

Perceived Effectiveness of Smart Tourism Technologies among Hotels in Cagayan Valley

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Abstract

The tourism industry is a significant contributor to economic development. However, the COVID-19 pandemic caused substantial disruption, particularly in regions such as Cagayan Valley, Philippines, where tourism-related revenues experienced a sharp decline. This research investigates the contribution of Smart Tourism Technologies (STTs) to the post-pandemic recovery of the local tourism sector. STTs, encompassing innovations such as artificial intelligence (AI) and mobile applications, are posited to enhance operational efficiency and elevate the customer experience through the provision of personalized services.

This study utilized a descriptive research design to evaluate the effectiveness of STTs implemented by tourism establishments in Cagayan Valley. The assessment focused on their influence on tourist engagement, user acquisition, and revenue outcomes. Primary data were collected from hotel managers through a validated questionnaire adapted from existing scholarly literature. The findings indicate that while numerous establishments have adopted STTs, with adoption periods ranging from 1 to 5 years, the overall integration level remains constrained. The predominant STTs in use include electronic guest applications and social media platforms for reservation purposes. Perceived effectiveness of these technologies is reported as high, demonstrating significant positive correlations between STT implementation and tourist satisfaction. However, challenges such as inadequate technological infrastructure and insufficient staff training impede broader adoption. This study emphasizes the necessity for targeted strategic interventions to strengthen STT integration within Cagayan Valley's tourism sector. Such efforts aim to foster sustainable development and cultivate enhanced tourist loyalty through superior digital experiences. Further research is recommended to explore the long-term impacts of STT adoption on regional tourism recovery.

Keywords: *Smart Tourism Technologies, Hotels, Tourism*

INTRODUCTION

The tourism sector is a vital driver of economic growth of for most countries. It provides employment, boosts income levels, and supporting a wide array of industries (Khalid et al., 2019). Though, due to the pandemic that caused unprecedented disruptions, it has brought decline on lobar tourism exports (World Tourism Organization, 2020). In the Philippines, the pandemic greatly impacted tourism as seen on the decline of tourism receipts. This is also seen in the tourism sector of Cagayan Valley. As a result, there is a decline on the local economies, many tourism workers are displaced and emphasized the urgent solutions to recover the sector.

Smart tourism technologies (STTs) have a significant role for the recovery and progress in the post-pandemic era. It seeks to enhances the adeptness of the standards of tourism related-establishments, customer experience and health and safety. One of the key features of AI powered apps is letting potential tourists personalize experiences by having a preview of destinations before travelling which enhances their satisfaction and helps them with their purchase decisions. The adoption and the effectiveness of smart tourism technologies (STTs) in Cagayan Valley remain underexplored despite few advancements in technology. The unique challenges of this region, including its reliance on local tourism and its recovery from the pandemic, impose a focused investigation. Additionally, limitations

such as technological infrastructure, cost of adoption, and employee training require consideration to understand its limitations. Addressing these gaps is critical in providing insights for stakeholders for better tourism products and services in the region.

In many ways, smart tourism can be perceived as a logical development from traditional tourism. Moreover, e- tourism as an avenue for the innovations and the technological orientation of industry and the consumers were laid early with the widespread adoption of information and communication technologies (ICT). Also, the integration of Web-based technologies for global distribution and central reservation systems has led to the emergence of e-Tourism (Werthner and Ricci, 2004). Smart tourism allows for the revolution of massive data into meaningful information for potential tourists with the aim of providing tourist satisfaction and the attractiveness.

A range of digital tools namely mobile payment systems, social media platforms, the Internet of Things (IoT), artificial intelligence (AI), augmented reality (AR), are some of the examples of Smart Tourism Technologies used in hotels to enhance the tourism services. Additionally, the behavioral intentions of the tourist are greatly influenced by these technologies to improve tourists' satisfaction, enrich their experiences. It also provides significant added value to tourists' travel experiences thru offering real-time, personalized, and interactive services.

As outlined by Buhalis and Amaranggana (2015), the key attributes of STTs are information, accessibility, interactivity, personalization, and security. Information quality is defined as reliable and detailed information about destinations. This is crucial for tourists in decision-making to help them plan and enjoy their trips effectively (Kim et al., 2004). Accessibility points out on how easy information can be accessed. Interactivity allows for two-way communication between tourists and stakeholders, improving engagement and satisfaction (Huang et al., 2017). As tourist have varied demands, personalization tailors the experience to individual preferences which can boost satisfaction by reducing decision-making time (Jeong & Shin, 2019). Finally, security is when they feel their personal data is secured while accessing the smart technology. Perceived value is a comprehensive evaluation of benefits that justifies the costs of the product used/ availed. Positive experiences with STTs are linked to tourist satisfaction, which is influenced by destination image, service quality, and perceived value. Satisfaction with STTs can lead to positive post-experience behaviors, such as revisiting intentions or recommending them to others in shaping tourist loyalty (Yoon & Uysal, 2005).

Hence, this study is conducted to identify the commonly used smart tourism tools used by tourism-related establishments in Cagayan Valley. Also, it will determine the effectiveness of these tools as perceived by tourism-related establishments. Moreover, it shall identify the problems or constraints in using these technologies.

