

The Emergence of Service Robots at Selected Quick Service Restaurants: Impact on Customer Experience and Satisfaction

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Abstract. This study investigates the impact of e-service quality, such as reliability, responsiveness, assurance, perceived risk, enjoyment, and speed of service, on customer experience and satisfaction at selected quick-service restaurants that use service robots. Respondents of the study were 181 patrons/diners at selected quick-service food establishments using automation and robots in their operations. Spearman rho, weighted mean, and frequency and percentage data analysis were employed. The study's findings revealed that customers find the usage of service robots and automation reliable, with a 4.56 mean score and the speed of service (4.45) as the two highest E-SERVQUAL dimensions. The study reveals that the six E-SERVQUAL dimensions strongly correlate with customer experience and satisfaction. The same conclusion was revealed regarding a strong positive relationship between customer experience and satisfaction. Thus, the association has a unidirectional relationship. Customers reported higher satisfaction levels when services were prompt, responsive, accurate, and risk-free, and the overall experience was enjoyable. The study adds to the theoretical enrichment of the literature about the impact of e-service quality on customer experience and satisfaction in the context of restaurants in the Philippines. Future research directions may use AI and service robots in people management strategies in the hospitality sector.

Keywords: Customer experience; Customer satisfaction; E-SERVQUAL; Quick service restaurant; Service robots

1.0 Introduction

In this globalization period, most businesses are now transitioning to adopting innovative technologies brought about by the Industrial Revolution. Technology integration in various industries has led to the emergence of service robots in the restaurant sector. These robots are designed to assist with taking orders, delivering food, and providing customer service. Adopting service robots may indicate a lack of interpersonal interactions and decreased perceived virus transmission risk, boosting visitors' intent to visit (Wan et al., 2020). Automating tasks and duties that restaurant workers would typically do is what restaurant robots entail. Researchers and business professionals have been paying greater attention to the usage of service robots in recent years as technology has advanced (Jang & Lee, 2020). The possibility of replacing workers in frontline service professions with robots has given rise to justification from both supporters and opponents (Kim et al., 2021). For instance, in the hotel industry, the widespread adoption of automation was significantly influenced by the COVID-19 pandemic. The pandemic has made customers more risk-averse, which has increased the usage of service robots in the hotel sector. Due to

safety concerns, customers prefer hotels with robot personnel more than human workers (Kim et al., 2021; Shin & Kang, 2020). According to projections made by Technavio in 2020, cited by Choi and Chan (2021), the market for service robots in the hospitality and healthcare industries will increase by 942 million USD between 2020 and 2024.

Automation in restaurants is not intended to replace people; rather, it is intended to improve customer satisfaction and enhance customer experience. Robots with artificial intelligence (AI) are expected to replace or supplement services currently rendered by humans in various industries, including hospitality and tourism (Song et al., 2022; Yoganathan et al., 2021). The research found that relative to service quality delivery, consumers are more likely to expect better service quality provided by human-like service robots (Christou et al., 2020; Lin & Mattila, 2021; Qiu et al., 2020; Yoganathan et al., 2021). In particular, robots could not imitate personalized care (Ariffin, 2013), human connection (Kattara & El-Said, 2013), quality of service (Choi et al., 2020), genuine connections (Shin & Jeong, 2020), and encounter enrichment (Chan & Tung, 2019) that humans added to their service delivery. Thus, the study aims to prove the service quality theory (SERVQUAL model by Parasuraman et al., 1985) using the latest hierarchical model called e-service quality, proposed in 2005 by Parasuraman and Zeithaml, in examining the impact of service robots on customer experience and satisfaction. Still, there are differing viewpoints regarding the impact of a service robot's look on the customer experience. According to Yrjola et al. (2019), customer experience is the total experience created through interactions with service providers.

