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Green Information Technology Strategies for Promoting Sustainable Development Practices among Kirkuk University Affiliates in Iraq

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ABSTRACT
Purpose: This study aims to examine the effect of Green Information Technology strategies on sustainable development and to analyze the relationship between them.
Methodology: The study used a descriptive-analytical method with data collected through an electronic questionnaire distributed to administrative and human resource employees at governmental universities in Kirkuk Governorate.
Results: The study found that Green Information Technology strategies play an important role in supporting sustainable development within governmental universities. The findings indicate that the adoption of environmentally friendly information technology practices can improve institutional efficiency, reduce environmental impact, and support sustainable administrative performance.
Conclusions: The study concludes that Green Information Technology contributes positively to achieving sustainable development in governmental universities in Kirkuk Governorate.
Limitations: This study is limited to governmental universities in Kirkuk Governorate and focuses only on administrative and human resource employees.
Contribution: This study contributes by highlighting the role of Green Information Technology strategies in supporting sustainable development practices in higher education institutions.

Keywords: *Administrative Performance, Governmental Universities, Green Information Technology, Kirkuk Governorate, Sustainable Development.*

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1. Introduction

In the modern era, rapid technological development has made Information Technology an essential component of organizational activities. Information Technology includes both computer technology

and communication technology, which share common characteristics through microelectronics and software systems used to collect, process, store, and distribute information (Dewett & Jones, 2001; Effendi, Harahap, & Rambe, 2023; Hany Maria & Lira Arum Kusumaning, 2024). Along with this development, the emergence of information systems has also responded to increasing demands from laws, authorities, and environmental movements to reduce pollution, minimize the negative effects of industrial and human activities on the environment, and protect the rights of future generations to live in a healthy natural environment.

Green Information Technology has become an important approach in supporting environmental sustainability and improving the quality of life of local communities. This approach encourages organizations to manage their activities more responsibly by reducing pollution from manufacturing, service, and operational sectors (Afnan, Wijaya, Kartono, & Wibowo, 2024; Dabbous & Aoun Barakat, 2023; Mia, Andri Muhamad, & Hadi, 2025; Nugroho, 2013). It also supports efforts to reduce gas emissions, solid and liquid waste, and excessive resource consumption through recycling, efficient energy use, and the rational management of natural resources. The proper application of Green Information Technology can help organizations minimize waste, reduce pollutants, and improve environmental performance while maintaining productivity and operational efficiency (Gentari, Agustina, & Susillawati, 2026; Rosyafah, Hidayat, & Nitawati, 2025).

Based on the field survey conducted by the researcher at the University of Kirkuk under the supervision of the Iraqi Ministry of Higher Education and Scientific Research, several fundamental problems were identified. These problems are mainly related to human infrastructure and the limited provision of environmentally friendly information technology, although such technology has an important role in supporting human resource management processes (Imron, Arif, Gifari, Aritonang, & Harun, 2024; Sulastri, 2017; Tari & Nirmala, 2025). Therefore, the need to apply Green Information Technology in Iraqi educational institutions has become increasingly urgent, particularly in strengthening employee awareness, addressing environmental issues related to information technology, and improving institutional practices toward sustainability (Abdillah, Rofiq, & Indriani, 2018; Zaman & Sedera, 2016).

The research problem of this study focuses on how Information Technology strategies can be adopted in an environmentally friendly manner within educational institutions. This includes understanding the environmental impacts of Information Technology strategies, identifying the major environmental issues that need to be addressed, and determining how information technology infrastructure, services, operations, applications, and practices can be developed in line with sustainability principles. In addition, this study also examines how Information Technology can assist organizations and society in improving environmental sustainability, especially in the context of global efforts to implement sustainable development projects for future generations.

