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Innovative Service Design for Sustainability in the Tourism and Hospitality Industry: A Case Study of Small and Medium Hotels in Thailand

Anupong Avirutha[a, *] and Supawadee Hamanee[b]

[a] College of Tourism and Hospitality, Sripatum University, Bangkok, Thailand
[b] School of Business Administration Sripatum University, Bangkok, Thailand

*Corresponding author: *anupong.av@spu.ac.th*

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Abstract: In the tourism and hospitality industry, innovative service design for sustainability plays a crucial role in balancing economic growth with environmental and social responsibility. This study investigates how policies, digital technology, and sustainability-driven service design impact small and medium-sized hotels in Thailand. Through quantitative research utilizing Structural Equation Modeling (SEM), the study examines the relationship between regulatory frameworks, digital readiness, and the adoption of sustainable service practices. The findings highlight the positive impact of policies, incentives, and compliance mechanisms on sustainability adoption. Furthermore, digital technologies—such as smart resource management systems, data-driven decision-making, and digital collaboration—significantly enhance sustainability efforts. The research confirms that well-implemented sustainable service design not only mitigates environmental impact but also enhances economic resilience and social well-being, fostering a more competitive tourism sector. The study underscores the need for continuous policy innovation, digital adaptation, and stakeholder collaboration to achieve long-term sustainability in Thailand's tourism and hospitality industry.

Keywords: Sustainable service design, Tourism and hospitality, Digital technology, Policies and regulations, Stakeholder engagement

1. Introduction

In the digital age, digital technology has become an integral part of everyday life, profoundly impacting society and the environment. The concept of sustainable service design in technology has gained significant importance as organizations and individuals strive to balance technological advancements with long-term sustainability goals. This research article aims to explore and analyze the design of technology services that can lead to sustainability by examining existing frameworks, best practices, and successful case studies from various organizations and projects.

The growing awareness of environmental and social issues has prompted a shift in how digital technology is developed and implemented. Sustainable service design seeks to create services that not only meet the immediate needs of users but also consider the broader impacts on the environment and society. By integrating sustainability into the core of service design, organizations can contribute to a more sustainable future while also enhancing their competitiveness and reputation.

The importance of sustainable service design is underscored by pressing environmental challenges such as climate change, resource depletion, and pollution. The increasing severity of these issues has highlighted the need for innovative solutions that can mitigate negative impacts and promote sustainable development. For example, the United Nations' Sustainable Development Goals (SDGs) provide a comprehensive framework for addressing global challenges, with several goals directly related to sustainable technology, such as affordable and clean energy (Goal 7), industry, innovation, and infrastructure (Goal 9), and responsible consumption and production (Goal 12) (United Nations, 2015).

1.1 Statement of Problems

overconsumption of natural resources and the generation of waste. Traditional technological practices often prioritize efficiency and profitability, sometimes at the expense of environmental and social well-being (Bocken, Short, Rana, & Evans, 2014). This has led to a growing recognition that sustainable service design must be an integral part of technological development. By focusing on sustainable practices, companies can reduce their environmental footprint, enhance their social responsibility, and ensure long-term economic viability.

Overconsumption in the tourism and hospitality industry manifests through excessive use of natural resources, energy, and materials, leading to environmental degradation and resource depletion, the high demand for water, energy, and food often exceeds the local supply, straining the infrastructure and natural ecosystems, which can lead to water scarcity in surrounding communities, contributing to increased carbon emissions and fossil fuel consumption (Gössling et al., 2012).

Thailand faces significant environmental challenges, including deforestation, water pollution, and waste management issues (Rigg, 2013). Especially, the tourism and hospitality industry are essential due to its profound impact on Thailand's economy, environment, and society. Although, this sector is a major contributor to the country's GDP, providing millions of jobs and supporting numerous related industries, the environmental and social impacts of tourism have become increasingly apparent, necessitating a shift towards more sustainable practices.

Thailand's government has recognized the importance of sustainability and has implemented various policies and initiatives to promote sustainable development, seeking to balance economic growth with environmental preservation and social well-being, encouraging businesses and organizations to adopt sustainable practices.

1.2 Significant of the Study

However, there are still significant challenges to be addressed. One major issue is the gap between policy and implementation. While there are numerous policies promoting sustainability, their effective execution often faces obstacles such as limited resources, lack of awareness, and insufficient stakeholder engagement. Moreover, the rapid pace of technological change can sometimes outstrip the ability of regulatory frameworks to keep up, leading to gaps in oversight and accountability (Phuaphanthong, Kerrigan, Soomlek, & Chutimaskul, 2018).

