



The Role of Technological Innovation in Improving the Egyptian Hotel Brand Image

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KEYWORDS

Technological Innovation
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Satisfaction Customer
Loyalty

ABSTRACT

Despite the formidable significance of technological innovation and brand image in the hotel industry. Literature has revealed limited research into this aspect, especially in the Egyptian hotel industry. Less research examined the antecedents of customer satisfaction and loyalty to technological innovation. This study aims to investigate the role of technological innovation in improving the hotel brand image, as manifested by the customer evaluation of hotel technological collaboration and expertise of the hotel and hotel brand image through their satisfaction and loyalty in the Egyptian hotel sector. A survey of 254 five-star customers has confirmed a newly proposed model to improve the Egyptian hotel brand image. Structural equation modelling has been used for hypothesis testing. The research results indicate that technology innovations have significantly positive effects on customer satisfaction and loyalty. Moreover, the tandem mediation of customer satisfaction antecedents (i.e., security, product and service merchandise, ease of use, perceived service quality and information quality) reinforces their loyalty toward the hotel brand. Finally, the mediation of customer loyalty dimensions (i.e., relationships, trust, emotional benefits, and perceived value) significantly improves the hotel brand image.

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1. Introduction

In recent years, the hospitality industry has become one of the largest and fastest-growing service sectors that contribute to the development of Egyptian social, economic, and business opportunities. In 2019, the analysis of the Egyptian ministry of tourism statistical reports revealed that the number of star-rated hotels in Egypt is about 893 hotels and a total of 183980 hotel rooms, with total revenue of 11.6 billion dollars. In the hotel industry, customer-based brand image is one of the

essential marketing strategies to win in a market that produces fierce brand competition. Its development plays a crucial role (So et al., 2013; Šerić et al., 2018). Therefore, hotels can contribute to their customers' reactions and increase their loyalty by producing new content and creating more services (Yoo & Donthu, 2001; Ruan et al., 2020).

In the global hospitality sector, technological innovation has attained great value and has become an essential source of competitive advantage as it facilitates the way hotels communicate with their

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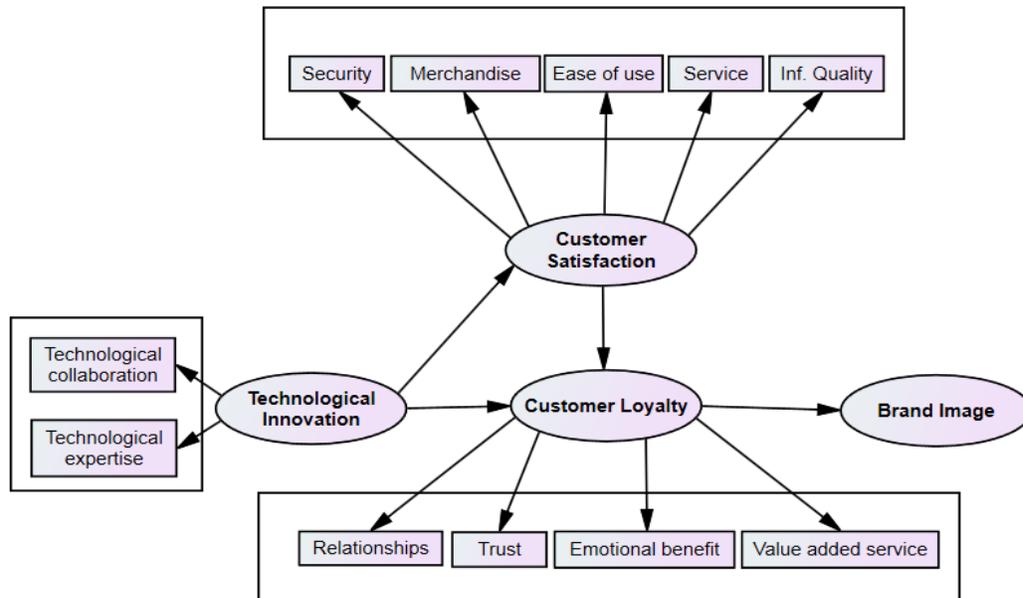
customers (Shin et al., 2019). The technological expertise of hotels is considered a new competitive strategy that has become an attraction, and it has significantly increased customer perceptions of value (Wu & Cheng, 2018). Thus, hotels can enhance the confidence of their customers and raise their satisfaction by increasing the perceived value generated by their perceptions of providing more innovative and efficient products and services, which can ultimately re-establish hotels' brand image (Lemy et al., 2019; Ruan et al., 2020). Furthermore, hotels can also improve their customers' trust through their own experience with positive electronic word-of-mouth (EWOM), as loyal customers are more likely to re-purchase the product and suggest it to other potential customers (Su et al., 2015; Septianto & Chiew, 2018). Recently, the Egyptian hospitality sector has increased with technological advancement and significantly endorsed impact on the hotel performance (Khalifa & Ali, 2017). However, few research papers on the impact of technology-driven hotel brands' image have been conducted to date in

Egypt. Therefore, this research poses a question of how to exploit the advantages of technological progress to change the path of hotel customers' loyalty to the brand image.

Stimulus-Organism-Response (SOR) theory assumes that a stimulus can trigger a response through the organism's internal evaluation process (Mehrabian & Russell, 1974). In this research paper, the independent variable of hotel technological innovation is positive stimuli that affect customer behaviours. In addition, customer satisfaction and loyalty represent the mediating role of the organism's internal evaluation process. Meanwhile, the dependent variable of the positive brand image is considered a good response to customer participation. In other words, high satisfaction and loyalty customers extensively assess the hotel's brand image (Šerić et al., 2018). Finally, a more complex model is constructed of the impact of technological innovation on the hotel brand image through customer satisfaction and loyalty is constructed (Figure 1)

Figure 1

Proposed research model (adapted from Nikhashemi et al., 2013; Ruan et al., 2020)



(Adapted from Nikhashemi et al., 2013; Ruan et al., 2020)

To ensure the validity of the proposed model with regard to improving the brand image of five-star hotels, this study aims to achieve the following objectives: (1) to determine whether technological innovation has a role in supporting the brand image of five-star hotels in Egypt; (2) to examine the

antecedents of customer satisfaction and loyalty toward hotel technological innovation and to examine whether interaction effects exist between these two factors; finally (3) to examine the mediating role of both customer satisfaction and

loyalty between hotels' technological innovation and its brand image.