Objectives of the Study

This study aims to identify the commonly used smart tourism technologies of tourism establishments in Cagayan Valley, its effectiveness and limitations. Specifically, it aims to:

- 1. Identify the profile of the hotel in terms of:**
 - a. Philippine Accommodation Classification
 - b. Number of years of operation
 - c. Number of Years Using Smart Tourism Technology
- 2. Identify the different smart tourism technologies used by hotels in terms of :**
 - a. Search
 - b. Booking
 - c. Greeting and Check in

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- d. Stay
- 3. **Measure the perceived effectiveness of the use of these smart tourism technologies in terms of:**
 - a. Audience Gain
 - b. Revenues
 - c. Information
 - d. Accessibility
 - e. Interactivity
 - f. Personalization
 - g. Security
- 4. **Identify the challenges and limitations of using smart tourism technologies?**
- 5. **Determine the significant relationship between the profile of hotels and perceived effectiveness of smart technologies.**

METHODS

The researchers utilized a descriptive research design in conducting the study. This design was used to describe the profile of the participants and the stages where smart tourism technologies are used, namely search, booking, greeting and check in and stay. It also described the perceived effectiveness of smart tourism technologies among hotels in Cagayan Valley. This design likewise relates to the level of perceived effectiveness of smart tourism technologies on hotels when grouped according to their profile variables.

This study was conducted in Cagayan Valley. The participants of the study are managers/ owners of different tourism related establishments which use smart tourism tools.

In order to obtain relevant information, the researchers made use of adapted questionnaire on the study of Zhang, Y., Sotiriadis, M., & Shen, S. (2022) entitled, "Investigating the Impact of Smart Tourism Technologies on Tourists' Experiences. Sustainability" which will be accomplished by the respondents. There were minor revisions incorporated and modified to suit the conditions of the existing scenario of tourism industry in Cagayan Valley. The questionnaire was also validated by technical experts in the tourism industry. It determined the perceived effectiveness of smart tourism technologies among hotels in Cagayan Valley using a five-point scale ranging from 1 (Not effective) to 5 (Very Effective). The questionnaire has the following parts which profile of respondents; Smart tourism technologies mostly used; perceived level of effectiveness of smart tourism technologies in Hotels in Cagayan Valley and challenges and limitations in using smart technologies.

A request letter was submitted to the Regional Tourism Office for approval. Following appropriate communication with the relevant authorities and upon receiving approval, the researchers provided a copy to the hotel owners and managers to facilitate the study. Prior to this, the study's purpose was thoroughly explained to the participants to secure their full cooperation. The researcher additionally reviewed the informed consent form with all participants. This process confirmed their understanding of confidentiality, specifically that their identities would remain anonymous and no data would be personally attributed.

To analyze the data collected, various statistical methods were employed. Frequency count was used to identify the smart tourism technologies utilized across the three operational areas and to assess the challenges and limitations associated with these platforms. The Weighted Mean measured the effectiveness of these technologies across five parameters using a Likert scale. Additionally, T-test and ANOVA were applied to determine whether significant differences existed in the effectiveness of smart tourism technologies when categorized according to profile variables.

RESULTS AND DISCUSSION

This chapter includes the analysis and interpretation of the data gathered. The research question presented as specific objectives were answered accordingly to how they are sequenced in the statement of the problem.

Table 1. Frequency and Percentage Distribution of Hotels According to Profile

Variables	Categories	Frequency (n=131)	Percent
Philippine Accommodation Classification	Hotel	45	34.4
	Resort	11	8.4
	Mabuhay Accommodation	55	42.0
	Homestay	20	15.3
Number of years of operation	Less than 1 year	16	12.2
	1 - 5 years	47	35.9
	6 - 10 years	47	35.9
	11 - 15 years	10	7.6
	More than 15 years	11	8.4
Number of Years using Smart Tourism Technology	Less than 1 year	19	14.5
	1 - 5 years	83	63.4
	6 - 10 years	24	18.3
	11 - 15 years	5	3.8

Table 1 presents the profile of the hotels including Philippine Accommodation Classification, number of years of operation and number of years using smart tourism technology.

Among the 131 hotels, 45 establishments, or 34.4 percent, are categorized as hotels. Mabuhay Accommodations make up the largest group, with 55 establishments, representing 42.0 percent of the total. Homestays account for 20 establishments, or 15.3 percent, while resorts are the smallest group, with 11 establishments, or 8.4 percent. The observed distribution indicates a predominant presence of economically priced and smaller-sized accommodation establishments.

