

## Article

# The Impact of Sustainable QR Menus on Service Quality and Customer Satisfaction: The Moderating Role of Perceived Risk

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**Abstract:** Technological applications have become increasingly important as competitive tools in the food and beverage industry. However, the effects of quick response (QR) menus, which exemplify sustainable menu practices, on service quality, e-service quality, and customer satisfaction, as well as the moderating role of perceived risk in these relationships, have not been sufficiently explored. To address this gap, data were collected through a face-to-face survey from 508 participants at three full-service casual dining establishments in the city center of Antalya, Türkiye, between 10 May and 26 June 2024. The research hypotheses were tested using structural equation modeling. The analysis revealed that technology-based service innovation and service quality significantly influence customer satisfaction, while e-service quality impacts customer satisfaction indirectly through service quality. Furthermore, when examining the moderating effect of perceived risk, it was found that perceived risk does not moderate the relationship between technology-based service innovation and customer satisfaction. In conclusion, the study presents managerial and practical implications that underscore the effect of technological innovations in enhancing service quality and customer satisfaction in the food and beverage sector.

**Keywords:** QR menu; technology-based service innovativeness; customer satisfaction; service quality; e-service quality; perceived risk



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## 1. Introduction

The service industry contributes significantly more value added to global gross domestic product (GDP) than the manufacturing industry. According to the World Bank, in 2021, manufacturing sectors contributed 17% to global GDP, while services sectors contributed 65.7% [1]. Restaurants are an important part of the service industry. As one of the sectors most affected by the pandemic, the restaurant industry continues to grow rapidly after the end of the pandemic, adding various technological service innovations to its applications.

It is stated that as of 2021, the restaurant industry in the United States provided employment to 15.5 million people and generated USD 731.5 billion in sales, contributing significantly to the gross domestic product with a share of approximately 4% [2,3]. The size of the food service market in Türkiye was USD 2.1 billion in 2020, and it is expected to grow nearly tenfold, surpassing USD 22.6 billion by 2026. Full-service restaurants are reported

to account for approximately 40% of the food service market [4]. Therefore, restaurant services are a key player in the anticipated growth of the food service market.

As in all areas of life, technology has also begun to be extensively used in food and beverage businesses. Examples of these technological applications include 3D printers, robot chefs, digital menus, robot waiters, kiosks, and automation systems [5]. Technology-based service innovations (TBSIs) in restaurants plays a critical role in reducing operational costs, improving customer experience, decreasing wait times, increasing operational efficiency, and providing a competitive advantage [6,7]. A common form of TBSI in restaurants is the use of quick-response (QR) menus. QR menus are the digital version of a restaurant menu that customers can access by scanning a QR code with their smart mobile devices. Through the QR code, customers can browse the items on the restaurant's menu, access detailed information, place orders, and even make payments. The ability for customers to place orders without waiting for a waiter reduces waiting times, while detailed information about products influences the decision-making process and enhances the operational efficiency of businesses [8]. For these reasons, QR menus are expected to have a positive impact on service quality.

Service quality refers to the difference between the service that the customer expects from the business and the service they receive, with any service exceeding customer expectations leading to satisfaction. The ease of use of QR menus, as a technological interface, impacts the perception of electronic service quality by facilitating a smooth ordering process, reducing wait times, and allowing the menu to be scanned and loaded effortlessly. These technological conveniences, which can be described as e-services, positively influence the perceived e-service quality of the business. However, the perception of risk that technology creates on today's people, that is, allowing access to their personal information and devices, may increase the perception of risk and this may affect customer satisfaction.

Due to the service-oriented and experiential nature of the restaurant industry, special attention must be paid to consumers' experiences with technology-based services [9,10]. Upon reviewing the relevant literature, it becomes evident that most studies have focused on examining consumers' adoption of technology and its outcomes, while the impact of self-service technologies, such as QR menus, on service quality and customer satisfaction has not been sufficiently explored. However, investigating the impact of self-service technologies, including QR menus, on service quality and customer satisfaction is particularly important for reasons such as adapting to the evolution of modern consumer expectations, increasing customer interaction by providing faster and more effective service delivery, and providing competitive advantage by considering various factors, especially hygiene.