2. Literature Review

2.1. Hotel Technology

Services play a very crucial role in enhancing the economy of any developing country. Thus, it has developed innovative technologies in managing the hospitality businesses that have changed the hospitality industry style. Innovation constantly presents something new to the hotel in terms of how it works time efficacious, easy to do things, etc. (Kamble & Chandel, 2019). Smart technologies are defined as specific services and products which add value to customer experiences by enhancing higher interactivity, co-creation, and personalization (Gretzel et al., 2015). Therefore, Neumann and Liao (2004) correlated the outcome of information technologies to strategic merits and confirmed that information technology could present and keep a competitive advantage for a hotel that chooses to follow the usage of information technology as an integral part of its business strategy. On the other hand, there are several barriers to applying technology innovations in the hospitality industry including staff willingness, ability, managers' support, customers' attitudes and expectations of the customers towards technology innovations (Šerić et al., 2014). Some of the basic barriers are the innovation cost, resistance from owners, unwillingness to change, training problems, budget, and time constraints (Nisar and Prabhakar, 2017).

Many visitors estimate that hotels that offer new technology innovations regularly, as these advancements directly impact their satisfaction and loyalty. Furthermore, new technology provides hotel managers extra revenue sources (Bilgigan et al., 2016). Therefore, the extent of use of technology differs from hotel to hotel. However, some hotels envision themselves as smart hotels by adopting the use of various technologies to enhance the guest experience. A smart hotel is defined as one that uses modern technologies and relies less on human staff to create a unique guest experience (Kim & Han, 2020). Because of the increased demand for contactless service delivery following the outbreak of the coronavirus disease (COVID-19), this tendency has accelerated (Shin & Kang, 2020). Hotels are more dependent on technology than ever before. The hotel industry's future will increasingly rely on mobile technology; therefore,

it is critical to stay on top of the latest technical solutions that it enables. As a result, new technologies are emerging that have the potential to completely transform the image of the hotel industry (Tomislav & Stifanich, 2020).

'Smart' technology, which we are constantly tangled with applications such as smartphones and smart cards in daily life, is supported by diverse physical infrastructures (Gretzel et al., 2015). The execution of modern technologies and innovations happening with keyless access in 2014 has progressed to wearable (smart watch apps), robots, and virtual reality. Several hoteliers rely on the Internet and smartphones to run their businesses (Kazandzhieva et al., 2017). Robotics, virtual reality (VR), artificial intelligence (AI), the Internet of things (IoT), information and communication technologies (ICTs), and augmented reality (AR) are just a few of the cutting-edge technologies currently in use in the hotel business (Law et al., 2009; Kansakar et al., 2019). As a result, technology has recently begun to be widely used in the hotel industry. The technological efficiency of hotels has become a draw and it has successfully improved the guest experience (Wu & Cheng, 2018). Customers' perceptions of hotel products and services may increase their perceived value and trust in the hotel, helping to restore the brand image of featured hotels (Lemy et al., 2019). Furthermore, because of the attractiveness and rapid spread of electronic word-of-mouth, customers' trust can be reinforced by their own positive electronic word-of-mouth experience (Septianto & Chiew, 2018). One of the most recent trends in the hospitality sector is the use of mobile technology in practically all corporate activities, allowing them to reach out to customers in new ways while providing new services and products. With increased competition for market share, hotels must adjust their operations to accommodate new multi-device mobile Internet access and provide a five-star customer experience in order to exceed customers' expectations and earn their loyalty (Lam & Law, 2019). Several academics (Yeo et al., 2017; Pee et al., 2018) have examined how website and application attributes affect customer satisfaction and loyalty with their experience regarding accommodation. Previous research has positively identified different important factors on the website and application factors that are useful before and

during accommodation (Jeon & Jeong, 2017; Pee et al., 2018).

Smart technology like smartphones, wearables, and the Internet of Things, together with artificial intelligence, will be capable of delivering a unique experience to customers at a better speed. Hotel managers these days gain customer data through social media applications, the main internet reservation platforms, and personal sites. They can also utilize technologies such as smartphones, tablets, and other devices to gain data from the customers by inquiring them to complete in questionnaires instantly (Kamble & Chandel, 2019). Therefore, the new trends in the tourism and hospitality industry in the 21st century revealed that modern technologies such as smart and digital technologies are considered the main motivators for customers to choose a place of accommodation. Research showed that 75% of tourists plan their journey on the internet, while 13% still utilize travel agencies to prepare the trips (Abdelmoaty & Soliman, 2020).

2.2. Antecedents of Customer Satisfaction toward Technological Innovation

2.2.1 Security

Mukherjee and Nath (2007) indicated that perceived value over security and privacy characteristics of the technology used is the decisive antecedent of trust, which finally positively impacts on guest satisfaction and loyalty. Therefore, restaurants and hospitality establishments have addressed privacy and security as the primary concern in researches (Liao and Cheung, 2002; Poon, 2008). Strategic goals for applying technology investments in 2017 for hotel managers have two clear advantages. Firstly, more than half of operators (52%) are focusing on enhancing customer engagement with digital technology. Their second priority is a continued concentration on data and payment security (40%), (Kazandzhieva et al., 2017)

Harris et al. (2016) revealed that guests' perceptions of security are critical for dissipating risks associated with applications and sites utilize. lately, Balapour et al. (2020) concluded that when customers realized that a hotel's privacy policy is efficient, they recognize it has higher security standards and incline to install and utilize its mobile applications. Furthermore, previous studies illustrated that guest perceptions of privacy or financial risks have a passive effect on the image

of a brand (Hwang & Choe, 2019). Therefore, previous research in the hospitality industry found that perceived privacy/ security is an indispensable factor that affects customer behavioural intentions to install mobile applications (et al., 2018), to utilize mobile applications (Ooi & Tan, 2016; Johnson et al., 2018), and in customer satisfaction with mobile applications (Susanto et al., 2016; Kumar et al., 2018).

At smart hotels that apply high standards of technology innovation, a high level of security and safety is commonly existence (Kim et al., 2021). For example, Kim and Han (2020) highlighted that a high standard of security and safety is the essential attribute of smart hotels today, and they confirmed how novel technologies are essential to achieve a great level of security and minimize risk. Thus, Go et al. (2020) argued that robots as one of the most important examples of technological innovation which help to protect the security and safety of humans from coronavirus during the COVID-19 pandemic in the hotel's industry. In addition, the COVID-19 pandemic creates several cases where technologies play a great role in crisis management; in order to present smart solutions with support to avert human-to-human interactions (Shin & Kang, 2020).