The significance of this study lies in its attempt to link Green Information Technology with sustainable development in higher education institutions, particularly at the University of Kirkuk. From a theoretical perspective, this study contributes to the literature by highlighting Green Information Technology as an important practice in educational institutions and by examining its impact on sustainable development. From a practical perspective, this study emphasizes the role of the University of Kirkuk in promoting Green Information Technology to improve economic resources, support social and cultural development, and address environmental problems that may affect national development (Chatterjee, 2025; Okigbo, Mbamalu, & Iruogu, 2025).

This study aims to provide a knowledge framework on Green Information Technology, including its dimensions, scope, and measurement methods based on scientific sources. It also seeks to identify the actual use of Green Information Technology applications in educational institutions and the factors influencing their implementation. Furthermore, this study examines the impact of Green Information Technology on the economic and environmental aspects of sustainable development. Finally, it aims to increase societal awareness and promote a culture of Green Information Technology as an important part of achieving sustainable development.

2. Literature Review and Hypothesis/es Development

2.1 The Concept of Information Technology

Information Technology has become an essential element in modern organizational management because it supports operational efficiency, decision-making processes, and institutional competitiveness. The increasing use of Information Technology enables organizations to improve the quality of their outputs, strengthen relationships with stakeholders, and access accurate information needed by managers and decision-makers. In this context, Information Technology plays an important role in planning, organizing, and controlling institutional strategies, particularly through the utilization of infrastructure resources across different administrative levels.

Information Technology is also considered one of the key factors influencing social and organizational development. In the information society, technology occupies a strategic position because of its widespread use in various aspects of human life and institutional activities. Bianchi and Sousa (2016) explain that Information Technology consists of infrastructure, devices, equipment, and operational processes that help universities and institutions achieve their objectives. In higher education institutions, Information Technology departments are responsible for designing, implementing, maintaining, and improving systems that support administrative and academic activities (Nursandi, Ramadhani, Maretmy, & Septian, 2025; Scalabrin Bianchi, Dinis Sousa, & Pereira, 2021).

Furthermore, Information Technology is closely related to the protection, processing, and distribution of information. Ali, Green, and Robb (2015) define Information Technology as a field those studies theories and strategies for protecting information from potential threats. It also facilitates interaction and communication between organizations and society. Therefore, Information Technology is not only a technical tool but also a strategic investment that must be implemented effectively to support organizational development.

2.2 Green Information Technology

Green Information Technology refers to the environmentally responsible use, management, and application of information technology resources. It emphasizes the need to reduce the negative environmental impacts caused by hardware, software, communication systems, databases, and other technological infrastructures. Green Information Technology is also associated with the efficient use of energy, reduction of electronic waste, responsible resource management, and the implementation of technology-based practices that support sustainability.

The concept of Green Information Technology has become increasingly important as organizations face growing pressure to improve environmental performance while maintaining operational effectiveness. K. Yu, Zhang, and Huang (2023) highlight that Green Information Technology supports communication and interaction and plays a significant role in fulfilling human and institutional needs. In addition, Green Information Technology skills are considered important for supporting economic growth and should be encouraged by governments and institutions.

2.3 The Importance of Green Information Technology

Green Information Technology provides significant benefits for organizations, particularly in improving operational efficiency, reducing risks, increasing return on investment, and enhancing organizational success. Vance, Elie-Dit-Cosaque, and Straub (2008) argue that Green Technology contributes to improving the effectiveness and efficiency of organizational activities. However, these benefits can only be achieved when institutions are able to manage their information technology resources properly and align them with organizational objectives.

In higher education institutions, Green Information Technology is important because universities increasingly depend on digital systems to support teaching, learning, administration, and institutional governance. During the COVID-19 pandemic, the role of Information Technology became more prominent as universities were required to develop digital capabilities and maintain accountability and performance in online learning environments. Jatmiko, Sofyani, and Putra (2022) explain that higher education institutions needed to strengthen their Green Technology capabilities to support educational

processes and improve institutional performance during the pandemic. The growing demand for online activities has encouraged universities to improve their technological infrastructure and maximize the use of Information Technology resources. This situation shows that Green Information Technology is not only related to environmental responsibility but also to governance, service quality, accountability, and institutional sustainability.

