-statistic of 4.530 (p-value < 0.001). This finding suggests that AI-driven technologies play a critical role in shaping the adoption and implementation of green accounting practices within organizations. In the context of state-owned banks in Central Java, AI-enhanced HR systems enable banks to automate data processing, monitor environmental costs, and streamline compliance with sustainability standards. For example, AI tools can analyze extensive datasets related to carbon footprints or resource usage, providing insights that facilitate more transparent and accurate environmental reporting (Madanchian et al., 2023). Many state-owned banks in Central Java have begun investing in AI technologies to strengthen their HR capabilities, such as talent acquisition, performance management, and employee training (Mubarak et al., 2024). These advancements not only improve operational efficiency but also empower employees to contribute more effectively to sustainability initiatives. For instance, training employees on the integration of AI tools with green accounting systems enhances their ability to track environmental metrics and develop eco-friendly business practices (Susilo & Mayowan, 2024). The synergy between AI and green accounting underscores the transformative potential of technology in advancing sustainable finance within the banking sector.

Hypothesis 2: Environmental Innovation Strategy → Green Accounting

The relationship between environmental innovation strategy and green accounting is also significant, with a t-statistic of 3.355 (p-value < 0.001). This result highlights the importance of implementing innovative strategies to address environmental challenges and integrate sustainability into financial reporting. In Central Java, state-owned banks have been actively pursuing environmental innovation strategies, such as introducing green financial products, reducing energy consumption, and supporting renewable energy projects. These initiatives align with the global shift toward more sustainable banking practices, driven by increasing regulatory pressure and customer demand for environmentally responsible financial services. The significant link between environmental innovation strategy and green accounting demonstrates how innovative efforts can enhance the measurement and disclosure of environmental impacts (Pathak, 2017). For example, some banks in Central Java have begun incorporating life cycle assessments into their green accounting systems, allowing them to evaluate the environmental effects of their operations comprehensively (Satria Avianda Nurcahyo; Raditya Ferdianto; Dyah Ayu Kusumawati, 2024). These practices not only improve transparency but also strengthen stakeholder trust, positioning banks as leaders in sustainable development. However, the implementation of such strategies requires strong leadership, adequate resources, and continuous innovation to ensure their long-term success.

Hypothesis 3: Environmental Innovation Strategy → Sustainable Development Performance

The findings also show that environmental innovation strategy significantly influences sustainable development performance, with a t-statistic of 5.270 (p-value < 0.001). This indicates that banks that prioritize environmental innovation are better positioned to achieve sustainable development goals. In practice, state-owned banks in Central Java have embraced various environmental initiatives, such as financing eco-friendly projects, partnering with local governments to promote green infrastructure, and offering incentives for businesses adopting sustainable practices (Raodatul Jannah, 2022). For instance, banks that introduce green loans for renewable energy projects contribute directly to reducing greenhouse gas emissions while promoting economic development (Nart et al., 2024). These initiatives not only enhance their sustainability metrics but also attract environmentally conscious customers, creating a competitive advantage in the market. The significant relationship observed in this study underscores the role of innovation in bridging environmental responsibility and organizational performance (Nurcahyo, Ramadhani, et al., 2024). However, for these strategies to succeed, banks must continuously adapt to evolving environmental challenges and invest in research and development.

Table 4

Mediation Testing

Variables	Original Sample	Sample Mean	Standard Deviation	T-Statistic	P-Value
AI Enchanced HR> Green Accounting> Sustainable Development Performance	0.004	0.016	0.054	0.075	0.470
Environtmental Innovation Strategy > Green Accounting> Sustainable Development Performance	0.004	0.014	0.061	0.083	0.467

Source: Authors' work

Hypothesis 4: Green Accounting → Sustainable Development Performance

The direct relationship between green accounting and sustainable development performance is found to be insignificant, with a t-statistic of 0.880 (p-value = 0.468). While green accounting plays a crucial role in improving transparency and accountability, its direct impact on sustainable outcomes appears limited in this context (Rehman et al., 2021). This result may be attributed to the early stages of green accounting adoption in state-owned banks in Central Java, where the primary focus is on regulatory compliance rather than strategic application. In the Central Java banking sector, green accounting practices are often constrained by the lack of standardized frameworks and limited integration with broader organizational strategies (Dewaelheyns et al., 2023). For example, while banks may report on their carbon emissions and energy consumption, these metrics are not always linked to decision-making processes or performance evaluations. To enhance the impact of green accounting, banks must adopt a more strategic approach, aligning environmental reporting with their sustainability goals and engaging stakeholders in the process.

Hypothesis 5: Organizational Sustainability → Sustainable Development Performance

The relationship between organizational sustainability and sustainable development performance is highly significant, with a t-statistic of 5.270 (p-value < 0.001). This finding underscores the importance of embedding sustainability principles within the core values and operations of financial institutions. In Central Java, state-owned banks have been actively promoting organizational sustainability through various initiatives, such as

implementing green office practices, fostering employee awareness of environmental issues, and supporting community development projects. Organizational sustainability also involves aligning corporate strategies with the United Nations Sustainable Development Goals (SDGs) (Tirno et al., 2023). For instance, banks that focus on reducing their environmental footprint, promoting gender equality in the workplace, and supporting inclusive economic growth contribute directly to sustainable development. The significant relationship observed in this study highlights the role of organizational commitment in achieving long-term sustainability objectives (Anjum et al., 2022). By prioritizing sustainability at all levels, banks in Central Java can enhance their reputation, build stronger stakeholder relationships, and drive positive social and environmental change (Nurcahyo, Jannah, et al., 2024).

The mediation analysis indicates that green accounting does not significantly mediate the relationships between AI-enhanced HR, environmental innovation strategy, and sustainable development performance. These results suggest that while green accounting is essential for transparency and compliance, its role as a connecting mechanism may require further development. In the context of Central Java, this finding reflects the challenges faced by banks in fully integrating green accounting into their sustainability strategies. To address these challenges, banks must invest in building capacity for green accounting, such as training employees on advanced accounting techniques, adopting internationally recognized frameworks, and leveraging technology to improve data accuracy. By strengthening their green accounting practices, banks can better align their environmental reporting with organizational goals, enhancing their contribution to sustainable development.

Conclusion

The findings of this study provide valuable insights into the factors influencing sustainable development performance in the Sharia banking sector. For state-owned banks in Central Java, prioritizing AI-enhanced human resource practices, environmental innovation strategies, and organizational sustainability is crucial for achieving long-term success. However, the limited role of green accounting as a mediating factor indicates the need for a more strategic integration of environmental metrics into managerial and financial decision-making processes. This research contributes to the growing body of literature on sustainable finance in Islamic banking, yet it is limited by its regional scope and reliance on cross-sectional data. Future studies are encouraged to expand the analysis across different regions, apply longitudinal approaches, and incorporate comparative perspectives with conventional banks. By addressing these areas, Sharia banks can enhance their sustainability efforts, contribute more effectively to regional and national development, and align with global standards for sustainable finance.

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