2.2.2 Product and Service Merchandise

The hotel's application and website provide customers with various hotel services and products, and the application includes all the services and products that are provided. A reward program is a kind of motivation used to attract customers, and it relies on collecting points for every purchase or visit to hotels, which are redeemable for free gifts and cash rebates (Nikhashemi et al., 2003). Moreover, the application is continuously updated to display any notification about any new hotel services, facilities, or restaurants inside the hotel. (Kazandzhieva et al., 2017)

2.2.3 Ease of Use

Zeithaml et al. (2002) mentioned that ease of use is the degree to which an innovation is not hard to comprehend or utilize. Davis (1989) and Davis et al. (1989) confirmed that the degree to which the customers believe that they could use the specific technology with minimum effort could be considered ease of use. Consult (2002) summarized that ease of use is the capability of customers to trial innovative technology and where they could assess its merits easily. Furthermore, ease of use

has been known as a substantial component to change the attitude and behavioural intention of customers and create an appreciation of technology utilization among customers (Cho & Sagynov, 2015). Chen & Barnes (2007) also revealed that ease of use notably influences customer expectations. To motivate more customers to use new technology, it is recommended that hotels develop systems that are easy to use (Jahangir & Begum, 2008). Therefore, the ease of use positively influences customer expectations and satisfaction (Chiu & Wang, 2008).

2.2.4 *Quality of the service*

Service quality has defined as fitness for use, or to what extent it can meet up the customer expectation or serves the purposes of customers (Kahn et al., 2002). Technology innovation is constantly changing. So, the hospitality industry needs to take a proactive position in executing technological developments, while continually striving to create standards of service quality and customer satisfaction (Magnini et al., 2003). Therefore, new technologies can improve brand image and service quality and they might become a source of long-term correlation ships with customers. Therefore, academics should also focus on the role of developed technology solutions to achieve customers' satisfaction and improving hotel brand image (Reid, 2002; Kliatchko, 2009). Customers request high-level e-Service quality when staying in hotels (Parasuraman et al., 2005). Therefore, delivering high quality applications through various applications and presenting several technology innovations is imperative for any hotel success or not (Jeon & Jeong, 2017).

Oracle hospitality conducted a survey of almost 3,000 US and European passengers to better understand the importance of technology in the hotel guest experience (Carter, 2017). According to the findings, 64% of hotel guests in the United States believe it is "very or extremely important" for hotels to continue investing in technology to improve the customer experience. Hoteliers will be able to differentiate themselves from the competition by delivering on every customer's expectation and attracting new consumers through innovation. A great experience will have an impact on a customer's stay, as well as their behavior intentions and online electronic word of mouse after they leave. By implementing current technology, managers should try to improve sales,

service quality, and customer satisfaction (Lam et al., 2007).

Scholars have recommended that the quality should involve both the website and applications service used by customers during accommodation (Pigatto et al., 2017). The efforts to enhance hotel service, to raise its service quality and managerial competence need a variety of technological innovations. Therefore, Wu and Cheng (2018) confirmed how advanced technologies with hotel accommodations, such as the Internet of Things (IoT), improve the quality of the customer experience. Domanski (2020) revealed personal perceptions towards smart hotels found that those novel technological solutions crucially participate in the enhancement of the service quality. Technologies achieve a higher standard of service quality (Kim et al., 2020). Furthermore, most evidence refer that the merit that customers obtain from modern technologies enhances their experience (Kabadayi et al., 2019, Kim and Han, 2020).

2.3 *Information Quality*

The last decade has observed numerous literatures on website and applications quality as an indicator for customer satisfaction and loyalty. Applications quality comprises factors like appropriateness, interactivity, and care (Srinivasan et al., 2002); technical integration, free of errors, and free services (Wirtz & Lihotzky, 2003); connectivity enjoyment, information credibility, learning, and interactivity (Chiu et al., 2005); appearance, specific content, tenor quality, and technical appropriateness (Liao et al. 2006); application design, communication, order execution, security/privacy, promotion, and merchandising (Jin & Park, 2006); and transaction rapidity, user-friendliness, and information quality security (Shih & Fang, 2006). Among all these elements, customers usually anticipate three advantages to help their online encounters, that is, information quality, service quality and system quality (Shih, 2004).

Information quality is essential to trust (Wang & Emurian, 2005; Flavian et al., 2006). Ballantine (2005) also confirmed a positive correlation ship between applications information features and consumer satisfaction. If the technology is deficiently designed, a guest will leave the hotel (McKinney et al., 2002). Information accessibility minimizes search time and consequently achieves

consumer satisfaction (Glazer, 1991; Lynch & Ariely, 2000) and eases the decision-making process. Moreover, the technology competence (Ballantine, 2005) may decide the success or failure of any hotel (Yang, 2001). Therefore, information quality is referring to the amount of reliability and the form of information about the products and services which is going to display on the application (Nusair & Kandampully, 2008). Thus, previous research suggests the following assumptions:

2.4. Hotel Technology and Customer Loyalty

Kandampully and suhartanto (2000) illustrated that a loyal guest is a guest who repurchases from the same service provider whenever possible and who continues to recommend or continue a positive behavioural intention towards the hospitality establishment. Moreover, Cass (2001) added that a satisfied guest is likely to display brand loyalty, and customer e-loyalty is affected by satisfaction. Therefore, loyal customers raise revenues by purchasing a wider diversity of the hotel's services and by making more repeated purchases (Bowen & Shoemaker, 2003).

Customer loyalty has two dimensions: behavioural and attitudinal (Julander et al., 1997). The behavioural dimension refers to a customer's behaviour on repeat purchases, while the attitudinal dimension refers to a preference for a brand (Bowen & Shoemaker, 2003). In contrast, attitude dimensions show a customer's intent to buy and suggest which are good indicators of loyalty (Getty & Thompson, 1994). Furthermore, behavioural intention or loyalty intention is a customer's desire to take action in a certain way toward services or products (Yeo et al., 2017). It is tremendously recognized as the most visible result of customer satisfaction is customer loyalty. Behavioural intention indicates an individual's expected behaviour in the near future concerning using products or services (Suhartanto et al., 2019). Therefore, it is now becoming obvious that guest loyalty is crucially more significant than guest satisfaction in hospitality organisations' success (Kandampully & Suhartanto, 2000).

2.5 Customer loyalty dimensions

2.5.1 Relationships

It is recently known that customer relationship is now the chief focus for most businesses. These businesses carry out the Customer Relationship

Management (CRM) which is sometimes referred to as relationship marketing to create a better environment for handling customer relationships (Ling et al., 2011). CRM is regarded as a distinctive marketing strategy that integrates technology, process, and all business activities to communicate with the customers (Nikhashemi et al., 2013). Several studies have been carried out to identify the elements that improve customer loyalty. Some factors that largely affect customers' loyalty include ease of acquiring information, frequency of use, and previous experience (Shankar et al., 2001). Trusting technology innovations, transaction costs and privacy are essential variables to increase customers' loyalty (Lee et al., 2000). However, the present research sheds more light on the fact that applying innovative technology influences loyalty in hotels.