2.4 Green Information Technology and Information Technology Management

Green Information Technology and Green Information Technology Management are closely related concepts. Many studies do not clearly distinguish between the two because they overlap in practice. Green Information Technology focuses on environmentally friendly technological practices, while Green Information Technology Management emphasizes the governance, planning, control, and evaluation of these practices within organizations.

Marczuk, Misztal, Bulatov, Nechayev, and Savinykh (2020) state that institutionalizing Green Information Technology Management helps organizations identify the negative impacts of information technology components, including hardware, software, communication systems, databases, and data warehouses. Effective management of Green Information Technology allows executives to control business operations more effectively and reduce risks associated with technological decisions. Therefore, Green Information Technology Management is necessary to ensure that the adoption of technology supports both organizational objectives and sustainability goals (Zwass, 1993).

2.5 Justifications for Implementing Green Information Technology

The implementation of Green Information Technology is necessary because organizations increasingly depend on information systems and digital technologies. Green Information Technology enables organizations to achieve competitive advantage, improve managerial excellence, and strengthen institutional performance. Several scholars, including Q. Yu, Foroudi, and Gupta (2019),Kwon and Kim (2021) emphasize that the implementation of Green Information Technology requires time, effort, attention, and institutional support.

There are several justifications for adopting Green Information Technology. First, organizations have become highly dependent on information systems and technologies in carrying out their operations. Second, investment in Information Technology continues to increase, requiring institutions to manage these investments efficiently and responsibly. Third, strategic information has become a valuable organizational asset. Fourth, interruptions or failures in information systems can cause significant losses. Finally, the growth of electronic commerce and digital services increases the need for reliable, efficient, and sustainable technology systems.

2.6 Green Information Technology Strategies

Green Information Technology strategies are related to the way organizations design, implement, and manage technology to achieve environmental and organizational objectives. These strategies include human infrastructure, technological infrastructure, policies, practices, and systems that support environmentally friendly information technology. Jenkin, Webster, and McShane (2011) identify four main dimensions of Green Information Technology, namely attitude, policies, practices, and information technologies and systems.

Attitude reflects the awareness and commitment of individuals and organizations toward environmentally responsible technology use. Policies refer to formal rules, guidelines, and institutional support for implementing Green Information Technology. Practices include the actual activities carried out by organizations to reduce environmental impacts, such as energy saving, recycling, and efficient use of technology. Meanwhile, information technologies and systems refer to the technological tools and infrastructures used to support green practices and sustainable institutional performance.

2.7 Dimensions of Green Information Technology

Green Information Technology can also be understood through several dimensions related to strategic management and organizational performance. Suzuki (2005) explain that Information Technology is a

continuous lifecycle that begins with strategy formulation and alignment with organizational objectives. This lifecycle includes value delivery, risk management, resource management, performance measurement, and continuous improvement.

The first dimension is strategic alignment, which refers to the compatibility between Information Technology strategy and the overall goals of the organization. Gheorghe (2010) states that strategic alignment is the starting point for developing an Information Technology strategy that supports organizational plans and business objectives. In the context of Green Information Technology, strategic alignment ensures that technological practices are consistent with sustainability goals.

The second dimension is value delivery. Information Technology should provide benefits at the right time, with appropriate costs, and within the available budget. From an organizational perspective, value delivery includes improving service quality, reducing costs, increasing stakeholder satisfaction, and supporting competitive advantage (Gheorghe, 2010). Green Information Technology contributes to value delivery by improving efficiency and reducing environmental costs.

The third dimension is resource management. Paletta and Silva (2021) explain that Information Technology should deliver strategic benefits while optimizing costs and ensuring the value of technological resources. Resource management involves the planning, utilization, and supervision of Information Technology infrastructure to meet current and future institutional needs. In Green Information Technology, this includes efficient energy use, responsible equipment management, and sustainable technology investment.