This study is significant as it addresses the critical need for sustainable service design in Thailand's tourism and hospitality industry, a sector that significantly contributes to the country's economy while simultaneously posing environmental and social challenges. By examining the impact of overconsumption and exploring sustainable solutions, this research provides valuable insights into how the industry can balance economic growth with environmental preservation and social responsibility. The findings and recommendations from this study can guide policymakers, industry stakeholders, and businesses in implementing sustainable practices that reduce resource depletion, minimize waste, and protect cultural and natural heritage. Moreover, this research highlights the importance of integrating sustainability into service design, ensuring that Thailand remains a leading tourist destination while promoting long-term environmental and societal well-being. Ultimately, the study aims to foster a more resilient and responsible tourism and hospitality sector, benefiting not only the environment and local communities but also enhancing the overall experience for future generations of tourists. The research model in this study is developed based on the

relationships among policies and regulations, digital technology readiness, sustainable service design, and industrial impacts. The model hypothesizes three key relationships as illustrated in Figure 1.

1.3 Objectives

- To analyze the impact of overconsumption in Thailand's tourism and hospitality industry
- To evaluate existing sustainable service design in the tourism and hospitality industry
- To develop a framework for sustainable service design

1.4 Hypothesis

- Policies and regulations affect sustainable service design
- Digital technology affects sustainable service design
- Sustainable service design affects the industrial impact (economic, environmental, and social impact)

1.5 Literature Reviews

1.5.1 Sustainable Service Design

Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This concept has become a cornerstone of global environmental policies and practices, addressing the need for a balanced approach to economic growth, environmental stewardship, and social inclusion. The United Nations' Sustainable Development Goals (SDGs) further emphasize this balanced approach, providing a universal framework for addressing critical global challenges, such as poverty, inequality, climate change, environmental degradation, peace, and justice (United Nations, 2015). Sustainable service design focuses on creating services that not only fulfill customer needs but also enhance social, economic, and environmental sustainability. This approach can be crucial in sectors like tourism and hospitality, where services have significant impacts on local communities and ecosystems.

Globally, sustainable development practices have been implemented across various sectors, including tourism and hospitality. For instance, Gössling et al. (2012) discuss how consumer behavior in tourism impacts climate change and the necessity of integrating sustainable practices within the industry. Bocken et al. (2014) review sustainable business model archetypes, emphasizing how businesses can adopt models that promote sustainability while remaining economically viable.

Dwyer et al. (2020) in their study "The Role of Education and Communication in Enhancing Stakeholder Awareness for Sustainable Tourism" emphasize that education and effective communication strategies significantly improve stakeholder awareness. Their research demonstrates that well-informed stakeholders are more likely to support and engage in sustainable practices. The study also highlights that targeted education programs for tourists, employees, and local communities lead to better environmental and social outcomes in tourist destinations.

Heras-Saizarbitoria, Arana, and Boiral (2021) explore the impact of stakeholder engagement on sustainability practices in their paper "Stakeholder Engagement for Sustainable Development: Evidence from a Comparative Analysis." They find that active participation and engagement of stakeholders, including local communities and businesses, lead to a higher adoption rate of sustainable practices. The study indicates that when stakeholders are involved in the decision-making process, they are more committed to implementing and maintaining sustainable initiatives.

1.5.2 Policies and Regulations

Policies and regulations play a pivotal role in shaping sustainable development within the tourism and hospitality industry. Effective policies can drive the adoption of sustainable practices by setting standards, providing incentives, and enforcing compliance. They provide the framework within which businesses can operate sustainably, balancing economic growth with environmental and social considerations. Effective policies and regulations help balance these three pillars of sustainability by setting standards, providing incentives, and enforcing compliance. This section provides an overview of the critical role that policies and regulations play in promoting sustainability within the tourism and hospitality sector.

Typically, the roles of policies and regulations can be broadly categorized 1) setting standard, 2) providing incentives, and 3) enforcing compliance. Effective policy design and implementation, supported by strong governance and stakeholder collaboration, are critical for ensuring that the tourism and hospitality industry can contribute to long-term sustainable development goals. As the industry evolves, continuous adaptation and refinement of policies will be necessary to address emerging challenges and opportunities.