2.5.2 Trust

Yoon (2002) revealed that there are four elements that are decisive in the creation of the trust, such as transactional security, application properties, search functionality, and personal data. These four factors establish trust and if they are achieved then the overall satisfaction is raised. Therefore, based on this consideration, it is predictable that trust in the application trust will have an important influence on customer satisfaction and loyalty. Numerous research have supported that the correlation is between trust and customer loyalty (Ling et al., 2011). Furthermore, 'human trust in an automated or computerized system relies on three crucial elements: (1) the perceived technical efficiency; (2) the perceived performance standard; and (3) the understanding of the underlying features and processes controlling the behaviour of the system' (McCole et al., 2010).

2.5.3 Emotional Benefit

Mittal and Lassar (1998) illustrated that this emotional benefit is a functional quality that can do its magic in winning customer loyalty. These emotional benefits include positive emotions like happiness, fun, and a sense of caring, and empathy when using technological innovations. Customers who are enthusiastic and positively surprised by the services delivered to them shall recommend the certain hotel to others. The emotional constituent of satisfaction serves as a good indicator of loyalty (Yu and Dean, 2001). Emotional benefit is the most significant key driver of loyalty (Nikhashemi et al., 2013). Thus, the prime objectives of technological

innovation in hotel services are to smooth the work of the staff and the make the stay of the guests more pleasant, reduce costs, impress guests with distinctive experiences and emotions, to inspire a unique atmosphere (Kazandzhieva et al., 2017). Customers' perceived outcomes linked with technology innovations in the hotel business generally and individually propose the following aspects that involve competence and entertaining, as well as security and safety (Tussyadiah et al., 2018; Hwang and Kim, 2021). On the other hand, entertainment, which includes delight and fun activities, is regularly researched as one of the perks that customers value when concerning utilizing of technology-powered products/services (Meuter et al., 2000; Chang et al., 2017). Robots in service delivery are an ideal example, and several studies have shown that the rise of robots in the service sector permits for fun interactivity with the customers (De Kervenoael et al., 2020). Lin et al. (2020) found that AI robotic gadgets in both limited-service and full-service hotels benefit customers' demands with exciting interactivity. As a result, these anticipated benefits underpin good consumer responses, encouraging perceived value and attitude in determining future hotel intentions (Kim et al., 2021). Furthermore, good feelings such as happiness and enjoyment are some of the promised benefits of applying technology, and they ensured that emotions have an impact on customers' favourable responses (Hwang & Kim, 2021).

2.5.4 Value Added Service

Technological innovations are increasingly being utilized in the hospitality industry. It is obvious that investments in information technology investments will increase hotel productivity, decrease costs, and add value to products and services presented to their customers (Bilgihan et al., 2011). Furthermore, other possible factors of loyalty are value-added services like permitting valued customers to take advantage of the hotel's technology innovation and earn benefits from it (Nikhashemi et al., 2013). Therefore, with the advancement of smartphone technology in the hotels, nearly all hotels invest in innovative technologies for four main goals, as follows raising revenue, reducing costs, improving added value service to customers, and positively influencing the overall competence of the hotel (Jung et al., 2014).

Customers are searching for convenience. As a result, hotel applications play an important part in providing consumers with the best possible experience. Mobile technology is critical to the customer experience of a hotel stay, adding incredible value and increasing customer happiness by improving the quality and elasticity of hotel services, communication competency, and service personalization (Zhang et al., 2019). Many hotels and accommodation businesses, on the other hand, have seen improved financial performance as a result of the implementation of modern technologies, and it has been suggested that hotel applications could improve hotels' competitive advantage, for example, by lowering operating costs, adding value, increasing agility, reducing service turnaround time, and improving new products and services (Hua et al., 2020; Vikas & Deependra, 2019).

2.6 Hotel Brand Image

A positive brand image is an asset, as it affects the perceptions of customers regarding the hotel's experience and operations (Kang & James, 2004). Previous research also indicated that brand image remarkably influences customers' perceptions of value, satisfaction, and behavioural intention to revisit (Cretu & Brodie, 2007; Ryu et al., 2008; Lai et al., 2009). The influence of brand image and hotel reputation on customer loyalty was examined by Cretu and Brodie (2007), who assured that the brand image positively influenced the customer's perceived value. If we concentrate on the hospitality industry, three brand equity dimensions were found important in this context: (1) brand image, (2) perceived quality, and (3) brand loyalty (Kim et al., 2003; Kim & Kim, 2005; Kayaman & Arasli, 2007).

Research assured a positive impact of customer loyalty on the brand image within the hospitality industry (Kandampully & Suhartanto, 2003; Kandampully & Hu, 2007; Sean Hyun & Kim, 2011; Hsu et al., 2012). The image of the brand has an intense influence on the growth of brand loyalty. Thus, hotel establishments should do their best in creating a convenient brand image (Šerić et al., 2014). Therefore, Technology is the salient source of competitive advantage for hotels as it can change the way hotels communicate with customers and present effective services (Law et al., 2009; Shin et al., 2019). To date, however, few hospitality researchers have tested the impact of both

technology-driven and service-driven innovation on hotel brands (Chen, 2011; Wu & Cheng, 2018). Further research is essential on the leading factors of customer-based brand equity in hotels and how these factors affect hotels' competitive advantage (Šerić et al., 2018). Branding is a salutary marketing strategy for starred hotels which searching to gain in a market with fierce global competition so as to make a competitive advantage through new innovative technologies in the market (Ruan et al., 2020).

2.7 Relationship between Hotel Technology and Brand Image

Proactive identification and execution of technologies can help create a sustainable competitive advantage for the hotel brand over competitors (Piccoli, 2008). Therefore, many Hotels are concentrating on enhancing their online accessibility and marketing strategies to reach to the changing of customer demands by executing technological innovations and mobile applications, which have the possibility to improve the customer experience concerning hotel brand image (Kazandzhieva et al., 2017). Furthermore, Larivière et al. (2017) mentioned that, generally, technology has played two main roles in physical service encounters. First, it has reinforced service employees by supplying them with more effective data processing and analysis abilities. This permits them to comprehend customer desires better and achieve customer satisfaction, thus enhancing brand image (Marinova et al., 2017). Based upon these views, seven hypotheses are presented below:

- H1: Technological competence has a significant positive effect on customer satisfaction.*
- H2: Technological competence has a significant positive effect on customer loyalty.*
- H3: Customer satisfaction has a significant positive effect on customer loyalty.*
- H4: Customers loyalty has a significant positive effect on hotel brand image*
- H5: Technological innovation affects customers' loyalty through their satisfaction.*
- H6: Technological innovation affects hotel brand image through customers' loyalty*

3. Methodology

3.1 Sample Design and Sample Size

This study employed a quantitative research approach toward descriptive research design which was adapted and revised from Nikhashemi et al. (2013) and Ruan et al. (2020). For the current situation, a paper-based research questionnaire survey was used to test the relationship of independent variables of technological innovation with the dependent variable of the hotel brand image through the mediating variable of customer satisfaction and customer loyalty in five-star hotels in Egypt. This questionnaire was pilot tested to see how the questions were worded, sequenced, and how long they were.