In the academic literature on the tourism and hospitality sector, studies on QR codes primarily focus on mobile payment systems and the technology acceptance model (TAM). However, there is limited research comprehensively examining the impact of QR menu usage in restaurant businesses on service quality, e-service quality, and customer satisfaction. Innovative technologies such as smartphones and quick-response (QR) codes have significantly transformed daily life, offering ease of use across various industries. The COVID-19 pandemic further accelerated the adoption of QR menus due to heightened hygiene concerns and the need to reduce physical contact, making them a widely used solution in restaurants. With the pandemic, increased hygiene awareness led to a decline in the use of physical menus, while QR menus emerged as a safer and more practical alternative for both businesses and customers. This study aims to contribute to the food and beverage services sector both theoretically and practically by analyzing the effects of QR menus on service quality and customer satisfaction. From an academic perspective, QR codes are expected to enhance information accessibility, improve operational efficiency, facilitate users' learning processes, and streamline transactions such as payments and reservations.

Additionally, the adoption of this technology presents a valuable opportunity for countries transitioning from traditional manual methods to digital solutions. However, ensuring the widespread and accepted use of QR codes requires further research, particularly in the context of ethnic, cultural, and economic differences. Therefore, the aim of this study is to investigate the impact of technology-based service innovation on service quality, e-service quality, and customer satisfaction, as well as the moderating role of risk perception in this effect.

## 2. Literature Review and Research Hypotheses

### 2.1. Technology-Based Service Innovation and QR Menus

Service innovation is defined as an innovation made in the service concept [11], a new service offered to customers [12], or changes made in the quality of the service for the benefit of customers [13,14]. Service innovation is a critical success factor that influences the behaviors of both customers and competitors [15]. The primary goal of the innovation presented is to enhance service quality and elevate the perceived value for the customer [16,17].

Today, technology has become a significant driving force for service innovation [18,19]. In the restaurant industry, as in many other sectors, the widespread use of technology is evident in various service areas, especially in the service production and delivery process. Examples of the integration of technology into restaurant services include tablet menus, QR menus, online payment options, 3D prepared meals, and serving with robots [5]. Technology-based service innovation contributes to reducing a business's costs, shortening service time, and thereby enhancing operational efficiency [20]. It also improves service quality [21], which enables the business to gain a significant competitive advantage [22]. On the other hand, face-to-face interaction with staff may decrease [23]. While this may appear advantageous for some customers, it can be seen negatively by those who prefer to interact with staff. Nevertheless, several studies have shown that involving customers in the service process [24] has a positive impact on service quality, customer satisfaction, and consequently, customer loyalty [25–27]. QR menus are a good example of the use of TBSI in food and beverage businesses. QR codes, which are formed from the initials of the English words quick response, are codes that allow for the presentation of a wide range of information from website URLs to e-mail addresses, from product images to promotional coupons [28]. In food and beverage businesses, QR menus are the digital version of a restaurant's menu. QR codes, usually placed on the table, can be easily scanned by customers through their smartphones or mobile devices to access the restaurant's menu, leading to their rapid adoption [29]. The increased hygiene measures brought about by the COVID-19 pandemic also played a significant role in the widespread adoption and acceptance of QR menus [30,31]. Compared to traditional printed menus, QR menus are preferred by customers for several reasons, such as providing more detailed information about the products (calories, nutritional values, allergen warnings, ingredient details, etc.), offering images, enabling direct ordering, eliminating the need to wait for a waiter to place an order, and saving time.

The use of QR menus is frequently preferred not only because it facilitates customer experience but also because it serves as a convenient tool for businesses. Research shows that 56% of businesses update their menus on a weekly basis [32]. QR menus reduce printing costs for businesses [33], which is particularly important in countries like Türkiye, where the economy is volatile and prices change frequently. Reducing printing costs also contributes to sustainability. Additionally, QR menus help businesses save time, make it easier to display promotions [33–35], enable the analysis of customer preferences and the

evaluation of reviews [33], and allow restaurant staff to create more meaningful customer relationships and hospitality experiences [32].