A research gap is considered based on numerous research studies that have already been conducted on robotics in restaurants, most of which have been conducted in European and Asian nations. Still, given the country's unique sociocultural context and population, understanding how such technological breakthroughs affect customer perception in the Philippines is not present. Thus, Filipino consumers differ from others due to differences in culture and the availability of disposable income. This study will close the knowledge gap on Filipino consumers' perceptions of the employment of robotics in the restaurant sector and whether or not this will ultimately result in a new dining experience and satisfaction. Therefore, with the emergence of service robots in the restaurant sector, the study aims to explore the impact of service robots on customer experience and satisfaction in selected Quick Service Restaurants (QSR) in Taguig City. It will identify the significant relationships among e-service quality, customer experience, customer satisfaction, and the relationship between customer experience and customer satisfaction. This research will provide valuable insights into the impact of service robots, helping restaurant owners and managers make informed decisions about their implementation. By understanding the factors influencing customer perception and acceptance, the industry can adapt and optimize the use of service robots to enhance the overall dining experience. It is further expected to reveal improvements in the e-service quality dimensions of quick-service restaurants.

2.0 Methodology

2.1 Research Design

The study used a descriptive-correlational research design to gather data on the respondents' profiles, the assessment of e-services quality, customer experience, and satisfaction in QSR using service robots in Taguig City. The researchers employed the correlational approach to investigate the link between the independent and dependent variables. According to Bhandari (2022), a correlational study examines the correlations between variables without allowing the researchers to change or exert any control over them. A quantitative approach would ensure the data's objectivity, leading to more precise results.

2.2 Research Respondents

The respondents of this study were customers who visited and dined in the selected QSR, namely Jollibee, McDonald's, and Genki Shushi in Taguig City, Philippines. However, respondents who visited quick service restaurants other than these pre-identified locales were included unless the restaurants used automation and robotics. The study's respondents were those 18 years old and above, of any gender, and those who had consented to answering the survey until reaching the desired sample requirement. The study used convenience sampling to obtain respondents' data. Convenience sampling was employed as the primary method for participant selection. This approach involved choosing individuals who were readily available and accessible, allowing the researchers to efficiently gather data without the need for extensive random sampling techniques. By relying on this method, the study aimed to obtain a preliminary understanding of the phenomenon in question, although this may limit the generalizability of the findings. Convenience can occasionally be a valuable and practical strategy that can

yield insightful data from the community (Showkat & Parveen, 2017). The study targeted 181 customers from the available population among the participating QSRs, totaling 4,400 population-based. The results of the distribution: The majority of the respondents in Taguig City were from McDonald's, with 75 or 41.4%; 71 or 39.2% dined at Jollibee; 33 or 18.2% visited Genki Sushi; while others 1 or 0.6% went to Wendy's and BonChon respectively. The most visited restaurant is McDonald's, and the least visited are Wendy's and BonChon. This finding revealed that robotics and AI-capable systems increase in restaurants because they provide a convenient, easy-to-use option for customers who order food without employee assistance.

2.3 Research Instrument

The questions in the questionnaire were adapted from various literature and studies on the topic under investigation. E-Service quality is anchored from the SERVQUAL and E-SERVQUAL models of Parasuraman et al. (1988) and Mason et al. (2021) that comprised Reliability, Responsiveness, and Assurance (De Kernevenoael et al., 2020; Ivanov et al., 2018), Perceived risk (Jang & Lee, 2020), Enjoyment (Cha, 2020; Park & Kwon, 2016), speed of service (El-Said & Al Hajri, 2022), customer experience (De Kervenoael et al., 2020; Ivanov et al., 2018; Nair, 2016) and customer satisfaction (Khadka & Maharjan, 2017). The researchers included additional indicators as supplemental items to fit the instrument in the study correctly and adequately, as suggested by validators. The researchers asked permission from the original authors to use the tools electronically, and the researchers received positive responses from the authors. The 27-item survey questionnaire used a five-point Likert scale to indicate the level of agreement with the statements, with one (1) as the lowest and five (5) as the highest rating. The instrument validity and internal consistency reveal a 0.966 Cronbach's Alpha value.

2.4 Data-Gathering Procedure

The researchers obtained authorization from the QSR in Taguig City to gather data, and the major tool utilized was a survey questionnaire. Before taking the survey, each customer was given an informed consent form. The researchers used a modified questionnaire after the validation process as a guide with a set of questions to analyze information on relevant variables in a predetermined and systematic way. This activity sought to elicit the respondents' perspectives about their dining experience and satisfaction with service robots in selected QSRs. The surveys were individually distributed and collected by the researchers.