In terms of operational tenure, a substantial majority of the establishments (71.8%) have been active for 1 to 10 years. Specifically, 47 establishments (35.9%) have operated for 1 to 5 years, and an equal number (47 establishments, also 35.9%) have been in operation for 6 to 10 years. A smaller segment, comprising 16 establishments (12.2%), has operated for less than 1 year. Establishments with 11 to 15 years of operation account for 10 entities (7.6%), while 11 establishments (8.4%) have been in business for more than 15 years. This pattern suggests a predominance of newer establishments, indicating growth within the hospitality industry. Concerning the implementation of smart tourism technologies, a majority of establishments have utilized them for a relatively short duration. Specifically, 83 establishments (63.4%) have employed these tools for 1 to 5 years. A smaller segment, comprising 24 establishments (18.3%), has adopted these technologies for 6 to 10 years. In contrast, 19 establishments (14.5%) have been using them for less than 1 year, while only 5 establishments (3.8%) possess over a decade of experience with smart tourism technologies. This pattern suggests that the adoption of these technologies is predominantly in its nascent stages across many establishments, reflecting an ongoing drive towards digital transformation within the hospitality sector.

Table 2 Frequency and Percentage Distribution of Hotels According to Smart Tourism Technologies Used

Variables	Categories	Frequency (n=131)	Percent
Search	E-guest app	95	72.5
	Electric vehicles as shuttle	23	17.6

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	Not using any app	13	9.9
Booking	Social Media Sites	116	88.5
	E-booking(Mobile App)	31	23.7
	Not using any app	11	8.4
Greeting and Check in	E-payment	67	51.1
	Facial Recognition	35	26.7
	Fast Check -in (Mobile app)	28	21.4
	E-Concierge	4	3.1
	Not using any app	19	14.5
Stay	Wireless internet access	112	85.5
	Smart TV	73	55.7
	Smart Room Key (Ving cards or keyless)	44	33.6
	Sensors	28	21.4
	In-room Charging Station	26	19.8
	Aromatherapy Diffuser	15	11.5
	In-room voice assistant	6	4.6
	Power bank rentals	2	1.5
	Handy 2.0 (complimentary smartphone)	1	0.8

Table 2 presents the smart tourism technologies commonly utilized by tourism establishments in Cagayan Valley.

In terms of search technologies, 95 establishments (72.5%) primarily employ e-guest applications. This demonstrates a substantial reliance on digital platforms to facilitate guest access to accommodations and services. Conversely, the adoption of electric vehicles for shuttle services is limited, with only 23 establishments (17.6%) utilizing this technology. Thirteen establishments (9.9%) do not currently use any search applications, indicating an opportunity for technological integration in this domain.

Concerning booking technologies, social media platforms are the most prevalent, utilized by 116 hotels (88.5%). Electronic booking via mobile applications is adopted by 31 hotels (23.7%), indicating moderate implementation. Conversely, 11 hotels (8.4%) do not employ any digital booking tools, highlighting a deficiency in leveraging digital platforms for reservations. The widespread integration of social media for reservations is noteworthy. This observation aligns with the findings of El Nemar et al. (2022), whose research on the impact of e-service on hotel bookings demonstrated that online service quality significantly influences customers' intentions to book hotels digitally, thereby emphasizing the criticality of digital booking platforms within the hospitality sector.

For greeting and check-in processes, e-payment systems are the most frequently adopted technology, utilized by 67 establishments (51.1%). Facial recognition technology is employed by 35 establishments (26.7%), while expedited check-in through mobile applications is implemented by 28 establishments (21.4%). E-concierge services exhibit minimal adoption, with only 4 establishments (3.1%) utilizing this tool. Furthermore, 19 establishments (14.5%) do not employ any technology for greeting and check-in, indicating substantial scope for digital transformation in these operations.

In terms of room technologies, wireless internet access is almost universally available, with 85.5% of establishments providing this fundamental service. However, advanced technologies such as in-room voice assistants (4.6%), power bank rentals (1.5%), and complimentary smartphones (0.8%) constitute niche offerings. Their limited adoption suggests their potential as distinctive features for establishments seeking competitive differentiation. A study of Millar et. al., (2007) found that about most of hotel websites advertised wireless Internet access, indicating a significant presence of Wi-Fi in the hospitality industry

Table 3a. Perceived Effectiveness of the Use of Smart Tourism Technologies in terms of Audience Gain

Audience Gain	Mean	Descriptive Interpretation
The hotel site has more good reviews than bad reviews.	4.24	Very Effective
There were reviews and comments available on the site.	4.19	Very Effective
The online site used has an ample number of followers.	4.17	Very Effective
The website used has good number of engagements	4.11	Very Effective
There are queries on hotel rates and facilities regularly.	4.11	Very Effective
There are follow up queries on the site after the initial message.	4.08	Very Effective
There were bookings received from guests through the online apps.	3.98	Very Effective
There is an increasing number of followers on your site monthly.	3.95	Very Effective
The page used is verified.	3.94	Very Effective
Posts and pictures have numerous likes and emojis.	3.91	Very Effective
There are queries about bookings on the on the hotels online app.	3.90	Very Effective
The site has a regular number of engagements.	3.75	Very Effective
Bookings from the online site received is minimal.	3.30	Moderately Effective
Category Mean	3.97	Very Effective

Table 3a outlines the perceived effectiveness of the use of smart tourism technologies in terms of audience gain. As shown, smart tourism technologies are perceived as very effective for audience gain, with a category mean of 3.97. As perceived by the managers/supervisors, using smart tourism technologies is very effective in increasing positive reviews compared to negative ones on hotel sites (Mean = 4.24). This supports the study of Deng and Tu (2023) which shows that positive online reviews significantly influence consumer hotel booking decisions. Positive reviews contribute to establishing a positive brand image for hotels, leading to word-of-mouth promotion and increased bookings.