## 2.2. Impact of TBSI on Service Quality, E-Service Quality, and Customer Satisfaction

Service quality (SQ) is commonly defined as the differences between customers' expectations of the service provider's performance and their evaluations of the services they receive [36,37]. If a business's performance falls short of customer expectations, perceived service quality is low, leading to customer dissatisfaction [38]. Perceived quality is the consumer's judgment about a business's overall excellence or superiority, which is formed as a result of the consumer's subjective evaluations [36].

These subjective evaluations of quality are not only based on the service outcome but also include an assessment of the service delivery process [39]. Service-providing businesses adopt new technologies developed to enhance the efficiency of their processes and improve service quality, which leads to the development of new service products [40]. When the customer benefits from the service delivery process, it also results in benefits for the business [41].

Until the pandemic affected the whole world, QR menus were an alternative to traditional printed menus. However, with the COVID-19 pandemic, the process of taking orders with waiter–customer interaction was rapidly replaced by QR menus due to increased hygiene measures, and they became a necessity for that period. Although the pandemic conditions have disappeared, many businesses continue to use only QR menus due to the benefits they provide and do not offer a printed menu option to the customer. In this regard, the offering of QR menus in restaurant businesses and the customer's experience with these menus can be considered a factor influencing the perception of service quality. QR menus can be viewed as an element that enhances service quality due to their hygienic nature, the time they save, and the easy access they provide to more detailed information about the products. However, the use of QR menus is not an application that completely eliminates staff, which is a crucial component of the service quality perception. Although service staff may not always have a direct role in the ordering process; they are still indirectly involved in the service process (e.g., bringing the order to the table, answering additional questions). Besides staff, factors such as atmosphere [42], price [43,44], and the quality of the food [45,46] are also components that influence the overall service quality. Therefore, evaluating a business's overall service quality solely based on QR menu usage would be incorrect. It is believed that considering QR menus as one component of the overall service quality is a more appropriate approach.

Research has shown that customers' ability to access higher-quality information more quickly and easily through technology-based service innovations, including QR menus, positively influences their perception of service quality [47,48]. In addition, one of the most important factors affecting perceived service quality is the waiting time [49,50]. QR menus can enhance the perception of service quality by reducing waiting times. However, it has also been noted that self-service technologies, including QR menus, can negatively impact the customer experience [51]. For individuals who avoid using technology for any reason (such as lack of technological literacy, age, perceived risk, or dislike of technology), these technologies may negatively affect their perception of service quality. The impact of QR menus on the overall service quality of restaurant businesses has not yet been thoroughly researched. With the assumption that QR menus are beneficial for both the customer and the business, the research hypothesis was formed as follows:

**H1.** *TBSI has a positive effect on overall service quality within the scope of QR menus.*

E-service quality (E-SQ) can be defined as the general evaluation and judgment of consumers regarding the perceived quality of the electronic service [52]. Evaluating e-services is different from evaluating traditional service quality, since it contains technological elements. Many factors such as technology readiness [53], customer segment [54], perceived usefulness and convenience [55], and beliefs about technology may affect the perception of e-service quality [56]. Previous experiences are also determinants of the perception of e-service quality [57,58]. When a customer uses a well-designed technological interface, it is expected that they will feel engaged, excited, and have positive outcomes [59]. Therefore, in restaurant businesses, using well-structured QR menus that provide sufficient information effectively and are easy to use can facilitate the ordering process and reduce waiting time, positively influencing the perception of e-service quality. Based on this idea, the research hypothesis is formed as follows:

**H2.** *TBSI has a positive effect on e-service quality within the scope of QR menus.*

### 2.3. Effect of TBSI on Customer Satisfaction

Numerous theories have been developed to explain customer satisfaction, offering diverse perspectives on its complex and multifaceted nature. Among these, Oliver's (1980) expectation confirmation theory is widely recognized [60–62]. This theory posits that customers evaluate a product or service's performance by comparing it to their pre-purchase expectations. Satisfaction arises when performance meets or exceeds expectations, while dissatisfaction occurs when it falls short. Similarly, the SERVQUAL model, proposed by Parasuraman, Zeithaml, and Berry (1988) [37], assesses customer satisfaction across five dimensions, namely reliability, tangibles, empathy, assurance, and responsiveness. This model has been pivotal in understanding customer expectations and in formulating strategies to improve service quality. In addition to these foundational theories, alternative approaches such as attribution theory, equity theory, and perceived value theory further emphasize the subjective and dynamic nature of customer satisfaction [60,61,63].