2.5 Data Analysis.

The data sets were analyzed using frequency, percentage, weighted mean, and standard deviation. However, the researchers utilized the Spearman rho test in correlational analysis, a non-parametric tool due to deviation from the data normality that falls under the correlation and regression categories. The p-values provided by SPSS (quoted under Sig. for Kolmogorov-Smirnov and Shapiro-Wilk) revealed 0.000 (reported as $p < 0.000$). The researchers had significant evidence that the assumption for normality of data has been violated, meaning the data are not normally distributed. Thus, non-parametric tests were appropriate (Green & Salkind, 2014).

2.6 Ethical Considerations

The study followed all ethical requirements for data collection, including adhering to Republic Act 10173 of the Philippines to comply with the Data Privacy Act 2012. No respondents were coerced into the data collection, and anonymity and confidentiality were ensured.

3.0 Results and Discussion

3.1 Profile of the Respondents

Table 1 revealed that the majority of the respondents in terms of age were 18 - 28 years old, with 156 respondents or 86.2% equivalent; 29 - 39 years old to 9.9% or 18 54, followed by 41 - 50 years old with the equivalent of 2.8% or 5; and lastly those with an age range from 51 above equivalent to 1.1% or 2. The finding implies that most age groups are young adults fond of eating at quick-service restaurants. Regarding sex, the results show that 93 out of 181 respondents are male, 51.4%, while females have 88 respondents, with 48.6%. This finding did not have much bearing, having a slight edge of male over female. The reason for this finding is that during the data collection, more males answered the questionnaire. The researchers believe another period will eventually change the results, wherein females dominate males, especially on weekends. In the occupation dimension, most respondents were employed, equivalent to 53.6% or 97. followed by students with an equivalent of 41.45% or 75; and lastly. Unemployed respondents with the equivalent of 5% or 9. The result is evident from the questionnaire

distribution, wherein the QSR in Taguig has been dominated by employed individuals working nearby and making the mall their relaxation space. Most respondents' monthly income is less than Php 20,000, with a percentage of 42.5%. This includes the student who categorized their allowances as income, followed by Php 40,000 to Php 49,000 with 30.4% and next is Php 30,000 to Php 39,000 with 14.4% and followed by Php 20,000 to Php 29,000 with 9.4% and lastly above Php 50,000 income with 3.3%.

Table 1. *Demographic profile of respondents*

Age	Frequency	Percentage
18 – 28 year old	156	86.2%
29 – 39 year old	18	9.90%
40 – 50-year-old	5	2.80%
51 – up	2	1.10%
Sex		
Male	93	51.4%
Female	88	48.6%
Occupation		
Employed	97	53.6%
Unemployed	9	5.00%
Student	75	41.4%
Monthly Income		
Less than Php20,000	77	42.5%
Php20,000 - Php29,999	17	9.40%
Php30,000 - Php39,999	26	14.4%
Php40,000 - Php49,999	55	30.4%
Php50,000 above	6	3.30%

3.2 E-Service Quality Dimensions, Customer Experience and Satisfaction

Six E-Service Quality Dimensions

Customers rated the six e-service quality dimensions of using service robots positively. As shown in Table 2, customers rate the E-service reliability quality with an overall mean of 4.56 and interpreted it as “strongly agree” using AI and service robots in selected quick service restaurants as the highest among the six E-service quality dimensions. In explaining this result, it is evident that consumers believe that robots help improve the productivity of restaurants by serving food with contactless actual orders. In addition, customers are aware of the possible reduction of restaurant costs due to automation, like a workforce cutback. Service robots' abilities have gradually exceeded human service providers' performance in certain areas, e.g., memory, computing power, physical strength, and handling unpleasant or dangerous tasks. However, those service robots have a limited level of AI to provide various services. AI can be classified into four categories: mechanical, analytical, intuitive, and empathetic (Huang & Rust, 2018; Laowattana, 2020). The revolution of AI has enabled service robots to offer services with greater productivity, efficacy, and efficiency (Wirtz et al., 2018).