However, while still effective, minimal bookings from online platforms (Mean = 3.30) highlight a limitation in converting engagement into direct sales. Overall, smart tourism technologies are very effective in enhancing audience engagement and growth.

Table 3b. Perceived Effectiveness of the Use of Smart Tourism Technologies in terms of Revenues

Revenues	Mean	Descriptive Interpretation
There is a constant increase of sales while using online apps.	4.06	Very Effective
There are bookings received through the hotel's reservation site.	4.04	Very Effective
There is high occupancy rate of the hotel while using the online app.	4.02	Very Effective
There is an increased number of bookings of the hotel while using reservation apps.	3.90	Very Effective

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There is a repeat -sales booked online.	3.89	Very Effective
There are cancellations done on bookings through online smart technology.	3.53	Very Effective
The hotel has reached the allotted number of rooms in the online smart apps.	3.49	Very Effective
The hotel exceeds the target revenue per month due to use of online booking apps	3.48	Very Effective
Room sales doesn't change even if the hotel is using an online reservation site.	3.33	Moderately Effective
The sales of online booking decreases after a year of using online smart tourism	3.14	Moderately Effective
Category Mean	3.69	Very Effective

Table 3b outlines the perceived effectiveness of the use of smart tourism technologies in terms of revenues. As shown, using smart tourism technologies is very effective in achieving revenue-related goals, as indicated by a category mean of 3.69. As perceived by the managers/supervisors, using smart tourism technologies is very effective in increasing sales through online apps (Mean = 4.06) and generating bookings through the hotel's reservation site (Mean = 4.04). However, room sales that remain unchanged despite online reservations (Mean = 3.33) and a decrease in sales after a year of usage (Mean = 3.14) highlight areas for improvement. Overall, the category mean of 3.69 indicates that smart tourism technologies are very effective in boosting hotel revenues.

This corroborates to the study of Sujuod et. al., (2022) on the integration of smart technologies in tourism is influenced by consumer trust and intention to use these technologies. When consumers trust and are willing to use smart technologies, it can lead to increased engagement with online apps and platforms, potentially boosting sales.

Table 3c. Perceived Effectiveness of the Use of Smart Tourism Technologies in terms of Information

Information	Mean	Descriptive Interpretation
Information provided about the travel via web app is useful.	4.28	Extremely effective
Smart tourism technologies enable the tourists to complete travel with reliable and detailed information.	4.15	Very Effective
Smart devices contribute to minimizing the travel concerns of the hotel clients	4.08	Very Effective
All statements and instructions on the website can be easily followed by tourist.	4.05	Very Effective
Smart devices give tourist more freedom of mobility.	4.03	Very Effective
Information about the facilities and services offered by the hotel is sufficient on the hotels' website.	3.98	Very Effective
There are instructions given on how to use different smart tourism technologies within the vicinity of the hotel.	3.73	Very Effective
There is no such thing as a manual for smart devices that is written in simple plain language	3.32	Moderately Effective
Category Mean	3.95	Very Effective

Table 3c outlines the perceived effectiveness of the use of smart tourism technologies in terms of information. As shown, using smart tourism technologies is perceived by managers and supervisors

as very effective in providing information, as indicated by a category mean of 3.95. The highest effectiveness is noted in the usefulness of information provided through web apps (Mean = 4.28), suggesting that managers believe these platforms significantly enhance the tourist experience. While the sufficiency of information about hotel facilities and services on websites (Mean = 3.98) and instructions for using smart devices (Mean = 3.73) are viewed positively, managers perceive the lack of clear, simple manuals for smart devices (Mean = 3.32) as an area needing improvement. Hien and Trang (2024) suggest that the integration of smart technologies in tourism is influenced by consumer trust and intention to use these technologies. Consumer trust in and willingness to utilize smart technologies can foster greater engagement with digital applications and platforms, potentially stimulating sales. Overall, the results suggest that smart tourism technologies are highly effective in providing essential information, according to managers and supervisors.

Table 3d. Perceived Effectiveness of the Use of Smart Tourism Technologies in terms of Accessibility

Accessibility	Mean	Descriptive Interpretation
There is an easy access to the Wi-fi connection of the hotel.	4.34	Extremely effective
Smart devices (e.g., smartphone, and tablet) can be used anywhere and at any time within the vicinity of the hotel	4.29	Extremely effective
When browsing the net, the website or page of the hotel can be easily found.	4.29	Extremely effective
Smart online apps can be used anywhere and at any time.	4.14	Very Effective
Smart tourism technologies are accessible.	4.05	Very Effective
There are signages in the hotel that gives direction on the use of smart gadgets	3.93	Very Effective
Smart tourism gadgets are easily found without complicated processes when traveling.	3.85	Very Effective
Anyone can use smart gadgets of the hotel.	3.75	Very Effective
Smart gadgets can be easily requested from the hotel	3.35	Moderately Effective
Use of smart gadgets are limited according to the services/ rooms availed in the hotel.	3.22	Moderately Effective
Category Mean	3.92	Very Effective