The fourth dimension is risk management. Selig (2018) emphasizes that the use of Information Technology creates various risks that must be monitored and managed properly. These risks may include system failure, data loss, security threats, and environmental risks caused by inefficient technology use. Therefore, Green Information Technology requires effective risk management to reduce negative impacts and ensure sustainable operations.

The fifth dimension is performance measurement. Bhaskaran and Jaafar (2022) explain that performance measurement focuses on monitoring Information Technology outputs through tools such as balanced scorecards and maturity models. In Green Information Technology, performance measurement is used to evaluate how effectively technology contributes to organizational performance, environmental responsibility, and sustainable development.

Overall, the literature shows that Green Information Technology is a strategic approach that integrates technological efficiency, environmental responsibility, and institutional sustainability. In higher education institutions, Green Information Technology is important because it supports administrative efficiency, improves service quality, reduces environmental impacts, and strengthens sustainable development practices. Therefore, understanding its concepts, strategies, and dimensions is essential for examining its role in promoting sustainable development at the University of Kirkuk.

Sustainable development is generally understood as the result of interaction among economic, social, and environmental dimensions. It emphasizes the ability of economic systems to balance production and consumption, manage resources efficiently, and support continuous improvement in the quality of life. At the same time, the social dimension focuses on ensuring social justice, equal participation, poverty reduction, and fair access to resources for all members of society. Sustainable development also refers to the responsible use of natural resources at a rate that does not exceed their ability to regenerate, so that these resources can be preserved for future generations. Therefore, sustainable development can be viewed as a comprehensive process that integrates economic growth, social welfare, environmental protection, and the use of modern technology to achieve long-term development goals (Chen et al., 2014; Zhang et al., 2016).

The importance of sustainable development lies in its role in improving the social, cultural, economic, and health conditions of society, creating job opportunities, reducing underdevelopment, and

encouraging the efficient use of environmental resources. It also seeks to develop individuals' abilities to work, think, innovate, and make use of renewable energy resources. Based on its objectives, sustainable development aims to achieve economic, social, and environmental goals in an integrated manner. Although scholars differ in determining its dimensions, most studies emphasize that sustainable development is built upon three main dimensions: economic development, social development, and environmental sustainability. These dimensions form the basis for understanding how institutions can promote balanced and responsible development (Harris, 2000; Kolk, 2016; Gregory et al., 2018; Ebert et al., 2020; Haamann & Basten, 2019; Levstek et al., 2022; Petretta, 2017).

2.2 Hypoteses Development

H_1: Green Information Technology has a statistically significant effect on sustainable development at the 0.05 significance level

H_1a: Strategic alignment has a statistically significant effect on sustainable development at the 0.05 significance level

H_1b: Value delivery has a statistically significant effect on sustainable development at the 0.05 significance level

H_1c: Resource management has a statistically significant effect on sustainable development at the 0.05 significance level

H_1d: Risk management has a statistically significant effect on sustainable development at the 0.05 significance level

H_1e: Performance measurement has a statistically significant effect on sustainable development at the 0.05 significance level

3. Methodology

The descriptive-analytical approach measures the aspects of Green Information Technology, closely observes and analyzes the phenomenon from its various dimensions after covering the main concepts related to the research variables associated with the use of Green Information Technology in the environment. It is employed for interpretation and evaluation within educational institutions and for examining its impact on sustainable development. Analytical methods are used to derive results and provide suggestions and recommendations for the research, in addition to interpreting the relationships among the various variables and determinants in a manner consistent with the nature of the topic and previous studies (Zhang, Sun, Yang, & Wang, 2020).

The study population consists of the university community at the University of Kirkuk, which operates under the supervision of the Iraqi Ministry of Higher Education and Scientific Research. The study will use a convenient random sample consisting of administrative and teaching staff from several colleges within the university. The limitations of the study include temporal and spatial boundaries. In terms of temporal limits, the questionnaire forms will be distributed and the field study will be conducted during the second half of the 2025–2026 academic year. In terms of spatial limits, the study will be restricted to selected colleges at the University of Kirkuk, focusing on administrative and academic staff who are relevant to the research topic.