1.5.3 Setting Standard

Policies and regulations are set the baseline or the minimum acceptable standard practices for environmental protection, social responsibility, and economic performance. These standards ensure that all businesses in the tourism and hospitality industry adhere to basic principles of sustainability. For example, environmental regulations may set limits on emissions, waste disposal, and resource use, while social policies might mandate fair labor practices and community engagement (Gössling et al., 2018).

1.5.4 Providing Incentives

Governments and regulatory bodies often use incentives to encourage businesses to adopt sustainable practices. These incentives can take various forms, such as tax breaks, grants, and subsidies for businesses that implement eco-friendly technologies or practices. Incentives are designed to offset the initial costs of adopting sustainable practices and make them more economically viable for businesses. Furthermore, Non-financial incentives such as recognition programs and sustainability awards can motivate businesses to pursue sustainable practices. Being recognized as a leader in sustainability can enhance a company's reputation and attract environmentally conscious consumers (Wong et al., 2020).

1.5.5 Enforcing Compliance

Enforcement mechanisms are crucial for ensuring that businesses adhere to sustainability standards. Regulatory agencies monitor and inspect businesses to ensure compliance with environmental, social, and economic regulations. Penalties for non-compliance, such as fines or business closures, act as deterrents against unsustainable practices. Effective enforcement requires adequate resources, political will, and cooperation between government agencies and the private sector (Gössling et al., 2018).

1.5.6 Digital Technology in Sustainable Service Design

Digital technology plays a crucial role in enabling sustainable service design, offering innovative ways to reduce environmental impacts, enhance efficiency, and improve customer experiences. Here are some keyways digital technology can be integrated into sustainable service design, particularly in industries like tourism and hospitality.

In the quest for sustainability, smart resource management systems emerge as pivotal tools, leveraging digital technology to optimize the

consumption of essential resources such as energy and water in service sectors.

Smart resource management, leveraging digital technology, significantly enhances sustainability in service design. Advanced systems for energy and water management utilize real-time data to optimize consumption patterns and reduce waste. For instance, smart thermostats and automated lighting, as discussed by Jones and Smith (2020), can adjust settings based on occupancy, contributing to substantial energy savings in hospitality settings (Jones & Smith, 2020)."

Furthermore, Digital platforms play a critical role in fostering community engagement, enabling a more sustainable economic impact by connecting tourists directly with local businesses and cultural experiences. Patel (2019) found that digital marketplaces not only connect tourists with local businesses but also ensure that tourism benefits are more equitably distributed (Patel, 2019). These platforms support local artisans and small enterprises, fostering a more inclusive economic environment.

Additionally, the forefront of technological advancements such as big data and internet of things (IoTs) that enhance operational efficiency in service design. Thompson and Zhao (2022) found that highlight how big data can be utilized to analyze customer behavior, optimizing resource allocation and minimizing waste (Thompson & Zhao, 2022). Furthermore, sustainability dashboards allow businesses to monitor and adjust their strategies based on performance metrics against environmental goals. In addition, Martinez (2021) discussed how sensors and connected devices can streamline operations, from managing energy use in unoccupied rooms to optimizing water usage in real-time, significantly reducing the environmental impact of hospitality services (Martinez, 2021)."

2. Materials and Methods

This study employed a quantitative research design using a questionnaire survey distributed to hotel owners, executives, and managers across small and medium-sized hotels in Thailand. A stratified random sampling method was used, resulting in a sample of 300 respondents. Cronbach's alpha coefficients confirmed the reliability of all constructs, with values exceeding 0.70: Policies and Regulations (α = 0.85), Digital Technology Readiness (α = 0.88), Sustainable Service Design (α = 0.83), and Industrial Impact (α = 0.86). Data were analyzed using Structural Equation Modeling (SEM) to test and refine the measurement model.

3. Results

Table 1 shows that the respondents' perceptions that they perceived for the policies and regulations; including standards (mean = 3.98), incentives (mean = 4.01), and enforcing compliance (mean = 4.13).

Table 2 shows that the respondents believed that their businesses are ready for digital technology usage, including digital strategy (mean = 4.13), digital literacy (mean = 4.05), digital procurement (mean = 4.17) and digital tools (mean = 4.25).

Table 3 shows that the respondents' opinions regarding the leverage in sustainable service design, including resource management systems (mean = 4.25), data-driven decision making (mean = 3.84), enhanced customer experience (mean = 3.96), and digital collaboration (ecosystem) (mean = 4.10).

Furthermore, Table 4 shows the the respondents' opinions regarding their business performance as the industrial impacts, including economic impact (mean = 4.25), environmental impact (mean = 4.24), and social impact (mean = 4.30).