Table 3d outlines the perceived effectiveness of the use of smart tourism technologies in terms of accessibility. Using smart tourism technologies is perceived as very effective in enhancing accessibility, with a category mean of 3.92. The highest effectiveness is observed in the easy access to Wi-Fi connections at the hotel (Mean = 4.34) and the availability of smart devices (e.g., smartphones and tablets) that can be used anywhere within the hotel (Mean = 4.29). Moreover, while smart gadgets can be used by anyone (Mean = 3.75), there is moderate effectiveness in how easily they can be requested from the hotel (Mean = 3.35), and the limitation of smart gadgets based on services or rooms availed (Mean = 3.22) is seen as moderately effective. The study of Cristian (2021) shows that hotels increasingly use smart devices such as smartphones and tablets to enhance guest experiences.

Overall, the results indicate that while smart tourism technologies are perceived as very effective in enhancing accessibility, there are areas that could be improved.

Table 3e. Perceived Effectiveness of the Use of Smart Tourism Technologies in terms of Interactivity

Interactivity	Mean	Descriptive Interpretation
Apps and website of the hotel gives prompt transactions.	4.09	Very Effective

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The hotel website or page is easy to navigate.	3.93	Very Effective
It is easy to share information and content on smart tourism technologies (hotel reviews, posts and forums)	3.93	Very Effective
Smart tourism technologies are highly responsive.	3.81	Very Effective
Smart tourism technologies are interactive.	3.79	Very Effective
There is an in-room service assistant on guestroom to answer basic queries.	3.71	Very Effective
Online self-service check-in and check-out is available for tourist.	3.49	Very Effective
Facilities with sensors function easily when used.	3.41	Very Effective
Category Mean	3.77	Very Effective

Table 3e outlines the perceived effectiveness of the use of smart tourism technologies in terms of interactivity. As shown, using smart tourism technologies is very effective in enhancing interactivity, as shown by a category mean of 3.77. The highest-rated effects include the prompt transactions provided by hotel apps and websites (Mean = 4.09), the ease of navigation on hotel websites (Mean = 3.93), and the ability to share information and content on smart platforms such as reviews and posts (Mean = 3.93). Smart tourism technologies are also very effective in being responsive (Mean = 3.81) and interactive (Mean = 3.79), with features like in-room service assistants addressing basic queries (Mean = 3.71). The technologies also support online self-service check-ins and check-outs (Mean = 3.49) and facilitate easy use of sensor-based facilities (Mean = 3.41).

Sripaew and Katkaeo(2017) highlights an empirical study on the usability of online hotel reservation websites emphasizes the importance of creating user-friendly platforms that facilitate prompt and efficient transactions. This includes ensuring that websites are easy to navigate and provide clear information to users.

Overall, the results indicate that smart tourism technologies demonstrate high efficacy in improving interactivity. Nevertheless, specific domains, such as sensor functionality and self-service options, warrant additional development.

Table 3f. Perceived Effectiveness of the Use of Smart Tourism Technologies in terms of Personalization

Personalization	Mean	Descriptive Interpretation
It is easy to share information and content on smart tourism technologies (hotel reviews, posts and forums)	4.11	Very Effective
Hotels sites and pages have options for reviews and comments.	4.08	Very Effective
Smart tourism technologies are highly responsive.	4.03	Very Effective
Smart tourism technologies are interactive.	3.96	Very Effective
Smart tourism technologies are interactive.	3.90	Very Effective
Reservations on online platforms has an option for guest special requests.	3.81	Very Effective
Websites and apps of the hotel uses local dialects for local guests.	3.61	Very Effective
The hotel has tablet-controlled room system or any gadget with similar function.	2.99	Moderately Effective
Category Mean	3.81	Very Effective

Table 3f outlines the perceived effectiveness of the use of smart tourism technologies in terms of personalization. Using smart tourism technologies is very effective in enhancing personalization, according to the perceptions of managers and supervisors of tourism-related establishments, as shown

by a category mean of 3.81. The highest-rated effects include the ease of sharing information and content on smart tourism technologies, such as hotel reviews and posts (Mean = 4.11), and the availability of review and comment options on hotel websites (Mean = 4.08). Additionally, managers perceive smart tourism technologies as highly responsive (Mean = 4.03) and interactive (Mean = 3.96), which contribute to a more personalized guest experience. The capacity to accommodate special requests via online reservations is also notably strong, evidenced by a mean score of 3.81. The use of local dialects on hotel websites and apps for local guests (Mean = 3.61) further supports personalization efforts. However, the use of tablet-controlled room systems or similar gadgets received a lower rating (Mean = 2.99), indicating that there is potential for improvement in this area. Ruzima et. al., (2024) states that trust in online reviews is a crucial factor in booking intentions. Consumers are more likely to book a hotel when they trust the reviews, especially if the reviews are positive and numerous Overall, the results suggest that smart tourism technologies are very effective in personalizing the guest experience, with some room for improvement in certain features.