The questionnaire was started with some instructions to target the specific customers of frequent hotel applications' users who were in position to provide the information needed for the study. In addition, the questionnaire was divided into two parts. In the first part, customers were asked to rate twelve constructs (56 items) in response to the question: to what extent do you agree or disagree with each statement? On 5 points Likert scale. Technological Collaboration (TC) scale with three items, Technological Expertise (TE) scale with four items, Security (SEC) scale with three items, P.S. Merchandise (PSM) scale with five items, Ease of Use (EU) scale with seven items, P. Service Quality (P.SQ) scale with six items, Information Quality (IQ) scale with four items, Relationships (REL) scale with four items, Trust (TR) scale with five items, Emotional Benefits (EB) scale with three items, P. Value (P.V) scale with five items, and Brand Image (BI) scale with seven items. Customers were invited to fill out a profile in the second section.

A purposive sample of customers who book or use hotel technology at least twice per stay in five-star hotels was considered for the study from September 2020 through January 2021. "Purposeful sampling is widely used in research for the identification and selection of information-rich cases related to the phenomenon of interest" (Palinkas et al., 2015). Three hundred (300) sampled customers were selected from six international hotel chains, with 30 each selected specifically from hotels at Greater Cairo (i.e., Fairmont Nile City; InterContinental Cairo Semiramis; Four Seasons Nile Plaza; Cairo Marriott Hotel; Kempinski Nile Hotel; Nile Ritz-Carlton; Hotel Sofitel Cairo Nile El Gezirah; Sheraton Cairo Hotel & Casino; Steigenberger Pyramids Cairo; Sunset Guesthouse). The hotels

that took part in the survey were chosen using a convenience sampling technique, in which hotels offer technology services in different locations in the hotel e.g., in-room, lobby, restaurants/bars, fitness centre, meeting rooms, and mobile applications. As shown in table 1, number of 300

paper-based questionnaires were distributed; two hundred and seventy-three (n 273) questionnaires were returned out of which 254 no. of purposive customers were in the position of utilization representing a response rate of 84.7 percent.

Table 1:

customers' response rate

Hotel Code	Distributed No.	Returned	Response Rate		Valid Percentage to Total
			Valid	Invalid	
1. H001	30	29	28	1	93.3%
2. H002	30	27	25	2	83.3%
3. H003	30	24	24	-	80%
4. H004	30	29	29	-	96.7%
5. H005	30	28	23	5	76.7%
6. H006	30	30	29	1	96.7%
7. H007	30	26	23	3	76.7%
8. H008	30	28	25	3	83.3%
9. H009	30	22	20	2	66.7%
10. H010	30	30	28	2	93.3%
Total	300	273	254	19	84.7%

Statistical Package for the Social Sciences (SPSS) The version 20 of The Statistical Package for the Social Sciences (SPSS) was used to descriptively assess the study's variables by their means and standard deviations. Moreover, Analysis of Moment Structure (AMOS) was utilized to guarantee questionnaire items' factor loading (Confirmatory Factor Analysis) and evaluate the overall measurement model (Structural Equation Modeling).

4. Finding and results

4.1. Profile of Respondents

This part was focused on the respondents' demographic profile covering categories of gender,

age, nationality, education, and marital status. Table (2) showed male respondents (63%) (n=160) were slightly higher than female respondents (37%) (n=94). Furthermore, the majority of the participants were middle age, 66.9% of the respondents were aged between 20 and 40 years and 22.5% of the respondents were over 40 years. On the other hand, there was a low percentage (10.6%) were less than 20 years. With regards to nationality, most of the participants (79.1%) were Egyptian guests, and only 20.9 % were foreigners. Finally, the most significant sample of the customer was 58.3% (n=148) in the "married with children" category.

Table 2:

Profile of respondents (N=219)

Demographic Data		Frequency	%
Gender	Male	160	63
	Female	94	37
Age group in yrs.	Below 20	27	10.6
	21 - 40	170	66.9
	40 and above	57	22.5
Nationality	Egyptian	201	79.1
	Foreigner	53	20.9
Marital Status	Single	64	25.2
	Married with children	148	58.3
	Married without children	42	16.5

4.2. Confirmatory factor analysis (CFA)

In this research paper, a fit of confirmatory factor analysis (CFA) model was used to perform configuration reliability and validity tests. Table 3 and Figure 2 shows both the results of the structural model and its constructs' factor loading. According to these results, some of the constructs' factor loading was not appropriate, implying that the initial model was not a good fit. Therefore, it is required to modify some indices in order to enhance the overall model's fit. Modification indices, in particular, provided treatments for seven items of the scale (i.e., to attain model fit indices,

EU2; EU6; P.SQ6; IQ1; IQ2; REL1 and REL2 have been eliminated). Then, standard residual covariance was examined to see if it may considerably reduce the model fit. As a result, few items were covariate in the latent variables. TC2 and TC3 in TC latent variable, TE1 and TE3; TE2 and TE3 in TE latent variable, PSM1 and PSM5; PSM1 and PSM4; PSM2 and PSM3; PSM2 and PSM5; PSM3 and PSM4; PSM3 and PSM5 in PSM latent variable, P.SQ2 and P.SQ5 in P.SQ latent variable, TR1 and TR3; TR2 and TR4; TR4 and TR5 in TR latent variable, BI5 and BI7 in BI latent variable were covariate

Table 3

Factor loadings, validity analysis, and reliability test of the measurement model