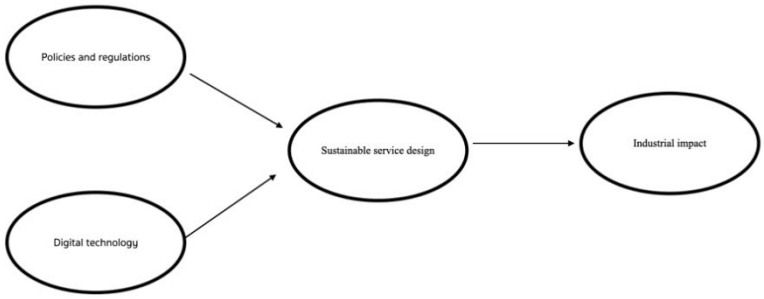

Figure 1 Conceptual Framework of the Study

Table 1 Means, Standard Deviations, and Median Response with Items for Policies and Regulations

Policies and Regulations	**Mean**	**SD.**
Standards	3.98	0.68
Incentives	4.01	0.57
Enforcing Compliance	4.13	0.94

Table 2 Means, Standard Deviations, and Median Response with Items for Digital Technology Readiness

Digital Technology Readiness	**Mean**	**SD.**
Digital Strategy	4.13	0.77
Digital Literacy	4.05	0.63
Digital Procurement	4.17	0.93
Digital Tools	4.25	0.94

Table 3 Means, Standard Deviations, and Median Response with Items for Sustainable Service Design

Sustainable Service Design	**Mean**	**SD.**
Resource Management Systems	4.25	1.21
Data-Driven Decision Making	3.84	1.07
Enhanced Customer Experience	3.96	0.87
Digital Collaboration (Ecosystem)	4.10	1.41

Table 4 Means, Standard Deviations, and Median Response with Items for Industrial Impacts

Industrial Impacts	**Mean**	**SD.**
Economic Impact	4.26	0.74
Environmental Impact	4.24	0.66
Social Impact	4.30	0.68

According to Table 5, the results exhibit that all the measurements have significant loadings to their corresponding construct. Overall, the model has a satisfactory fit with GFI = 0.946, AGFI = 0.921, NFI = 0.911, IFI = 0.923, CFI = 0.915, and RMSR = 0.043. Those are all very good, which is representing a reasonable model-data fit. Therefore, the model fix indexes for the path model indicated an acceptable approximation of the proposed relationship among the constructs and the results should be interpreted meaningfully.

Table 6 shows the testing which are reported in terms of z-value (Critical Ratio) at the level of significance of 0.05 or lower. All construct relationships are found to be positive.

The results suggest that there is a significant relationship between the perceptions in policies and regulations and sustainable service design ($p < 0.01$) as the direction of the relationship is positive as the study proposed.

The results show a significant relationship between digital technology readiness and sustainable service design ($p < 0.01$) as the direction of the relationship is positive as the study proposed. Additionally, the results show a significant relationship between sustainable service design and industrial impact ($p < 0.01$) as the direction of the relationship is positive as the study proposed.

Among the significant relationships, the standardized coefficients are 2.213 (perceptions in policies and regulations to sustainable service design), 2.624 (digital technology readiness to sustainable service design), and 2.291 (sustainable service design to industrial impact). The paths represent directly link in the proposed model. It can be concluded that effective sustainable service design will greatly lead to improve industrial impacts.

4. Discussions

This study contributes significantly to the academic discourse on sustainable service design in the tourism and hospitality industry, particularly within the context of Thailand's environmental, economic, and social landscapes. Through a quantitative analysis leveraging structural equation modeling, we have illuminated the intricate dynamics between policies, digital technology adoption, and sustainable practices, echoing and extending the findings of previous research (Gössling et al., 2012; Heras-Saizarbitoria, Arana, & Boiral, 2021).

In Thailand, many small and medium-sized hotels are currently facing challenges due to rising utility costs, lack of clear guidance on sustainability implementation, and limited digital integration. For example, hotels in tourist-heavy provinces such as Chiang Mai and Phuket often struggle with water scarcity and energy overuse during peak seasons, while simultaneously dealing with increased pressure from environmental regulations. Moreover, many businesses lack a clear roadmap for integrating sustainable technologies or adapting to government policies effectively.

The findings of this study directly address these issues. The positive relationship between policy perception and sustainable service design suggests that clearer, well-communicated regulations and stronger enforcement mechanisms could significantly enhance sustainability practices. Furthermore, the demonstrated impact of digital technology readiness highlights the importance of capacity-building programs and government support for digital transformation, particularly in resource management. By aligning digital innovation with sustainability goals, hotels can reduce operating costs, improve environmental performance, and meet growing customer expectations for eco-conscious services.