Table 3g. Perceived Effectiveness of the Use of Smart Tourism Technologies in terms of Security

Security	Mean	Descriptive Interpretation
Online websites and reservation systems of hotels respect guest privacy and the safety of my transactions.	4.33	Extremely effective
CCTV's are equipped at public areas of the hotel to ensure guest safety.	4.22	Very Effective
Hotel websites and page protect guest personal and sensitive information.	4.21	Very Effective
Smart tourism technologies are trustworthy and reliable.	4.08	Very Effective
E-payment platform of the hotel is safe.	3.65	Very Effective
Facial images are used for authentication/verification to gain access to guest areas and services.	3.49	Very Effective
Tourists complain of pop up sites while browsing the page or website.	2.92	Moderately Effective
Tourists are given access on elevators only to floors where their guest rooms are located thru ving cards.	2.54	Moderately Effective
Category Mean	3.68	Very Effective

Table 3g outlines the perceived effectiveness of the use of smart tourism technologies in terms of security. Using smart tourism technologies is very effective in enhancing security within tourism establishments, as perceived by managers and supervisors, with a category mean of 3.68. The highest-rated aspect is respect for guest privacy and the safety of transactions on hotel websites (Mean = 4.33), which is considered extremely effective. Additionally, the use of CCTV in public areas (Mean = 4.22) and the protection of guest personal information on hotel websites (Mean = 4.21) are seen as very effective in ensuring security. Other technologies, such as the trustworthiness of smart tourism systems (Mean = 4.08) and the safety of e-payment platforms (Mean = 3.65), also received high ratings. However, several security aspects received comparatively lower ratings, suggesting areas for improvement. Specifically, the use of facial recognition for access (Mean = 3.49) and concerns about pop-up sites encountered during browsing (Mean = 2.92) were identified. The lowest rating was attributed to the elevator access control system, which uses Ving cards (Mean = 2.54), indicating a significant need for enhancement in this particular security feature. These findings are consistent with the concerns guests express regarding data vulnerability and privacy risks when providing personal information to hotels, as noted by Pipatpong and Manosuthi (2024). Hotels must enhance data security measures to mitigate these concerns and foster trust among guests. Overall, smart tourism technologies are perceived as very effective in improving security, with some opportunities for refinement in specific areas

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Table 4. Challenges and Limitations of Using Smart Tourism Technologies

Issues and Challenges	Mean	Descriptive Interpretation
Smart Tourism Technologies require constant maintenance and upgrading.	3.30	Strongly Agree
Training of employees is required in Smart Tourism Technologies integration	3.30	Strongly Agree
It is challenging to utilize data and enhance guest experience.	3.18	Agree
Smart tourism technology implementation and installation is costly.	3.17	Agree
It is difficult to partner with a software provider.	3.08	Agree
The software provider has low level of support and service	2.80	Agree
Smart Tourism Technologies are sophisticated and difficult to manage.	2.76	Agree
Threat of hotel network attacks and cybercrime is high.	2.71	Agree
Smart Tourism Technologies are not adequately marketed to hotel guests.	2.71	Agree
Sufficient privacy and security measures are not guaranteed.	2.67	Agree
Overall	2.27	Agree

Table 4 presents the challenges and limitations of using smart tourism technologies. As presented, Using smart tourism technologies poses challenges and limitations, as reflected by an overall mean of 2.27, which indicates a general agreement among managers and supervisors. The most significant challenges include the frequent need for maintenance and upgrading, along with the necessity for employee training during integration, both rated as with mean of 3.30, showing strong agreement. Pribadi et al.(2021) explains that smart tourism technologies require regular maintenance and upgrading to ensure they remain effective and efficient. This includes updating software, replacing hardware, and ensuring compatibility with new technologies. The cost and complexity of these processes can be significant challenges for tourism operators. Significant challenges identified include the difficulty of leveraging data to enhance guest experiences (mean = 3.18) and the substantial costs associated with technology implementation and installation (mean = 3.17). Obstacles such as establishing effective partnerships with software providers (mean = 3.08) and the perceived inadequacy of their support (mean = 2.80) also received moderate agreement. Furthermore, concerns regarding cybercrime threats, insufficient marketing directed at guests, and inadequate privacy and security measures, each with an approximate mean rating of 2.70, indicate a consistent recognition of these problems. Effectively addressing these challenges is crucial for enhancing the widespread adoption and successful implementation of smart tourism technologies.