Although there are existing theories in the field, no comprehensive theory fully captures the multidimensional nature of customer satisfaction. Existing theories and studies address specific contexts and perspectives but fail to encompass all dimensions. Consequently, there is a continued need for further research to test existing frameworks in diverse settings and to develop new theoretical approaches.

QR menus, one of the areas of application for technology-based service innovation in restaurants, allow customers to easily access the menu without needing to wait for a waiter to place an order. By simplifying the ordering process, QR menus can enhance customer satisfaction. Additionally, as a form of self-service, QR menus can provide a more reliable service environment and consistent service standards, as noted in some studies, thereby increasing customer satisfaction [64,65]. In their study on human–robot interaction, De Kervenoael et al. [66] found that the presence of social robots was perceived as cool and innovative, increasing the intention to use social robots and providing customers with an enjoyable experience. Based on this information, the following hypothesis has been formed:

**H3.** *TBSI has a positive effect on customer satisfaction within the scope of QR menus.*

### 2.4. Effect of Perceived Service Quality and E-Service Quality on Customer Satisfaction

Customer satisfaction and service quality are fundamental topics in the tourism and hospitality industries, both theoretically and practically. A search conducted on

10 February 2025 in the Web of Science (WoS) database using the keyword “customer satisfaction” revealed 28,025 documents. When combined with the term “service quality”, this number narrows to 7163, and when specifically focusing on the tourism, hospitality, and restaurant sectors, 1207 results were identified, including 1042 articles [67]. These findings underscore the interdisciplinary significance of these concepts and their prominent position in the literature.

Empirical studies have consistently demonstrated the significant relationship between service quality and customer satisfaction. Lee et al. (2005) found that high service quality is directly linked to increased satisfaction and loyalty in family restaurants, with loyal customers being more likely to recommend and return [68]. Wu and Liang (2009) focused on luxury hotel restaurants, highlighting the crucial role of service quality in fostering satisfaction, which in turn drives customer loyalty and positive word-of-mouth [69]. Further research by Barber, Goodman, and Goh (2011) expanded on these findings, showing that service quality improvements lead to increased repurchase intentions in restaurant settings [70]. Similarly, Tuncer, Unusan, and Cobanoglu (2021) identified that both service quality and perceived value are essential in shaping satisfaction and influencing customer behaviors, such as repeat visits and recommendations [71].

Perceived service quality is one of the main factors affecting customer satisfaction [44,72–74]. Studies conducted in the restaurant industry sample have indicated that food quality, service quality, and atmosphere are the key determinants of business satisfaction [75,76]. Although food services are the core product in restaurant services, it has also been argued that service quality is more important than food quality [77]. Similarly, it has been stated that perceived quality has a direct positive effect on customer satisfaction, and in some cases, perceived price may not significantly affect satisfaction [78]. Numerous studies to date have supported the idea that service quality positively impacts customer satisfaction [44,72,79,80]. Based on this, the hypothesis is formed as follows:

**H4.** *Restaurant service quality has a positive effect on customer satisfaction.*

QR menus, one of the e-service applications used in restaurants, can be considered a tool that enhances customer satisfaction by providing quick service, as they save customers' time [8,81]. Various studies suggest that customer-centric innovative technologies have the potential to increase customer satisfaction and revisit intention [82,83]. However, it is difficult to claim that technology-based applications always lead to positive customer evaluations. For customers who believe that such applications interfere with the relationship between employees and customers, this can result in negative assessments. For instance, Hanks et al. [84] noted in their study that using self-service technologies could negatively affect a customer's intention to participate in customer relationship management campaigns. Difficulties or concerns experienced during the use of e-services (e.g., internet connection problems, failure to load the menu) can also negatively affect overall service quality and customer satisfaction. Sometimes individual factors, such as age, interest in technology, and attitude toward innovation, can influence the perception of e-service quality. However, the increasing presence of technology in our daily lives, the changes in the ordering process and hygiene expectations due to the pandemic, and the development of technological interfaces may have positively impacted the reduction in prejudice and the acceptance of technology. Based on the idea that changing living conditions could lead to the evaluation of e-service quality as part of overall service quality, the following hypotheses have been formed:

