

Technology adoption and implementation of selected Filipino restaurants toward sustainable tourism at fort Santiago, Intramuros, Philippines

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INTRODUCTION

Heritage destinations globally are increasingly integrating digital technologies to enhance visitor engagement, operational efficiency, and sustainability outcomes. In the Philippine context, Intramuros; particularly Fort Santiago, represents a historically significant site where tourism, conservation, and commercial activities intersect. While smart tourism initiatives such as augmented reality (AR) applications and digital visitor systems have been introduced at the destination level, limited empirical research examines how small and medium-sized enterprises (SMEs), particularly restaurants, adopt technology to support sustainable tourism.

Restaurants within heritage destinations play a crucial role in shaping visitor experiences and influencing resource consumption patterns. Digital technologies such as QR code menus, contactless payment systems, inventory management tools, and social media platforms present opportunities to reduce waste, enhance efficiency, and promote local culture. However, the extent to which these technologies contribute to sustainability remains underexplored.

LITERATURE REVIEW

Smart tourism is increasingly defined by the integration of advanced digital technologies aimed at enhancing tourist experiences, improving operational efficiency, and supporting sustainable development within destinations (Gretzel et al., 2015). In the hospitality sector, digital transformation has become a critical driver of innovation, enabling automation, real-time decision-making, and more personalized customer interactions (Buhalis & Leung, 2018). Technologies such as mobile applications, digital payment systems, QR-based platforms, and online reservation systems have evolved into essential components of modern service delivery, particularly in environments where efficiency and customer convenience are highly valued. These technological advancements not only improve service quality but also create opportunities for more resource-efficient operations.

However, the adoption of such technologies among small tourism enterprises (STEs) remains uneven. Existing literature highlights that STEs often face significant barriers, including limited financial resources, lack of technical expertise, inadequate infrastructure, and resistance to organizational change (Thomas et al., 2011). Despite these constraints, digital tools can enhance competitiveness and operational performance when effectively implemented, particularly in highly dynamic tourism environments such as heritage destinations.

Within this context, sustainable tourism provides a critical lens for evaluating the broader implications of technology adoption. The Triple Bottom Line (TBL) framework emphasizes the need to balance economic viability, environmental protection, and socio-cultural sustainability (Elkington, 1997). In hospitality operations, sustainability practices are manifested through initiatives such as waste reduction, energy efficiency, responsible sourcing, and cultural preservation. This study operationalizes the TBL framework by linking each sustainability dimension to specific technological applications, as shown in Table 1.

Table 1. Operationalization of the Triple Bottom Line (TBL) Framework

Dimension	Indicators	Technology Application
Economic	Efficiency, profitability	POS systems, digital payments
Environmental	Waste reduction, energy use	QR menus, energy monitoring
Socio-cultural	Local sourcing, heritage promotion	Social media, storytelling

METHOD

A descriptive-analytical quantitative research design was employed to examine patterns of technology adoption and their alignment with sustainability dimensions among selected Filipino restaurants in Fort Santiago, Intramuros. This design allows for a structured analysis of respondents' perceptions while maintaining an analytical perspective on how technology contributes to economic, environmental, and socio-cultural aspects of sustainability.

The study involved a total of 150 respondents composed of restaurant operators, employees, and tourists, ensuring a multi-stakeholder perspective on technology adoption.

Data were collected through structured survey questionnaires utilizing a 5-point Likert scale to measure levels of agreement across indicators related to technology implementation, sustainability practices, perceived benefits, and challenges. The instrument was designed to capture both operational and perceptual dimensions of digital adoption within the context of heritage-based food service establishments.

For data analysis, descriptive statistical tools, including mean, frequency, and ranking, were applied to identify patterns and trends in responses. Given the nature of the research design, findings are interpreted cautiously as perception-based insights rather than causal relationships, thereby ensuring analytical rigor while acknowledging methodological limitations.

FINDINGS

The findings of the study are presented through a structured analysis of technology adoption, perceived benefits, and challenges, with tables used to summarize key quantitative trends.