Table 5a. Test of Difference on the Perceived Effectiveness of the Use of Smart Tourism Technologies when Tourism-Related Establishments are grouped according to Philippine Accommodation Classification

Variables	F	df1	df2	p
Audience Gain	1.85	3	127	.141
Revenues	4.10	3	127	.008
Information	4.41	3	127	.006
Accessibility	3.15	3	127	.027

Interactivity	7.93	3	127	< .001
Personalization	7.24	3	127	< .001
Security	6.31	3	127	< .001

Table 5b. Post Hoc Analysis using Tukey's HSD

Variables	Classification	Hotel	Resort	MA	Homestay
Revenues	Hotel	—	.458	.004	.531
	Resort		—	.924	.985
	Mabuhay Accom.			—	.570
	Homestay				—
Information	Hotel	—	.169	.004	.187
	Resort		—	1.000	.977
	Mabuhay Accom.			—	.936
	Homestay				—
Accessibility	Hotel	—	.639	.025	.133
	Resort		—	.949	.958
	Mabuhay Accom.			—	1.000
	Homestay				—
Interactivity	Hotel	—	.333	<.001	.007
	Resort		—	.692	.830
	Mabuhay Accom.			—	.998
	Homestay				—
Personalization	Hotel	—	.997	<.001	.076
	Resort		—	.031	.222
	Mabuhay Accom.			—	.876
	Homestay				—
Security	Hotel	—	.856	<.001	.024
	Resort		—	.344	.536
	Mabuhay Accom.			—	.998
	Homestay				—

A one-way ANOVA was conducted to assess whether the perceived effectiveness of the use of smart tourism technologies varies based on their Philippine accommodation classification.

In terms of audience gain, the analysis revealed no significant differences in the perceived effectiveness of the use of smart tourism technologies across classifications, $F(3,127) = 1.85$, $p = .141$.

In terms of revenues, the analysis revealed significant differences in the perceived effectiveness of the use of smart tourism technologies across classifications, $F(3,127) = 4.10$, $p = .008$. Post hoc comparisons using Tukey's HSD test indicated that the effectiveness of use of smart tourism technologies in terms of revenues to hotels are significantly higher than Mabuhay Accommodations.

In terms of information, the analysis revealed significant differences in the perceived effectiveness of the use of smart tourism technologies across classifications, $F(3,127) = 4.41$, $p = .006$. Post hoc comparisons using Tukey's HSD test indicated that the effectiveness of use of smart tourism technologies in terms of information to hotels are significantly higher than Mabuhay Accommodations.

In terms of accessibility, the analysis revealed significant differences in the perceived effectiveness of the use of smart tourism technologies across classifications, $F(3,127) = 3.15$, $p = .027$. Post hoc

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comparisons using Tukey's HSD test indicated that the effectiveness of use of smart tourism technologies in terms of accessibility to hotels is significantly higher than Mabuhay Accommodations. This supports the study of Mitala et. al., (2022) indicates that accessibility and personalization are crucial factors in enhancing tourists' experiences through smart tourism technologies. Hotels tend to perform better in these areas compared to other accommodation types, which may be due to their larger scale and resources.

In terms of interactivity, the analysis revealed significant differences in the perceived effectiveness of the use of smart tourism technologies across classifications, $F(3,127) = 7.93$, $p < .001$. Post hoc comparisons using Tukey's HSD test indicated that the effectiveness of use of smart tourism technologies in terms of accessibility to hotels are significantly higher than Mabuhay Accommodations and homestay. This supports the study of Zheng and Wu(2023) that hotels often provide more effective use of smart tourism technologies in terms of information and interactivity. This includes offering personalized recommendations and real-time updates, which can enhance the overall tourist experience.

In terms of personalization, the analysis revealed significant differences in the perceived effectiveness of the use of smart tourism technologies across classifications, $F(3,127) = 7.24$, $p < .001$. Post hoc comparisons using Tukey's HSD test indicated that the effectiveness of the use of smart tourism technologies in terms of personalization to hotels and resorts are significantly higher than Mabuhay Accommodations.

In terms of security, the analysis revealed significant differences in the perceived effectiveness of the use of smart tourism technologies across classifications, $F(3,127) = 6.31$, $p < .001$. Post hoc comparisons using Tukey's HSD test indicated that the effectiveness of use of smart tourism technologies in terms of security to hotels are significantly higher than Mabuhay Accommodations and homestay.

Table 6a. Test of Difference on the Perceived Effectiveness of the Use of Smart Tourism Technologies when Tourism-Related Establishments are grouped according to Number Years of Operation

Variables	F	df1	df2	p
Audience Gain	2.74	4	126	0.031
Revenues	2.28	4	126	0.064
Information	1.02	4	126	0.402
Accessibility	1.25	4	126	0.292
Interactivity	2.02	4	126	0.095
Personalization	1.84	4	126	0.125
Security	1.96	4	126	0.104

Table 6b. Post Hoc Analysis using Tukey's HSD

Variables	Years of Operation	< 1	1 - 5	6 - 10	11 - 15	>15
Audience Gain	Less than 1 year	—	.535	.026	.447	.927
	1 - 5 years		—	.245	.964	.995
	6 - 10 years			—	.981	.465
	11 - 15 years				—	.922
	More than 15 years					—

A one-way ANOVA was conducted to determine whether the perceived effectiveness of smart tourism technologies differs based on the number of years a hotel has been in operation. The findings, as detailed in Table 6a, show that the perceived effectiveness of these technologies in terms of revenues, with a p-value of 0.064; information, with a p-value of 0.402; accessibility, with a p-value of 0.292; interactivity, with a p-value of 0.095; personalization, with a p-value of 0.125; and security, with

a p-value of 0.104, does not exhibit statistically significant differences when categorized by years of operation.