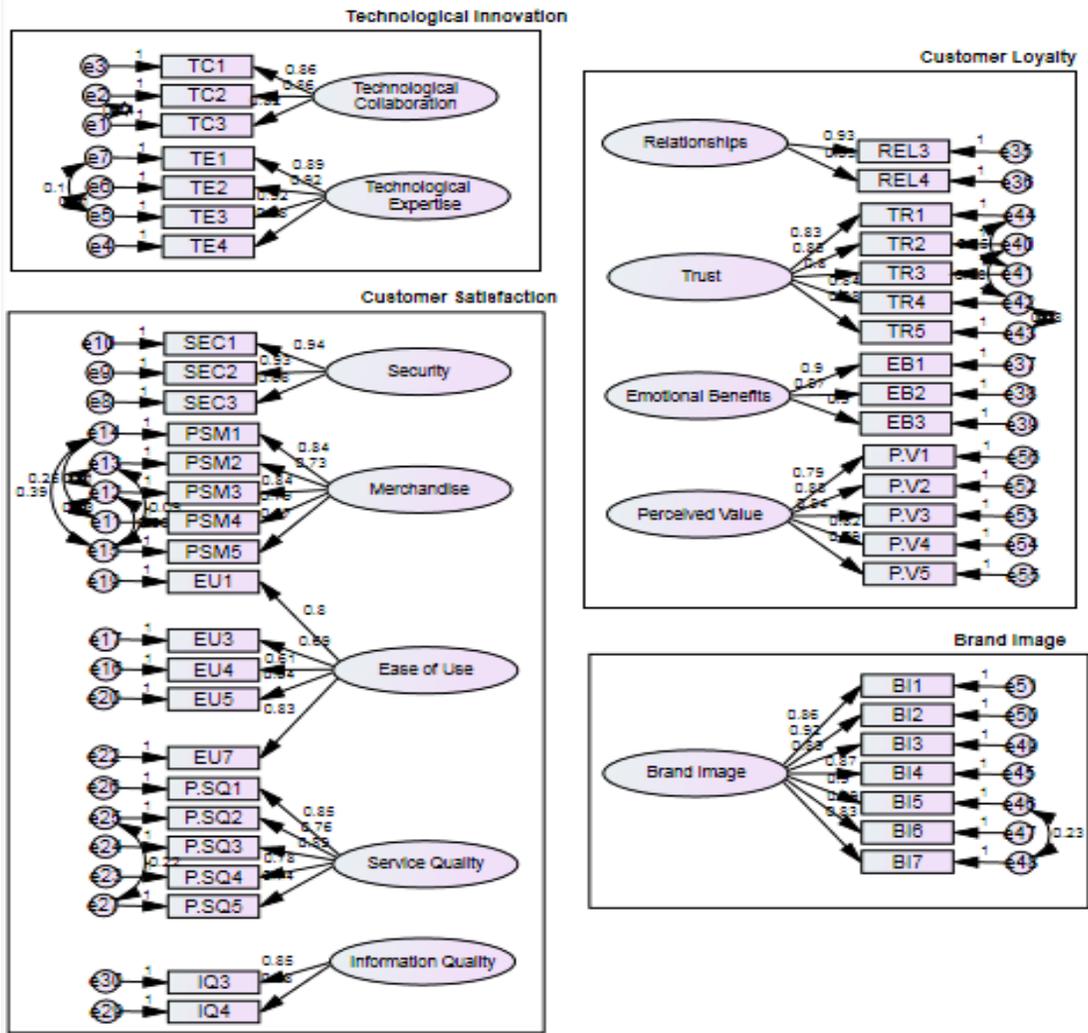
Code	Construct	Factor Loading	CR	α	AVE
Technological Innovation					
1- Technological Collaboration			0.887	0.855	0.725
TC1	The hotel uses technology products and service processes.	0.865			
TC2	The hotel uses results of advanced technology.	0.865			
TC3	The hotel is known for having successful service innovations.	0.823			
2- Technological Expertise			0.948	0.953	0.821
TE1	Being satisfied with knowing how to use technology practically.	0.895			
TE2	The application of technology is included in the hotel service.	0.923			
TE3	Products/services are highly complex.	0.923			
TE4	The hotel is famous for its technical quality.	0.883			
Customer Satisfaction					
1- Security			0.944	0.942	0.849
SEC1	Private information is protected.	0.949			
SEC2	There is a clear privacy policy.	0.931			
SEC3	Data transaction is well protected.	0.883			
2- Product & Service Merchandise			0.911	0.896	0.673
PSM1	The product / service is low priced.	0.848			
PSM2	Product/Service is up-to-date.	0.737			
PSM3	Discounts/Promotions	0.840			
PSM4	Varieties of product/service	0.790			
PSM5	Low delivery charges	0.879			
3- Ease of Use			0.873	0.881	0.583
EU1	A few clicks are required to get information.	0.804			
EU2	Easy registration to website and application (deleted)	—			
EU3	The website and application are always accessible.	0.691			
EU4	Various types of credit card can be used.	0.616			
EU5	The web page loads quickly.	0.843			
EU6	Links can be clearly displayed (deleted).	—			
EU7	Website and application use an easily understood language.	0.836			
4- P. Service Quality			0.906	0.894	0.659
P.SQ1	Efficient complaints are handled.	0.859			
P.SQ2	Quick responses are available for enquiry.	0.760			

Code	Construct	Factor Loading	CR	α	AVE
P.SQ3	The hotel staff is friendly and responds quickly to queries.	0.896			
P.SQ4	Service delivery is achieved in the promised time.	0.784			
P.SQ5	Products are received in good condition.	0.749			
P.SQ6	High quality product or service is delivered. (deleted)	—			
5- Information Quality			0.831	0.834	0.759
IQ1	The hotel provides clear information. (deleted)	—			
IQ2	The hotel offers in-depth information. (deleted)	—			
IQ3	The hotel presents easy to understand information.	0.858			
IQ4	The hotel introduces accurate, updated and trustworthy information.	0.884			
Customer Loyalty					
1- Relationships			0.931	0.931	0.871
REL1	The hotel exceeds the expectations of the customers. (deleted)	—			
REL2	The hotel knows customers' preferences. (deleted)	—			
REL3	The hotel understands the needs of the customers.	0.932			
REL4	The hotel keeps track of customers' services/transactions.	0.935			
2- Trust			0.925	0.928	0.713
TR1	The hotel verifies the authenticity / endorsement of the website.	0.839			
TR2	The hotel practices strict security standard on customer data.	0.852			
TR3	The hotel imposes a strict privacy policy.	0.804			
TR4	The hotel provides reliable customer service.	0.841			
TR5	The hotel delivers what it promises.	0.883			
3- Emotional Benefits			0.951	.9470	0.865
EB1	I feel highly appreciated.	0.906			
EB2	I feel welcomed.	0.976			
EB3	I feel contented with the experience.	0.907			
4- P. Value			0.917	0.915	0.689
P.V1	I receive good value in terms of the price paid, and, thus, I improved the hotel image.	0.799			
P.V2	Provide "My Account" profile for your own use.	0.880			
P.V3	My specific needs are met.	0.841			
P.V4	I am allowed to change orders easily.	0.829			
P.V5	I have access to track orders.	0.799			
Brand Image					
Brand Image			0.961	0.962	0.781
BI1	The hotel is comfortable.	0.863			
BI2	The hotel offers a high level of service.	0.921			
BI3	The hotel is clean.	0.894			
BI4	The hotel is luxurious.	0.874			
BI5	The hotel has good taste.	0.903			
BI6	The hotel is special.	0.895			
BI7	The hotel shows a differentiated image.	0.833			

Source: Adapted from (Nikhashemi *et al.*, 2013; Ruan *et al.*, 2020).