**H5.** *Restaurant e-service quality has a positive effect on service quality.*

**H6.** *Restaurant e-service quality has a positive effect on customer satisfaction.*

### 2.5. Moderating Effect of Perceived Risk

Since it is a technology-based innovation, it is possible that customers may feel some risks related to the use of QR menus. Perceived risk is the state of uncertainty that occurs when customers cannot predict the consequences of their purchasing decisions [85]. Perceived risk is related not only to the consumer's "pre-decision information gathering" and "action process" but also to post-decision processes [86], and it can evoke good or bad feelings that may affect beliefs, attitudes, and behavioral intentions [87]. In this study, perceived risk primarily refers to perceived privacy risk. Perceived privacy risk represents the fear of potential losses arising from the unauthorized disclosure of personal information [88]. Nowadays, since mobile applications access individuals' personal belongings, such as smartphones, they are also considered a significant security concern. From time to time, there are news reports about malicious data collectors placing fake QR menus in businesses to access customers' personal information. Scanning a QR code with mobile devices may raise concerns such as access to users' private information and the sharing of personal data with malicious third parties. Additionally, as information like location, orders placed, and past activities may be collected, it can lead to intrusions into a person's private life and increase security vulnerabilities. Some studies suggest that perceived risk negatively impacts a user's intention to adopt a new product [88,89]. Slade et al. [90] also found that perceived risk is negatively associated with the intention to use remote mobile payments. Zhang and Prybutok [91] state that perceived risk has a significant impact on customers' perceptions of e-service quality and satisfaction. It is expected that perceived risk will negatively affect customers' intention to use technology and internet-based tools, such as QR menus. However, perceived risk can also have a moderating effect on technology-based services. Therefore, the level of perceived risk is an important factor. It is expected that customers with low perceived risk will give more positive feedback to TBSI applications. To determine whether this inference is valid, the following hypotheses have been formed:

**H7.** *Perceived risk has a moderating effect on the impact of technology-based service innovation on e-service quality.*

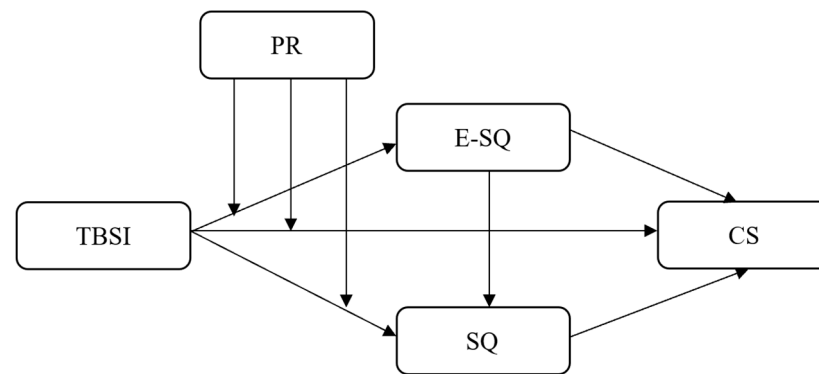
**H8.** *Perceived risk has a moderating effect on the impact of technology-based service innovation on service quality.*

**H9.** *Perceived risk has a moderating effect on the impact of technology-based service innovation on customer satisfaction.*

## 3. Materials and Methods

### 3.1. Research Purpose and Model

The use of QR menus in food and beverage businesses is no longer just a trend but has become a continuously evolving technology. Although it is thought that QR menus provide benefits to businesses and customers, more research is needed on the effects of QR menus. Therefore, the research model shown in Figure 1 has been developed, and the results are explained in the next sections.



**Figure 1.** Research model. (TBSI: technology-based service innovations; PR: perceived risk; E-SQ: e-service quality; SQ: service quality; CS: customer satisfaction).