On the other hand, the analysis revealed significant differences in the perceived effectiveness of smart tourism technologies concerning audience gain across groups, with $F(4,126) = 2.74$ and a p-value of 0.031. Post hoc comparisons using Tukey's HSD test indicated that establishments operating for 6 to 10 years perceived significantly higher effectiveness in terms of audience gain compared to those operating for less than a year.

Table 7a. Test of Difference on the Perceived Effectiveness of the Use of Smart Tourism Technologies when Tourism-Related Establishments are grouped according to Number Years Using these Technologies

Variables	F	df1	df2	p
Audience Gain	2.57	3	127	0.057
Revenues	2.50	3	127	0.063
Information	3.57	3	127	0.016
Accessibility	1.71	3	127	0.169
Interactivity	2.39	3	127	0.072
Personalization	1.02	3	127	0.387
Security	1.47	3	127	0.226

Table 7b. Post Hoc Analysis using Tukey's HSD

Variables	Years of Operation	< 1	1 - 5	6 - 10	11 - 15
Information	Less than 1 year	—	.643	.062	.070
	1 - 5 years		—	.176	.177
	6 - 10 years			—	.777
	11 - 15 years				

A one-way ANOVA was performed to examine whether the perceived effectiveness of smart tourism technologies differs depending on the number of years these technologies have been used. As shown in Table 7a, the analysis revealed no statistically significant differences in the perceived effectiveness of these technologies for audience gain, with a p-value of 0.057; revenues, with a p-value of 0.063; accessibility, with a p-value of 0.169; interactivity, with a p-value of 0.072; personalization, with a p-value of 0.387; and security, with a p-value of 0.226, when grouped by the number of years of operation.

However, the results showed a statistically significant difference in the perceived effectiveness of smart tourism technologies concerning information across groups, with $F(3,127) = 3.57$ and a p-value of 0.016. Despite this, post hoc comparisons using Tukey's HSD test indicated no significant differences in pairwise comparisons between the groups.

CONCLUSIONS

This research highlights the impact of smart tourism technologies (STTs) on the operations of hotels in the Cagayan Valley. It highlights particularly how to enhance hotel operations. The study finds that that Smart Tourism Technologies (STTs) substantially enhance audience engagement, revenue generation, information dissemination, and guest interactivity. This trend reflects an ongoing shift toward digitalization within the region. The pervasive adoption of STTs underscores their increasing significance for sustaining industry competitiveness. While STTs have demonstrated efficacy in delivering positive customer experiences and generating revenue through bookings and repeat business, a stabilization in long-term revenue growth suggests the necessity for evolving strategic approaches.

Furthermore, the analysis identifies specific areas for enhancement in the user interfaces and sensor-

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based functionalities of smart tourism technologies deployed in hotels, aiming to optimize guest experiences. STT-enabled personalization facilitates customized guest experiences; however, certain technological components necessitate further refinement. While security protocols are largely robust, their continued enhancement is advisable. The study additionally identifies several operational challenges, including elevated implementation costs, ongoing maintenance requirements, personnel training, and cybersecurity vulnerabilities. Disparities across various accommodation types necessitate targeted investments in smaller establishments to ensure the equitable distribution of benefits. Conclusively, STTs are fundamental to the digital transformation of the hospitality sector.

RECOMMENDATIONS

Based on the study's findings and conclusions, several recommendations are posited. First, hotel owners should prioritize systematic technology upgrades and user experience optimization. This involves refining user interfaces for in-room devices to enhance usability and integrating more responsive sensor-based systems. Additionally, it is crucial to implement advanced marketing strategies to mitigate the observed stagnation in long-term revenue and foster sustained customer engagement, particularly via personalized offerings. Owners must also strengthen digital platform security features to build trust and implement comprehensive cybersecurity training for staff to mitigate potential risks associated with smart tourism technologies. Second, the Department of Tourism (DOT) should focus on expediting the adoption of smart tourism technologies (STTs) by smaller accommodation providers, such as homestays. This can be achieved by providing subsidized access to cost-effective technologies and offering comprehensive training to ensure equitable guest experiences across all types of accommodations. The DOT should also establish clear guidelines and standards for the consistent implementation of STTs, with the aim of promoting data-driven decision-making and cultivating innovation through strategic partnerships with technology providers and research institutions. Lastly, future research could conduct similar studies, integrating additional variables and expanding their scope.

Appendices (if any)

Appendix A. Indorsement





ENDORSEMENT

To Whom It May Concern:

This is to endorse the following members of academia-researchers from the Cagayan State University-Andrews Campus who will be conducting a study entitled, "Rethinking Smart Tourism in the New Normal" to all accommodation establishments that uses tourism technologies in Cagayan Valley, to wit:

1. Gretchen A. Jellonza – Associate Professor IV
2. Edmer Sibakua – Instructor III

The research work is important as we revitalize the tourism industry in the region.

Rest assured that the data they collect will be used solely for academic purposes and will be treated with confidentiality.

Issued this February 6, 2023 in Tuguegarao City, Cagayan.


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