Table 2. *Mean scores of ESERVQUAL dimensions*

E-Service Quality Dimensions	Mean	Std. Dev	Interpretation
1. Reliability	4.56	0.72	Strongly Agree
2. Responsiveness	4.40	0.86	Strongly Agree
3. Assurance	4.42	0.85	Strongly Agree
4. Perceived Risk	4.40	0.86	Strongly Agree
5. Enjoyment	4.36	0.88	Strongly Agree
6. Speed of Service	4.45	0.82	Strongly Agree

The lowest rating among the six e-service quality dimensions is enjoyment, with an overall mean of 4.36. However, despite the low mean score, it is interpreted as a “Strongly Agree” rating, which suggests that customers are confident that the service robots delight customers by providing care and personal attention. The results show a parallel, as argued in past research: if consumers do not enjoy or intend to use service robots, the cost savings and bottom-line benefits will remain untapped (Allmendinger & Lombreglia, 2005), and extant research offers few insights into the drivers of trust in service robots. All the six E-service quality dimensions were rated “strongly agree.” The findings likewise discovered that dependability and responsiveness were the most influential factors influencing user satisfaction with service robots. This emphasizes the significance of ensuring that service robots are reliable and responsive to user requirements to increase user satisfaction, according to Chang et al. (2021). The finding was supported by the literature, arguing that service robots can alleviate the workload of first responders while keeping customers safe from risk, perform tasks so that humans can practice social distancing, execute

delicate procedures that not many staff have the skills or stamina to perform (Matthews, 2020). According to the study of Stranjancevic and Bulatovic (2015), speed of service is being able to provide faster service without reducing quality, which translates to happier customers and additional revenue for the restaurant. Today, robotic service has been integrated into service organizations to enhance customer experience (Prentice & Nguyen, 2020).

Customer Experience and Customer Satisfaction

Both constructs were rated excellent, with 4.54 and 4.48, respectively (see Table 3). The results imply that customers are impressed that service robot delivery can perform its job professionally and sufficiently. Due to the infancy of its implementation, customers or diners are still curious about the technology's usage. Customer expectations, experiences, and technological capabilities influence social robots' ability to provide services (Chiang & Trimi, 2020).

Table 3. Mean scores of customer experience and satisfaction

Constructs	Mean	Std. Dev	Interpretation
Customer Experience	4.54	0.72	Excellent Experience
Customer Satisfaction	4.48	0.81	Extremely Satisfied

Further, a category of customer experience as a user is described as engagement, which has been shown to impact behavioral intention directly (Anzalone et al., 2015). The ability of service robots to perform their job is fulfilling and pleasing to the customers, and they enjoy the technology while dining in the restaurant. The study's findings are consistent with other research (Sivadas & Jindal, 2017; Jalilvand et al. (2017); Adam et al. (2015); Lockyer, 2003) showing a relationship between fast-food restaurant customer satisfaction, word-of-mouth, and restaurant service quality.

3.3 Relationship between E-Servqual and Customer Experience

Table 4 shows a positive correlation between ESERVQUAL and customer experience ($r=0.798$, $p < 0.05$). In detail, the independent variables that displayed the hierarchy of the most substantial predictive effect include enjoyment ($r=0.807$), reliability ($r=0.793$), perceived risk ($r=0.786$), speed of service ($r=0.782$), assurance ($r=0.779$), responsiveness (0.732) respectively.

Table 4. Relationship between E-SERVQUAL and Customer Experience

		ESERVQUAL	Customer Experience
ESERVQUAL	Correlation Coefficient	1	.798**
	Sig. (2-tailed)		0.00
Customer Experience	Correlation Coefficient	.798**	1
	Sig. (2-tailed)	0.00	

** Correlation is significant at the 0.01 level (2-tailed).

The predictive enjoyment of customers in using the technology gives pleasure and happiness among users of the technology robotics. Likewise, restaurants, also called automated restaurants, make the food industry safer, more personalized, and more efficient. Service robots help improve the speed of service and order accuracy. The reliability dimensions provide solutions to the problems that restaurants are facing today. Not only does this make running the kitchen easy, but now staff can focus on the quality of the food, brand identity, and, of course, providing a top-tier customer experience, especially after the COVID-19 experience. The acceleration of robots and AI in the restaurant industry is inescapable, and this technology will be critical in moving the restaurant industry forward. However, restaurants should remember that customers will still seek human-to-human interaction when dining—as seen recently with the evolution of QR codes as customers returned to on-premises dining—so there will be a need to find a healthy balance between tech and humans. Restaurants will keep developing artificial intelligence despite the dangers involved with its usage because they think the advantages outweigh the disadvantages.