CR = composite reliability; α = Alpha reliability; AVE = average variance extracted.

Figure 2
CFA of Latent Variable Construct of the Final Model



4.3 Reliability, Convergent validity, and Discriminant validity

First and foremost, to determine the reliability of the customer perception of their respective hotel, frequent hotel applications users who book or use hotel technology at least twice per stay are regarded as a reliable sample. Table 5 also shows the findings of CFA, which revealed that the lowest Cronbach's α and construct reliability value was 0.70, indicating that the data is acceptable and reliable (Pallant, 2005). CR and AVE were also

utilized to estimate convergent validity. Furthermore, both values of MSV and ASV were utilized to evaluate discriminant validity. Convergent validity was above the minimum acceptable level for the CR and AVE indices, indicating adequate convergent validity. On the other hand, to ensure the discriminant validity, both AVE of each research construct and the square correlation of each two constructs were compared. This is a satisfactory level of internal consistency of the measures and there exist some common points of convergence (Hair et al., 2010).

Table 4

Discriminant Validity for the Measurement Model

Variables	TC	TE	SEC	PSM	EU	P.SQ	IQ	REL	TR	EB	P.V	BI
• Technological innovation												
Technological Collaboration (TC)	0.72											
Technological Expertise (TE)	0.59	0.88										
• Satisfaction												
Security (SEC)	0.39	0.45	0.84									
P.S. Merchandise (PSM)	0.70	0.75	0.34	0.67								
Ease of Use (EU)	0.27	0.43	0.51	0.26	0.58							
P. Service Quality (P.SQ)	0.28	0.45	0.34	0.33	0.43	0.65						
Information Quality (IQ)	0.32	0.50	0.50	0.33	0.49	0.64	0.76					
• Loyalty												
Relationships (REL)	0.45	0.43	0.43	0.44	0.39	0.37	0.44	0.87				
Trust (TR)	0.56	0.80	0.54	0.61	0.56	0.46	0.58	0.48	0.71			
Emotional Benefits (EB)	0.39	0.57	0.21	0.41	0.29	0.34	0.40	0.16	0.54	0.86		
P. Value (P.V)	0.36	0.53	0.37	0.36	0.54	0.59	0.67	0.47	0.64	0.49	0.68	
• Brand Image												
Brand Image (BI)	0.27	0.41	0.67	0.26	0.50	0.53	0.62	0.39	0.57	0.26	0.49	0.78

Note: The bold values along the diagonal line are the AVE values for the constructs, and the other values are the squared correlations for each pair of constructs

The results of the estimation from the model yielded the overall fit indices for the good fit of the model fit was achieved for the measurement model, which was acceptable threshold, with $\chi^2= 178.445$ with 87 degrees of freedom, $p < .0001$, $\chi^2/df = 2.05$ (<3 , Hair *et al.*, 2010). To determine the model fit, indices of CFI, IFI and TLI exceeded the minimum acceptable value of 0.90 (CFI= 0.918, IFI = 0.919, and TLI= 0.908), representing a good fit model (Tucker & Lewis 1973; Hu & Bentler, 1999). In addition, the root means square error of approximation (RMSEA) is 0.065 (<0.08 , Arbuckle, 2011).

4.4 Structural Model and Hypotheses testing

4.4.1 The hypothesized relationships

In view of the above, the hypothesized relationships were tested using standardized path coefficients (β) as shown in Table 5. Overall, the structural model achieved acceptable fit ($\chi^2 =$

26.152 with 14 degrees of freedom, $\chi^2/df = 1.868$, $p < 0.01$, CFI = 0.908, RMSEA = 0.038) (Hair *et al.*, 2010). These estimates can be described as positively strong since the majority of Absolute t-value > 3.29 , $p < 0.001$. The results showed that technological innovation has a positive impact on customer satisfaction and customer loyalty, supporting H1 ($\beta = 0.547$; t value = 23.58) and H2 ($\beta = 0.209$; t value = 6.48) respectively. Furthermore, the results showed that there is a strong relationship between customer satisfaction and customer loyalty, supporting H3 ($\beta = 0.718$; t-value = 14.73). Furthermore, the results showed that customer loyalty has a strong positive impact on the hotel brand image, supporting H4 ($\beta = 0.852$; t value = 16.72). These results supported theoretical hypotheses for direct relationships between technological innovation, customer satisfaction, customer loyalty, and hotel brand image.

Table 5

Standardized Parameter Estimates of the Structural Model

H	Path	Beta coefficients(β)	t-values	Results
H1	Technological Innovation \longrightarrow Customer Satisfaction	0.547	23.58***	Supported
H2	Technological Innovation \longrightarrow Customer Loyalty	0.209	6.48***	Supported
H3	Customer Satisfaction \longrightarrow Customer Loyalty	0.718	14.73***	Supported
H4	Customer Loyalty \longrightarrow Brand Image	0.852	16.72***	Supported

Absolute t-value > 1.96, p< 0.05; **Absolute t-value > 2.58, p< 0.01; ***Absolute t-value > 3.29, p< 0.00

4.4.2 Mediation results

The current model also investigated both the mediating relations of customer satisfaction towards technological innovation over customer loyalty and the mediating relations of customer loyalty towards technological innovation over hotel brand image with formulation of H5 and H6 using the Sobel test with bootstrapped standard errors based on 1000.

The Sobel test (Table 6) showed that customer satisfaction mediates the relationship between

technological innovation and customer loyalty. These findings mean there were indirect relationship between technological innovation and customer loyalty through customer satisfaction, supported H5 as the p-values of this relationship were less than 0.01. Furthermore, customer loyalty mediates the relationship between technological innovation and the hotel brand image. Meaning that there was indirect relationship between technological innovation and hotel brand image through customer loyalty, supported H6 (P-Value = 0, P ≤ 0.01)