This approach is considered appropriate for the present study because it enables the researcher to describe the actual practices of Green Information Technology in educational institutions and to analyze the extent to which these practices contribute to achieving sustainable development. Through this method, the study can identify the level of awareness, application, and institutional readiness regarding environmentally friendly information technology. It also allows the researcher to examine how administrative processes, technological infrastructure, resource efficiency, and environmental practices interact in supporting sustainability goals within the university context (Anthony Jnr, Abdul Majid, & Romli, 2019).

Moreover, the descriptive-analytical approach provides a systematic basis for understanding the relationship between Green Information Technology strategies and the economic, social, and environmental dimensions of sustainable development. By relying on quantitative data collected from

the study sample, this approach helps reveal patterns, trends, and relationships among the research variables. Therefore, it supports the formulation of evidence-based conclusions and practical recommendations that may assist university administrators and decision-makers in improving green technology practices, enhancing environmental responsibility, and strengthening sustainable institutional performance (Lei, Ngai, Lo, & See-To, 2023).

4. Results and Discussion

4.1 Reliability of the Study Instrument

Table 1. Cronbach's Alpha reliability coefficient for the dimensions of the questionnaire

Variables	Number of Items	Cronbach's Alpha Value
Green Information Technology	**21**	**0,939**
Strategic Alignment	6	0,747
Value Delivery	4	0,718
Resource Management	4	0,721
Risk Management	3	0,746
Performance Measurement	4	0,779
Sustainable Development	**25**	**0,930**
Economic Dimension	8	0,903
Environmental Dimension	8	0,877
Social Dimension	9	0,707
Overall Questionnaire	**46**	**0,958**

Table 1 show the results in the previous table indicate that the overall value of Green Information Technology was (0.939), while the overall value of Sustainable Development was (0.930), whereas the overall value of the questionnaire as a whole was (0.958). These results indicate that the instrument has a level of reliability that meets the requirements of the study, as the reliability coefficients are high and statistically significant.

4.2 Statistical Methods

The statistical criterion was used to determine the levels of the study instrument dimensions and their items based on the arithmetic means.

Table 2. Statistical methods

Category	Response Scale	Level of Importance
From 1 to 1.80	Strongly Disagree	Very Low
From 1.81 to 2.60	Disagree	Low
From 2.61 to 3.40	Neutral	Moderate
From 3.41 to 4.20	Agree	High
From 4.21 to 5	Strongly Agree	Very High

Table 2 show the rating scale ranges from 1 to 5 to indicate the level of agreement and importance of a statement. Scores from 1 to 1.80 indicate Strongly Disagree with Very Low importance, 1.81 to 2.60 indicate Disagree with Low importance, 2.61 to 3.40 indicate Neutral with Moderate importance, 3.41 to 4.20 indicate Agree with High importance, and 4.21 to 5 indicate Strongly Agree with Very High importance. This scale is used to measure respondents' perceptions or the significance of the variables under study.

4.3 Population and Sample of the Study

Table 2. Sample size calculation using herbert formula

Herbert Formula		$\boldsymbol{n = \frac{p(1-p)}{(E \div Z) + [p(1-p) \div N]}}$
Value	**Symbol**	**Details**
2494	N	Population size
1.96	Z	Standard score (Z-score) at a significance level of (0.05) and confidence level of (0.95)
0.05	E	Margin of error
0.5	p	Probability value
333	n	Sample size

Table 3 show the study population consists of academic and administrative staff at the University of Kirkuk, totaling (2,494) individuals. The sample size was calculated using the Herbert formula and was found to be (333). An electronic questionnaire was distributed to all members of the study population (2,494 individuals). A total of (333) responses were obtained, and after review and verification, all responses were found to be valid for statistical analysis.

4.4 Testing the Study Hypotheses

Testing the main hypothesis, which states: (There is a statistically significant effect at the significance level (0.05) for the adoption of Green Information Technology strategies on sustainable development).