This finding corroborates Chen et al. (2021) in examining customers' experiences with contactless hospitality services in Taiwan's intelligent hotels. Similarly, Ho et al. (2020) focused their research on the impact of service robots on customer service experience/encounter evaluations, perceived value and perceived responsibility for outcomes in which the factors affecting perception and customer assessment include service recovery source (Choi et al., 2019b), perceived usefulness, perceived ease of use, service assurance, personal engagement, tangibles (de

Kervenoael et al., 2020), the role of frontline service robots, perceived innovativeness, perceived ethical and societal reputation (Mcleay et al., 2021), technological autonomy and perceived behavioral control (Jörling et al., 2019). Using robots can alter the type and format of products, service design, delivery (Mozafari et al., 2022), and the ensuing consumer experiences (Prentice & Nguyen, 2020). Service robots introduce new interactions between customers, staff, and technology (Qiu et al., 2020).

3.4 Relationship between E-Service Quality and Customer Satisfaction

Table 5 depicts that the E-SERVQUAL dimensions positively correlate with customer satisfaction ($r=0.876$, $p<0.05$).

Table 5. Relationship between E-SERVQUAL and Customer Satisfaction

		ESERVQUAL	Customer Satisfaction
ESERVQUAL	Correlation Coefficient	1	.876**
	Sig. (2-tailed)		0.00
Customer Satisfaction	Correlation Coefficient	.876**	1
	Sig. (2-tailed)	0.00	

**. Correlation is significant at the 0.01 level (2-tailed).

On the variability of the dependent variable, the independent variables that displayed the hierarchy of the most substantial predictive effect include reliability ($r=0.851$), speed of service ($r=0.850$), assurance ($r=0.847$), enjoyment ($r=0.834$), perceived risk ($r=0.807$), responsiveness ($r=0.785$). This positive predictive effect of the variable indicates that customers are more satisfied to dine in the establishment with regards to the reliability of the service robots, the speed and accuracy of service delivery, assurance in providing the products, enjoying the usage of technology, and the risk of the possible transfer of infectious diseases will be eliminated, though of course despite that responsiveness likewise posted a significant finding. The customer still wants personal interaction and building emotional attachment among human service staff. This connotation indicates that for these E-service quality dimensions, the more the quick service restaurants emphasize the attention to detail in using service robots according to the customer, the higher the satisfaction.

Therefore, the result emphasizes that the management should consider the predictive effect of the above six (6) variables for a food establishment to be competitive in satisfying its customers. The result implied combining the modified service quality dimensions, singly or combined, would predict customer satisfaction. The study of Nguyen et al. (2018) supports the importance of service quality in Jollibee restaurants in the Philippines and found that tangibles, reliability, responsiveness, assurance, and empathy significantly positively affected customer satisfaction. Mensah and Mensah (2018) did a similar study on the impact of customer satisfaction and service quality on restaurant repurchase intentions. The study discovered a strong positive association between customer happiness and service quality. In addition, Qin and Prybutok (2009) proposed that consumer happiness in fast-food establishments is directly and favorably correlated with service quality. Customers were happier when services were rapid, responsive, sympathetic, and accurate, and the business looked nice overall. On the other hand, implications for findings reveal that restaurants are also evaluating how AI can help overcome critical issues with staffing, scheduling, and developing human resources, which are also essential in restaurant operations, wherein automation and AI can provide advantages.

3.5 Customer Experience and Customer Satisfaction

Table 6 shows a strong positive correlation between customer satisfaction and experience ($r=0.849$, $p<0.05$).

