Analysis of Green Information Technology on Sustainability Performance in Tour and Travel in Bali Province

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Abstract. One of the key challenges faced by companies engaged in tourism, particularly in the tour and travel sector, is minimizing the negative environmental impact of technology. Addressing this issue enables companies to enhance their sustainability performance. One proposed solution is the adoption of innovative concepts, such as green information technology. Green information technology involves the development of digital technologies in an environmentally responsible manner to achieve sustainable performance. This study aims to examine the impact of green information technology, focusing on virtualization, power management, material recycling, and telecommuting approaches, on the sustainability performance of tour and travel companies in Bali Province. Data were collected through surveys of 50 managers working in these companies and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) regression with Smart PLS 3.21. The findings indicate that green information technology, particularly digital technologies, positively affects sustainability performance. These results have both theoretical and practical implications for companies.

Keywords: Digital Technology, Green Information Technology, Sustainability Performance, Tour and Travel

1 Introduction

Environmental challenges such as climate change, pollution, and resource depletion demand innovative solutions, particularly through the development of green technology (Lu & Wang, 2023). Advancements in green technology are essential for reducing environmental impacts and promoting sustainability (Chien et al., 2024). The importance of this issue spans various sectors, from rural development to the shipping industry, where regulatory pressures drive its adoption (Deru et al., 2023). Moreover, green technology has improved financial performance and created a competitive advantages by minimizing environmental damage and fostering green innovation (Cheng & Ren, 2024). Aggarwal & Agarwala (2023) examined the impact of green human resource practices on environmental performance, while Nguyen-Viet (2023)

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focused on green marketing for eco-friendly products. Lin et al. (2022) emphasized the role of green technology in enhancing sustainability, economic performance, and environmental impact. With the support of regulations, green innovation drives improvements in sustainability (Demirel & Kesidou, 2019). Singh et al. (2022) highlighted that green innovations in processes and products are crucial for improving environmental performance and gaining stakeholder support. Xie et al. (2019) stressed that green product development and innovation enhance financial performance, while Lin et al. (2022) identified green technological innovation as a key driver of high-quality economic development and environmental protection. They found a strong relationship between regulatory pressure and the adoption of green technology in the shipping industry, positively influencing financial performance. Previous research has shown that green innovation is applied across various sectors, including the tour and travel industry, focusing on green information technology (Cheng & Ren, 2024). This approach aims to reduce the environmental impact of IT operations by designing, operating, and managing technology products in an eco-friendly manner (Fekry Gamal, 2022). Green IT offers numerous benefits, including reducing emissions to combat global warming, minimizing waste, lowering energy costs, raising environmental awareness, improving corporate culture, and supporting sustainability (Sarkis et al., 2013).

Based on these explanations, this research aims to analyze green information technology through approaches such as virtualization, power management, material recycling, and telecommuting, and their effects on sustainability performance in tour and travel companies in Bali Province.

2 Literature Review and Hypothesis Development

2.1 Green Information Technology Towards Sustainability Performance

Sustainability performance extends beyond regulatory compliance by focusing on minimizing environmental impacts (Chen et al., 2011). By analyzing and improving processes, products, and resource utilization, companies can reduce their carbon footprint and exceed legal requirements. Research shows that environmental performance is influenced by the quality of green products, the adoption of green processes, and the integration of environmental sustainability in business operations (Chen et al., 2011; Hameed et al., 2020; Oliva et al., 2019). Green information technology is positively associated with sustainability performance, leading to the following hypothesis:

H_1: Green Information Technology has a positive influence on sustainability performance.

2.2 Virtualization Approach Towards Sustainability Performance

Energy-efficient and eco-friendly data centers are gaining traction as organizations focus on energy conservation and sustainability. Emerging technologies, especially virtualization, help reduce energy consumption and costs in data centers (Katal et al., 2023; Sarkis et al., 2013). A proposed framework for Green IT offers insights into various approaches and evaluates the roles of different functions, highlighting operations as critical in greening data centers. Abdullah et al. (2023) emphasized the importance of sustainable IT practices, including energy-efficient hardware, virtualization, e-waste management, and paperless workflows. Research shows that Green IT virtualization positively impacts sustainability performance, leading to the following hypothesis:

H_{1a}: Green IT virtualization has a positive influence on sustainability performance.

2.3 Power Management Towards Sustainability Performance

The impact of Green IT on energy savings remains a topic of debate, with questions about whether IT increases or decreases overall energy consumption (Melville & Ross 2010; Mithas et al. 2010). While IT power usage doubled between 2000 and 2005, it still accounted for less than 3% of total U.S. electricity consumption, contributing to economic growth (Mithas et al., 2010). Research by Collard et al. (2005) indicated that power consumption increased with computer and software usage but decreased with the adoption of communication devices. Studies show that Green IT power management positively impacts sustainability performance, leading to the following hypothesis:

H_{1b}: Green Information Technology management power has a positive influence on sustainability performance.