Table 4. Analysis of the impact of green information technology with its various dimensions on sustainable development

Dimensions of the Independent Variable	**Dependent Variable**	**Standardized Beta Coefficient (β)**	**Coefficient of determination (R^2)**	**Correlation coefficient (R)**	**F-value (calculated)**	**t-value (calculated)**	**Sig**	**Significance**
Strategic Alignment	Sustainable Development	0.593	0.392	0.626	212.982	14.594	0,001	Significant
Value Delivery		0.501	0.377	0.614	199.895	14.138	0,001	Significant
Resource Management		0.506	0.381	0.618	204.038	14.284	0,001	Significant
Risk Management		0.420	0.329	0.574	162.629	12.753	0,001	Significant
Performance Measurement		0.572	0.573	0.757	443.597	21.062	0,001	Significant
Green Information Technology		0.637	0.495	0.704	324.887	18,025	0,001	Significant

Table 4 show the Green Information Technology (GIT) has a significant effect on sustainable development. The correlation coefficient (r = 0.704) indicates a moderate relationship, and the coefficient of determination ($R^2 = 0.495$) shows that 49.5% of the changes in sustainable development are explained by variations in Green Information Technology among academic and administrative staff at the University of Kirkuk. The beta coefficient ($\beta = 0.637$) suggests that a one-unit increase in Green Information Technology leads to a 0.637 unit increase in sustainable development, with the effect confirmed by an F value of 324.887 and a t-value of 18.025 at the 0.05 significance level, supporting the main hypothesis.

For the first sub-hypothesis, strategic alignment also shows a statistically significant effect on sustainable development. The correlation coefficient (R = 0.626) indicates a moderate relationship, and the coefficient of determination ($R^2 = 0.392$) reveals that 39.2% of the variations in sustainable development are explained by strategic alignment among the staff. The beta coefficient ($\beta = 0.593$) indicates that a one-unit increase in strategic alignment results in a 0.593 unit increase in sustainable development, with significance confirmed by an F value of 212.982 and a t-value of 14.594 at the 0.05 level, supporting the acceptance of this sub-hypothesis.

There is a statistically significant role at the significance level (0.05) of value delivery in sustainable development. The statistical analysis results in Table 4, revealed that the value delivery had a statistically significant impact on the sustainable development. The correlation coefficient (R) was (0.614) which suggests that there is a moderate correlation between the study variables. Finally, the coefficient of determination (R2) was (0.377) which means that 37.7% of the changes in sustainable development can be explained by the changes in the level of value delivery of faculty and administrative members at the University of Kirkuk. The beta coefficient (β) was (0.501) which means that the value delivery increased by one-unit, sustainable development increased by (0.501) unit. This effect reflected by the F value of (199.895) which is statistically significant at (0.05) level and t value of (14.138) which is statistically significant at (0.05) level. Therefore, it is concluded that the second sub-Hypothesis (There is a statistically significant role at the significance level (0.05) of value delivery in sustainable development) is accepted.

From the results of the statistical analysis in Table 4, resource management had statistically significant effect on the phenomenon of sustainable development. The correlation coefficient (R) obtained was (0.618) which means that the study variables have a moderate correlation. The coefficient of determination (R^2) was (0.381) which indicates that the level of resource management of the academic and administrative staff of the University of Kirkuk has contributed 38.1% of the changes in sustainable development. The beta coefficient (β) was (0.506) which suggests a positive relationship between the level of sustainable development (0.506) and resource management in the system. The F-value obtained was (204.038) and the t-value obtained was (14.284), which are statistically significant at (.05) level of significance, which substantiates the significance of this effect. Third sub-hypothesis: (There is a statistically significant role at (0.05) level of resource management in sustainable development) can therefore be accepted.