Table 6. Relationship between Customer Experience and Customer Satisfaction

		Customer Experience	Customer Satisfaction
Customer Experience	Correlation Coefficient	1	.849**
	Sig. (2-tailed)		0.00
Customer Satisfaction	Correlation Coefficient	.849**	1
	Sig. (2-tailed)	0.00	

**. Correlation is significant at the 0.01 level (2-tailed).

The link between service quality delivery, customer experience, and customer satisfaction is better understood due to these findings. Therefore, restaurant establishments are urged to prioritize improving the customer experience by managing customer issues and providing error-free, rapid service. They ensure their service robots are simple to use, operate as intended, and attend to service demands and specifications. Therefore, establishments

must raise customer satisfaction by exceeding their expectations, delighting them, and strengthening their relationship with them via dependable customer service. Based on previous studies, customers' experiences result from a favorable post-experience assessment of such experiences compared to the customers' pre-experience expectations (Gahler et al., 2019). According to this study, providing excellent customer service is inherently linked to improving customer experience. On the other hand, customer satisfaction is a standard performance metric and results from factors related to the gap between customers' expectations and their experience (Ban & Jun, 2019; Milner & Furnham, 2017). Furthermore, in the services marketing literature, despite the call for enhancing customer experience to increase customer loyalty (Ban & Jun 2019; Shourov et al., 2018; Tao & Kim, 2019), it is necessary to include other variables to reinforce this relationship further.

4.0 Conclusion

The study revealed several critical research gaps about how and to what degree service robots could radically improve customer experience and satisfaction. Service robots have grown increasingly widespread in the service industry. They are predicted to develop tremendously in the next few years, but empirical research on the service quality of robots is scarce. Thus, the study aims to explore the impact of service robots using E-service quality theory on customer experience and satisfaction in selected quick-service restaurants. This study found that most respondents were millennials and Z generations. Reliability, speed of service, and assurance were among the E-Service Quality dimensions that presented excellent customer satisfaction and experience upon dining in the selected QSR using AI and service robots. Service robots and artificial intelligence, exemplified by automated kiosks, significantly enhance how clients engage with businesses. These cutting-edge technologies introduce innovative features that foster interactive and enjoyable user experiences. With their user-friendly interfaces, designed to be intuitive and accessible, these systems streamline processes and simplify interactions, allowing customers to effortlessly access a wealth of information and services at their fingertips. By seamlessly integrating these advanced technologies into their operations, businesses can craft a customer journey that is not only more engaging but also remarkably efficient, paving the way for increased satisfaction and loyalty. Statistical findings exposed that e-servqual dimensions have a significantly strong positive relationship with customer experience and satisfaction. Moreover, the same conclusion of a strong positive relationship between customer experience and satisfaction was revealed as having a strong positive correlation. Thus, the association has a unidirectional relationship. Customers reported higher satisfaction levels when services were prompt, responsive, accurate, and risk-free, and the overall experience was enjoyable. The higher the service quality, the increase in customer experience and satisfaction.

Most previous research on service robots in hospitality has concentrated on the hotel business, such as concierge or delivery robots, with little from the restaurant sector. Theoretically, this research adds to the body of knowledge on technology advancements in the hospitality industry by examining changes in service management and marketing brought about by using service robots. Based on the findings, adding to the literature about the potential development of a recommended service process design using AI and robotics is crucial. For managerial implication, restaurant businesses should enhance customer service relationships and surpass customers' dining experience by effectively handling service robots and AI issues, providing prompt customer service, ensuring their technologies are simple to use, meeting service needs and requirements, and offering error-free services to increase customer satisfaction. In addition, QSRs should decide which combination of robot design, customer features, and service design characteristics such as human-likeness (e.g., face, voice, and movement) leads to a better implementation of service robots and AI in the restaurant sector. The study assured the restaurant industry that robots will not steal employment from workers, but they will undoubtedly affect how people work. Food service firms should embrace change since the duties that robots can take over from human workers are dull prescribed tasks with preset outcomes in which human workers' productivity is poor.

The study's modest sample sizes limit the study since they hinder generalizability aside from using cross-sectional surveys. Future research should analyze a broader sample of respondents with different restaurant classifications, as the current study used quick service and fast-casual restaurants. Future studies should focus on respondents using robot services at various restaurants and use longitudinal research. The study was conducted in only one city in Metro Manila, Philippines, and it is difficult to apply the results to other provinces or regions within the Southeast Asian context. The study supports future research on including AI and service robots in people management strategies in the hospitality sector.

5.0 Contributions of Authors

Each author made significant and equal contributions to every aspect of the study, demonstrating a collaborative and comprehensive approach. All authors meticulously reviewed and approved the final work, ensuring its accuracy and integrity.

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7.0 Conflict of Interests

The authors affirm that they have no conflict of interest that could influence the publication of this paper.

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