2.4 Material Recycling and Sustainability Performance

Green IT has garnered significant attention for its role in minimizing environmental impacts through the efficient design, production, use, and disposal of IT equipment (Sarkis et al., 2013; Dedrick, 2010). It also enhances energy savings and e-waste management by optimizing business processes (Melville & Ross, 2010; Chen et al., 2011). Key Green IT practices include responsible disposal, power management, data center management, server virtualization, regulatory compliance, and the use of renewable energy (Sarkis et al., 2013). Research suggests that Green IT material recycling positively impacts sustainability performance, leading to the following hypothesis:

H_{1c}: Green information technology material recycling has a positive influence on sustainability performance.

2.5 Telecommunicating Towards Sustainability Performance

Green information technology encompasses various approaches and definitions, but it generally involves using IT to enhance environmental sustainability in operations, products, services, and resources (Dao et al., 2011). It is defined as the design and implementation of IT to support more sustainable business processes (Chen et al., 2011). Research shows that telecommuting through Green IT positively impacts sustainability performance, leading to the following hypothesis:

H_{1d}: Telecommunicating Green Information Technology has a positive influence on sustainability performance.

2.6 The Moderating Role of Environmental Commitment

Ekawati et al. (2021) found that environmental commitment helps businesses adopt green practices and support environmental conservation. Hirunyawipada & Xiong. (2018) defined environmental commitment as integrating environmental practices into company strategies to minimize negative impacts and improve performance. This suggests a positive relationship between green information technology and environmental commitment, leading to the following hypotheses:

H_2. Sustainability performance has a positive influence on environmental commitment.

H_3. Environmental commitment moderates the relationship between green information technology and sustainability performance.

From the results of the previous literature study, a theoretical framework emerged which can be seen in Figure 1.

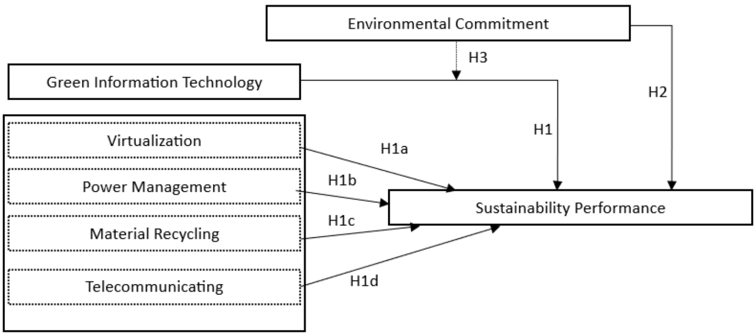

Figure 1. Conceptual model

3 Methodology

3.1 Sample dan Procedure

Data were collected through surveys randomly distributed to 50 managers of tour and travel companies in Bali, with 40 responses obtained. The responses were categorized based on gender, age, education, and experience. Table 1 presents the sample profile.

3.2 The Measurement Instruments

To ensure data validity, variables were measured using scales derived from previous studies. Green Information Technology and its dimensions (virtualization, power management, material recycling, and telecommuting) were assessed using 10 items from Chen et al. (2011), Hameed et al. (2020), Oliva et al. (2019), and others. Environmental commitment was measured using six items from Oliva et al. (2019), and

Lin et al. (2022). A 5-point Likert scale ranged from 1 (strongly disagree) to 5 (strongly agree).

Table 1. Profile of sample

No	Mapping	Sample	Percent
1	Gender	Male	90
		Female	20
2	Age	35 and less	35
		36 – 45 years	40
		46 – 55 years	15
		More than 55 years	10
3	Education	Bachelor	60
		Diploma	10
		Master	20
		PhD	10
4	Experience	5 Years and Less	10
		5 – 10 Years	50
		11 – 15 Years	20
		15 years and more	20

4 Analysis and Result

4.1 Measurement Results

Measurement results were evaluated for validity and reliability using composite reliability, Cronbach's Alpha, and Average Variance Extracted (AVE) for convergent validity. Table 2 shows that all composite reliability and Cronbach's Alpha values exceed the 70% threshold (Hair et al., 2014). Additionally, AVE values are above 0.71, surpassing the minimum convergent validity requirement of 0.5 (Hair et al., 2014).