### 3.2. Research Sample and Instruments

The population of this research consists of customers who have experienced QR codes in restaurant businesses. The data were collected face-to-face during May and June of 2024, using convenience and snowball sampling methods together. A survey was used as the data collection tool. The survey mainly consists of two parts. The first part includes demographic questions and questions related to the QR experience. The second part includes research scales. The scales were adapted from significant studies in the literature and modified to relate to QR menus. The use of previously developed scales that have been employed in various studies supports the reliability and validity of the survey instrument. The technology-based service innovation scale (4 items) was taken from the study by Kim, Tang, and Bosselman [10], while the service quality (4 items) and customer satisfaction scale (3 items) were adopted from the study by Ryu, Lee, and Kim [92]. The e-service quality scale (6 items) was adapted from Zhang and Prybutok's [91] website service quality scale. No scale has been found specifically to measure the use of QR menus in hybrid service environments, such as restaurant businesses where both technological services and business staff are involved. To measure e-service quality, scales such as WebQual [93], SITE-QUAL [94], E-S-QUAL [95], e-SELFQUAL [96], and website service quality [91] have been used. These scales are mostly suitable for evaluating the e-service perceptions of individuals using websites and e-commerce platforms. In this study, QR menus are expected to be beneficial to customers by facilitating access to product visuals, content information, and the ordering process. Therefore, among these scales, Zhang and Prybutok's [91] website service quality scale, which was considered appropriate for this research, was adapted to the use of QR menus. From the original 7-item scale, one item related to the guarantee policies of online shopping services was excluded, as it was not relevant to this study. Similarly, in the perceived risk scale (3 items), adapted from the same study and originally consisting of 4 items, one item reflecting concerns about the quality of products ordered online was removed because it was not directly related to the research topic. All scales were rated using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Since all the scales included in the survey were taken from the international literature, conceptual and semantic translation issues may arise. The most recommended approach in the literature to address potential translation problems is the translation–back translation technique [97,98]. In this study, the relevant technique was used in three stages. Accordingly, the scales were first independently translated from the source language, English, into the target language (Turkish) by the researchers and two different foreign language lecturers working at the university. Then, the translations were translated back into the source language by two different lecturers who are experts in the field of tourism and have foreign language proficiency. In the final stage, the translations were comparatively

evaluated, and it was determined that there were no significant differences except for a few words.

### 3.3. Data Collection

In the data collection process, a pilot test was first conducted between 2 May and 7 May 2024, with 48 participants. Participants were also asked to evaluate the clarity, comprehensibility, and content of the questionnaire. Based on the feedback received, minor changes were made to four scale items. The final data were collected face-to-face between 10 May and 26 June 2024 by the researchers from participants selected through convenience sampling at three different full-service casual dining establishments located in the city center of Antalya. Prior to the application, they were informed that participation was voluntary, no identifying information was requested, and that they could leave at any time without giving any reason. In line with this information, the participants who gave consent for voluntary participation started the survey after finishing their meal and just before leaving the restaurant. At the end of the data collection process, a total of 525 questionnaires were collected. For more accurate insights, 17 surveys identified as outliers using Mahalanobis distance [99] were excluded, and 508 valid surveys were included in the analysis.

### 3.4. Data Analysis

In this study, data analysis was conducted using SPSS Statistics 26 and LISREL 8.80 software. SPSS was utilized for descriptive statistics, reliability analyses, and basic hypothesis testing. LISREL, on the other hand, was employed for advanced analyses, including structural equation modeling (SEM) and confirmatory factor analysis (CFA).

In the analysis of the research data, normal distribution was first tested. At this stage, the skewness and kurtosis values of the scale items were examined. After the normality test, the demographic information of the participants was presented. Then, Cronbach's alpha and the average variance extracted (AVE) were calculated to determine the reliability and validity of the scales. Subsequently, the testing of the research hypotheses was initiated. In hypothesis testing, the two-step approach recommended by Anderson and Gerbing [100] and Hair et al. [99] was followed. Accordingly, in the first stage, the validity of the scales was tested using confirmatory factor analysis (CFA), and in the second stage, the research hypotheses were tested using structural equation modeling (SEM). Finally, to test the moderating effect of perceived risk, the process macro-extension developed by Hayes [101] was used.