The results indicate that technology adoption among selected Filipino restaurants in Fort Santiago is largely concentrated on customer-facing systems, particularly those that enhance convenience and efficiency. As shown in Table 2, contactless payment systems and QR code menus exhibit the highest levels of implementation, while sustainability-oriented digital communication remains comparatively lower.

Table 2. Technology Adoption Levels

Technology	Mean	Interpretation
Contactless Payment	4.60	Highly Implemented
QR Code Menus	4.45	Highly Implemented
Energy-efficient Equipment	4.20	Implemented
Biodegradable Packaging	4.30	Implemented
Sustainability Information Online	3.50	Moderately Implemented

These findings suggest that technological adoption is primarily driven by operational and customer service considerations rather than explicit sustainability goals.

In terms of perceived benefits, respondents strongly agreed that technology enhances operational efficiency and customer experience. As illustrated in Table 3, these dimensions rank higher than environmental impact, indicating that sustainability is perceived as a secondary outcome of digital adoption.

Table 3. Perceived Benefits of Technology Adoption

Benefit	Mean	Rank
Operational Efficiency	4.55	1
Customer Experience	4.50	2
Financial Performance	4.40	3
Environmental Impact	3.90	4

Furthermore, respondents identified several barriers to effective implementation. As presented in Table 4, high costs, customer resistance, and technical issues emerged as the most significant challenges.

Table 4. Challenges in Technology Adoption

Challenge	Mean	Rank
High Cost	4.60	1
Customer Resistance	4.30	2
Technical Issues	4.10	3
Limited Government Support	4.00	4

To provide deeper insight, the study also examined variations in perception across respondent groups. As shown in Table 5, differences exist between operators, employees, and tourists, particularly in terms of sustainability awareness and perceived challenges.

Table 5. Comparative Perceptions by Respondent Type

Variable	Operators	Employees	Tourists	Key Insight
Tech Importance	High	Moderate	High	Alignment between operators and tourists
Sustainability Awareness	High	Moderate	Low	Awareness gap
Adoption Challenges	High	High	Low	Internal operational burden

These findings highlight that while technology adoption is widely recognized as important, disparities in awareness and experience persist among stakeholders.

IMPLICATIONS OR CONCLUSION

Technology adoption in heritage-based restaurants operates primarily as a structural enabler of sustainable tourism rather than a direct or intentional driver of sustainability outcomes. The findings suggest that while digital tools such as contactless payment systems, QR code menus, and inventory management platforms contribute to improved efficiency and reduced resource use, their implementation is largely motivated by operational and economic considerations. As a result, environmental and socio-cultural benefits often emerge as secondary outcomes rather than deliberate strategic objectives. This highlights a critical gap between digital transformation and sustainability integration, particularly within small and medium-sized enterprises operating in heritage destinations.

To bridge this gap, there is a need for more deliberate alignment between technology adoption and sustainability goals through targeted policy interventions. Government agencies and tourism authorities play a crucial role in shaping this alignment by creating an enabling environment that encourages the use of digital technologies for sustainable practices. This may include the provision of financial incentives such as grants or subsidies for adopting eco-friendly technologies, as well as the development of digital literacy programs aimed at enhancing the technical capabilities of restaurant operators and employees. Strengthening digital competencies can empower stakeholders to maximize the sustainability potential of technological tools rather than limiting their use to basic operational functions.

Furthermore, the establishment of standardized sustainability key performance indicators (KPIs) specific to technology adoption in hospitality settings is essential to ensure measurable and consistent outcomes. These indicators can guide businesses in monitoring their environmental impact, resource efficiency, and socio-cultural contributions. In addition, improving digital infrastructure within heritage zones; such as reliable internet connectivity and integrated digital systems, can significantly enhance the effectiveness of technology implementation. Collectively, these measures can transform technology from a purely operational tool into a strategic mechanism that actively supports sustainable tourism development in heritage destinations.

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