Table 6

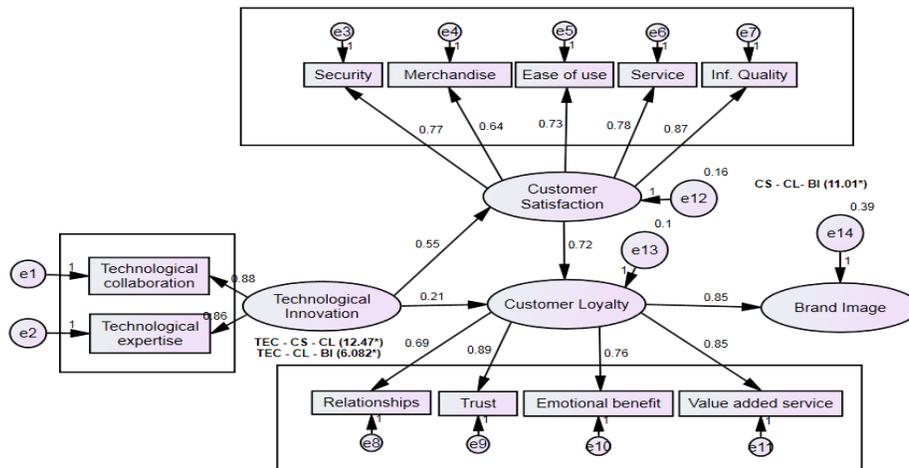
Hypotheses test results for indirect relationships

H	Path (Indirect Effects)	Sobel Test	P-Value	Results
H5	TEC → CS → CL	12.47	0	Supported
H6	TEC → CL → BI	6.082	0	Supported

**P < 0.001; *P < 0.05

Figure 3

Final structural equation model and standardized estimates



5. Discussion, Implications and conclusion

Customer perception regarding hotels that use innovative technologies towards brand image loyalty is determined by twelve factors, among which two mediating variables of customer satisfaction and customer loyalty. These factors are: technological collaboration, technological expertise, security, product, service merchandise, ease of use, perceived service quality, information quality, relationships, trust, emotional benefits, perceived value and brand Image. On the one hand, the findings of this study revealed that all seven hypotheses in this research were supported.

5.1. Direct Effect

Fig.3 illustrates the direct relationship between the research variables before joining the mediators. It was found that technological innovation (technological collaboration and technological expertise) significantly affects customer satisfaction (security, product, service merchandise, ease of use, perceived service quality, and information quality) which elucidates that customer prefer to stay in five star hotels that apply modern technologies rather than other hotels, supporting models H1. These results are like those in the study of Kamble and Chandel (2019) who mentioned that customer satisfaction is determined by the management decisions about technology

innovations type and ways of application. Thus, technological innovations are widely used today extensively utilized in the hospitality industry to satisfy large segments of customers.

Moreover, there is effect of the technological innovation (technological collaboration and technological expertise) on customer loyalty (relationships, trust, emotional benefits, and perceived value). It is worth mentioning that loyalty is important to keep customers. Therefore, this study suggests that innovative technologies should be significantly provided significantly in hotels to provide distinguished service in addition to meeting their requests easily. Thus, it is possible to explain the relationship between customer loyalty and the availability of the applied technology. These results support H2 and come to mind with Kazandzhieva et al. (2017) who stated that hoteliers supposed that through new technology and smart mobiles they would be capable of creating a dialogue between the hotel establishment and the guest, which can all be utilized to build a strong relationship and raise guest loyalty.

Customer satisfaction was shown in this research, that it had a significant effect on customer loyalty. Customers mostly agreed that “innovative technologies make your lodging safer, easier and enjoyable, which easily leads to satisfaction that quickly turns into loyalty, supporting H3. These findings are consistent with the findings of several former research studies like Fatkhurrohman, (2011) as well as Saleem and Raja (2014) who illustrated that loyalty is sincerity that emerges without any forces, but comes from responsiveness itself based on experience. In the past, some empirical studies recommend that there is a strong activist correlation between customer satisfaction and the most significant variable that is customer loyalty. Hence, customer loyalty appeared as a result of customers’ satisfaction with expectations, image, perceived quality, value, and hotel.

Research revealed that customer loyalty had a significant impact on brand image. Loyal customers feel sincere towards brand image hotel which uses innovative technology. These findings support H4 and are consistent with Saleem and Raja (2014), who indicated that there is much empirical evidence that proved that customer loyalty and brand image have a positive relationship with each other. However, other research proved positive impact on brand image by

concluding that service quality and customer loyalty have positive relationship with brand image.

5.2 Indirect Effect

The findings revealed that there is an indirect positive significant relationship between the technological innovation variable which were applied in five star hotels and customer loyalty. This means that their decision to lodge in these hotels and loyalty depends on what extent modern technology is applied. This means that customer loyalty depends entirely on customer satisfaction in using innovative technologies to decide to prefer this type of hotel over others. This is consistent with Horng et al. (2018), who revealed that implementing innovative technologies is regarded as a competitive strategy that distinguishes the hotel from others, as it creates the opportunity to attract new customers and it also helps to maintain sincere customers through the guests satisfied with distinctive experiences.

On the other hand, there was also an indirect positive significant relationship between the variable of technological innovation and brand image and the decision to visit these hotels that use modern technology. But this correlation resulted from partial mediation of the loyalty variable. This means that hotels depend entirely on innovative technology to reach a state of brand image loyalty and customers decide to repeat visiting these hotels through the customer loyalty toward modern technology as mediator. This is consistent with Varelas et al. (2021) who clarified that brand loyalty is a crucial factor that helps create a so-called “competitive advantage” for organizations, because it enhances a lasting relationship with customers. Consequently, innovative technologies form branding loyalty, which is a strategy that establishes long-term and value-based relationships with customers.

Findings revealed that technological collaboration and expertise are the key factors in the creation of technology innovations and have significant positive influences hotel brand image through two mediating variables which customers' satisfaction (i.e., security, product and service merchandise, ease of use, perceived service quality and information quality) improves their loyalty toward hotel brand. Finally, the mediation of customer loyalty dimensions (i.e. relationships, trust, emotional benefits, and perceived value)

significantly improves the hotel brand image loyalty. Therefore, the study suggests that hotels should increase their attempts for applying recent innovative technologies to increase customer satisfaction and encourage their loyalty to continue visiting hotels continually; particularly hotels should focus on developing current technologies to cope with global change. These results are consistent with the findings of some former research studies like Nikhashemi et al. (2013) and Ruan et al. (2020). Finally, this research found that the two mediators of satisfaction and loyalty are achieved through innovative technologies which influence brand image loyalty

6. Limitation and Future Research

Although this research investigates the role of technological innovation in improving hotel brand image, as manifested by customer evaluation and expanded on relevant research literature, it includes several limitations. First, this study solely focused on the formation of five-star hotel brand equity. Mazumder and Hasan (2014) stated that there are many differences between hotels regarding their star rating. Therefore, future research can examine technological innovation in other types of star hotels. The second limitation is related to methodology. Although, the research findings were based on a questionnaire survey from the perspective of customers, semi-structured interviews can be used as a qualitative method to discuss the robustness of these findings.

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