Policy and Regulation Impacts: Our findings reveal a robust linkage between the perceptions of policies and regulations and the implementation of sustainable service design practices. Specifically, in Thailand, the tourism industry is not only a major economic driver but also a significant contributor to environmental pressures, such as resource depletion and pollution. This aligns with earlier research which suggests that well-crafted policies and regulations not only promote standard-setting and compliance but also catalyze the adoption of sustainable practices by providing necessary incentives (Wong et al., 2020). The notable mean scores for policy perception indicate a strong awareness and approval of the current regulatory measures, yet highlight the need for more stringent enforcement and broader

Table 5 The Results of Adjusted Model Fit Index

Chi-Square	P-Value	CMIN/DF	GFI	AGFI	NFI	IFI	CFI	RMSEA
92.455	0.000	2.577	0.946	0.921	0.911	0.923	0.915	0.043

Table 6 Estimates of Regression Weights

			Estimate	S.E.	C.R.	P	Label
Sustainable Service Design	<---	Policies and Regulations	2.213	1.135	2.244	0.00**	par_10
Sustainable Service Design	<---	Digital Technology Readiness	2.624	1.471	2.757	0.00**	par_11
Industrial Impacts	<---	Sustainable Service Design	2.291	1.377	2.481	0.00**	par_12

Note: * shows p-value < 0.05 ** shows p-value < 0.01

stakeholder engagement to bridge the gap between policy intent and actual practice.

Digital Technology as a Catalyst for Sustainability: The study also confirms a significant positive relationship between digital technology readiness and sustainable service design. Thailand's rapid digital transformation, driven by government initiatives like "Thailand 4.0", has fostered an environment ripe for integrating advanced technologies in tourism services. The high readiness scores for digital technology adoption among Thai businesses reflect a sector poised to leverage technologies such as IoT and big data to enhance resource efficiency and customer engagement (Martinez, 2021). This supports the proposition that digital technologies—such as IoT, big data analytics, and smart resource management systems—serve as pivotal tools for enhancing sustainability within the tourism sector by optimizing resource use and enhancing customer engagement (Jones & Smith, 2020; Martinez, 2021). The readiness scores suggest that while there is a high level of digital adoption, continuous improvement and education in digital competencies could further leverage technology for sustainable ends.

Interplay Between Sustainable Design and Industrial Impact: Importantly, our research underscores the consequential impact of sustainable service design on the broader industrial metrics, including economic performance, environmental sustainability, and social welfare. The positive association between sustainable service design and industrial impacts in Thailand underscores the potential for sustainability to drive not just ecological benefits but also economic and social improvements. This is crucial for Thailand, where tourism not only fuels the economy but also supports myriad small and medium enterprises and local communities. This finding corroborates the view that integrating sustainability into service design does not merely fulfill an ethical obligation but also enhances the overall industry performance, fostering economic resilience and social well-being (Dwyer et al., 2020).

Challenges and Future Directions: Despite these positive associations, the study recognizes the challenges in fully realizing sustainable service design. The challenges of rapid technological change outpacing policy development are particularly pertinent in Thailand, where the speed of innovation occasionally clashes with traditional regulatory frameworks. This necessitates a more agile approach to policy-making, which can quickly adapt to new technologies and market dynamics

while ensuring that sustainability is not sidelined in pursuit of economic growth (Phuaphanthong et al., 2018). This calls for agile and adaptive governance structures that can keep pace with technological advancements and shifting consumer expectations towards sustainability.

4. Conclusion

This study elucidates how the interplay of policy, technology, and sustainability within Thailand's tourism and hospitality sector can serve as a model for similar emerging economies striving to balance economic development with environmental and social stewardship. This research not only enhances our understanding of the factors driving sustainable service design in Thailand's tourism and hospitality sector but also offers a model for other regions grappling with similar sustainability challenges. It highlights the critical role of policy frameworks, the transformative potential of digital technology, and the need for continuous stakeholder engagement in fostering a sustainable tourism industry. Furthermore, the lessons drawn from this research could inform both policy and practice, ensuring that the nation remains a vibrant, competitive, and sustainable tourist destination. Future studies might explore qualitative insights from stakeholders to complement these findings and provide a deeper understanding of the barriers and enablers of sustainability in this vital economic sector.

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