Table 2. Composite reliability, Cronbach's Alpha, AVE

Constructs	Composite reliability	Cronbach's Alpha	AVE
Green Information Technology (GIT)	0.805	0.787	0.716
Environmental Commitment (EC)	0.890	0.834	0.730
Sustainability Performance (SP)	0.875	0.841	0.754

To assess variable validity, the square root of the AVE was compared with the correlations between variables. As shown in Table 3, the square root of the AVE exceeds the correlations, which are bolded diagonally (Hair et al., 2014). For example, the correlation between Green Information Technology and environmental commitment (0.844) is lower than the AVE square roots for both variables (0.916 and 0.891, respectively). Table 3 confirms that the square root of the AVE for all latent variables exceeds their highest correlations with other variables.

Table 3. Squared roots of AVE

	Green Information Technology (GIT)	Environmental Commitment (EC)	Sustainability Performance (SP)
Green Information Technology (GIT)	0.916		
Environmental Commitment (EC)	0.844	0.891	
Sustainability Performance (SP)	0.777	0.751	0.920

4.2 Structural Relationship Model

Table 4 displays the path coefficients (β), critical ratios (C.R.), and significance levels. The results indicate that green information technology significantly and positively affects sustainability performance ($\beta = 0.644$, $p < 0.01$, C.R. = 17.178). Additionally, virtualization ($\beta = 0.573$), power management ($\beta = 0.717$), material recycling ($\beta = 0.678$), and telecommuting ($\beta = 0.726$) each have a positive and significant impact on sustainability performance (all $p < 0.01$). Environmental commitment also significantly influences sustainability performance ($\beta = 0.749$, $p < 0.01$, C.R. = 20.206). Table 4 shows that environmental commitment significantly enhances the effect of green information technology on sustainability performance ($\beta = 0.680$, $p < 0.01$, C.R. = 15.438). This moderating effect is stronger than the direct effect of green information technology on sustainability performance ($\beta = 0.644$), indicating that environmental commitment amplifies this impact. The structural model of this relationship is illustrated in Figure 2.

Table 4. Path coefficient, C.R., and s

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Path	Path coefficient	C.R.	Sig.	Result
Virtualization → sustainability performance	0.573	10.372	0.00	Supported
Power management → sustainability performance	0.717	15.252	0.00	Supported
Material recycling → sustainability performance	0.678	13.695	0.00	Supported
Telecommunicating → sustainability performance	0.726	15.696	0.00	Supported
Green information technology → sustainability performance	0.644	17.178	0.00	Supported
Environmental commitment → sustainability performance	0.749	20.206	0.00	Supported
Green information technology X environmental commitment → sustainability performance	0.680	15.438	0.00	Supported

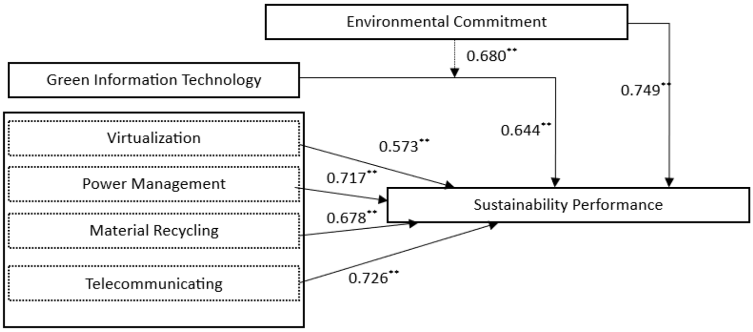

Figure 2. The path coefficient results

5 Discussion and Conclusion

5.1 Discussion

This study develops a model to explain how green information technology impacts sustainability performance, focusing on its relationship with environmental commitment and the moderating role of environmental commitment. The findings reveal that adopting green information technology positively affects sustainability performance in tour and travel companies, demonstrating that these practices enhance their sustain-ability efforts. These results align with studies by Hieu & Rašovská (2017) and Kneipp et al. (2019) which also demonstrate a positive impact of green information technology on sustainability performance. Sezen & Çankaya (2013) confirm that green information technology positively influences sustainability performance in travel agencies.

5.2 Conclusion

This research presents significant findings and contributes both theoretically and practically to understanding the importance of green information technology and its associated approaches (virtualization, power management, material recycling, and telecommuting) in positively impacting sustainability performance. The results are particularly relevant to the tourism industry, specifically in the tour and travel sector in Bali Province. Based on these findings, it is recommended that tour and travel business owners and managers in Bali adopt green information technology practices to improve sustainability performance. The adoption of green information technology not only contributes to achieving the financial goals of tour and travel companies but also helps protect the environment of tourist destinations and ultimately supports the local community.

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