Table 4 indicates statistically significant effect of risk management on sustainable development, as a result of the statistical analysis. The correlation coefficient (R) was (0.574), which means that there is a moderate correlation between the study variables. The coefficient of determination (R^2) is (0.329), which indicates that changes in the University of Kirkuk's sustainable development are explained by 32.9% of the changes in the level of risk management among the academic and administrative staff. The Beta coefficient (β) was (0.420), and an increase in risk management results in an increase in sustainable development (0.420). The F-value was found to be (162.629) and the t-value (12.753) which is statistically significant at (0.05) level, confirming the significance of this effect. Therefore, the fourth sub-hypothesis was accepted that states: (There is a statistically significant role at the significance level (0.05) of risk management in sustainable development).

The results of the statistical analysis in Table 4 showed a statistically significant effect of performance measurement on sustainable development. The correlation coefficient (R) was (0.757) which showed a

moderate relationship between the study variables. The coefficient of determination (R^2) was (0.573), which indicates that 57.3% of the changes in sustainable development are explained by the changes in the level of performance measurement among the academic and administrative staff at the University of Kirkuk. The beta coefficient (β) was (0.572), which means that if the performance measurement increases by one unit, the level of sustainable development increased by (0.572). The F-value obtained was (443.597) and the t-value was (21.062), both of which are statistically significant at (0.05) level confirming the significance of this effect. Based on this, the fifth sub-hypothesis can be accepted "there is a statistically significant role at the significance level (0.05) of the measurement of performance in sustainable development".

4.5 Discussion

Based on the statistical analysis, Green Information Technology significantly impacts sustainable development among the academic and administrative staff at the University of Kirkuk. The results indicate a moderate to strong relationship between the variables, with 49.5% of the variation in sustainable development explained by changes in Green Information Technology. Sub-dimensions such as strategic alignment, value delivery, resource management, risk management, and performance measurement each show statistically significant effects, confirming that improvements in these areas are positively associated with higher levels of sustainable development. These findings highlight the importance of integrating Green Information Technology practices into institutional operations to enhance both efficiency and sustainability.

Furthermore, the analysis demonstrates that each component of Green Information Technology contributes uniquely to sustainable development. Strategic alignment ensures that IT initiatives are consistent with organizational objectives, value delivery enhances operational outcomes, resource management optimizes infrastructure use, risk management mitigates potential threats, and performance measurement tracks progress effectively. Together, these dimensions provide a comprehensive framework for promoting environmental responsibility, efficient resource use, and long-term sustainability within higher education institutions. Consequently, the findings support the adoption of targeted Green Information Technology strategies to strengthen the institution's contribution to sustainable development goals.

5. Conclusions

5.1 Conclusion

Green Information Technology (GIT) serves as a fundamental pillar in strengthening university operations, supporting both academic and administrative functions. The findings show that staff members are satisfied with the quality of services provided through GIT, and that the university's IT resources and infrastructure effectively support the achievement of strategic objectives. Additionally, the administration demonstrates effective risk management, while GIT systems exhibit flexibility and responsiveness to future changes, ensuring sustainable institutional performance. The study further highlights that adopting GIT enhances operational efficiency, aligns institutional strategy with environmental and technological goals, and supports sustainable development initiatives. The integration of GIT into university processes contributes not only to improved service quality but also to the responsible management of resources and environmental preservation, emphasizing the role of technology in promoting long-term sustainability within higher education institutions.

5.2 Research Limitations

Future research could expand the sample to include multiple universities or educational institutions across different regions to increase generalizability. Studies could also examine the long-term impact of Green Information Technology adoption on institutional sustainability and explore additional factors such as cultural, economic, and policy influences on technology integration.

5.3 Suggestion and Directions for Future Research

Future research should expand the sample to include a broader and more diverse population to enhance generalizability. Studies could also track actual purchasing data within Metaverse platforms to verify self-reported behavior. Additionally, incorporating other potential influencing factors, such as social

interaction, gamification features, and brand engagement, would provide a more comprehensive understanding of the mechanisms through which Metaverse marketing shapes consumer behavior. Practically, marketers should prioritize building Digital Trust and personalization while maintaining interactive and immersive experiences to maximize consumer engagement and purchasing behavior.

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