The research data were collected using a single method during a single period through convenience sampling. Therefore, common method bias (CMB) may have arisen. To reduce potential CMB, participants were informed prior to the research, and it was emphasized that participation was voluntary and that no personal data would be requested. Additionally, Harman's single-factor test was used to examine whether there was CMB. In this analysis, all variable items are grouped under a single factor without rotation, and the explained variance should be less than 50% [102]. As a result of the analysis conducted using the maximum likelihood estimation method, it was found that the explained variance for the variables grouped under a single factor was 40.65%. In the study, the fit of the single-factor model was also examined using CFA, and it was found to have lower values than the multi-factor model ( $\chi^2 = 3252.92$ ,  $df = 170$ ;  $\chi^2/df = 19.13$ ; RMSEA = 0.19; NFI = 0.86; GFI = 0.61; CFI = 0.86; SRMR = 0.12). The results indicate that there is no CMB in this study.

## 4. Results

### 4.1. Demographic Findings

Information regarding the research participants is summarized in Table 1.

**Table 1.** Information about the participants.

| Variables               | Feature              | Frequency | Percent (%) |
|-------------------------|----------------------|-----------|-------------|
| Gender                  | Female               | 271       | 53.3        |
|                         | Male                 | 237       | 46.7        |
| Age                     | 18–29 age            | 134       | 26.4        |
|                         | 30–39 age            | 166       | 32.7        |
|                         | 40–49 age            | 125       | 24.6        |
|                         | 50+ age              | 83        | 16.3        |
| Marital status          | Single               | 195       | 38.4        |
|                         | Married              | 313       | 61.6        |
| Education level         | High school or below | 61        | 12.0        |
|                         | Associate degree     | 164       | 32.3        |
|                         | Bachelor's degree    | 209       | 41.1        |
|                         | Postgraduate         | 74        | 14.6        |
| Frequency of eating out | Rarely               | 28        | 5.5         |
|                         | Occasionally         | 185       | 39.3        |
|                         | Generally            | 159       | 31.3        |
|                         | Frequently           | 102       | 20.1        |
|                         | Always               | 34        | 6.7         |
| Previous QR code usage  | Yes                  | 471       | 92.7        |
|                         | No                   | 37        | 7.3         |
| Monthly income          | USD 620 and below    | 180       | 35.4        |
|                         | USD 620–930          | 116       | 22.8        |
|                         | USD 930–1240         | 98        | 19.3        |
|                         | USD 1240–1560        | 51        | 10.0        |
|                         | USD 1560+            | 63        | 12.4        |

USD 1 = TL 32.13 banknote buying rate on 5 October 2024 by the Central Bank of Türkiye [103].

### 4.2. Findings Regarding Validity and Reliability

In the analysis of the data, the first step was to conduct a normal distribution test. There are different methods used for normal distribution testing. In this study, the normal distribution test was conducted based on skewness and kurtosis values. In the literature, there is no universally accepted standard for skewness and kurtosis values that satisfy the assumption of the normal distribution. George and Mallery [104] suggest that skewness and kurtosis values within the range of  $\pm 2$  are sufficient indicators for conducting parametric tests. Kline [105], on the other hand, argues that both values should be within  $\pm 5$  to meet the assumption of normal distribution. The skewness values of the scale items used in the research range between  $-1.075$  and  $0.468$ , and the kurtosis values range between  $-1.180$  and  $0.456$ . Based on these values, it was assumed that the research data exhibited a normal distribution.

#### 4.3. Measurement Model

As a result of the confirmatory factor analysis (CFA), the fit indices were determined as follows:  $\chi^2 = 479.64$ ,  $df = 160$ ,  $\chi^2/df = 3.00$ , RMSEA = 0.063, NFI = 0.97, GFI = 0.91, CFI = 0.98, SRMR = 0.042. There are varying perspectives and references regarding the ideal thresholds for fit indices. The majority of these values fall within the range of good and acceptable fit [106–108]. However, to improve the fit indices, the modifications suggested by the software were examined. These modifications should be theoretically grounded, convey similar or related meanings, and be appropriate to the current dataset and the purpose of the analysis [108]. In this context, the modification suggested between items 3 and 4 of the service quality scale was found appropriate and implemented. It was observed that the statements in these items relate to customer interactions with staff and might have been understood in a similar manner. After the modification, the revised CFA results are summarized in Table 2.

**Table 2.** Result of confirmatory factor analysis.

| Variables/Items                                                                                      | Standardized Loading | t-Value | $\alpha$ | CR    | AVE   |
|------------------------------------------------------------------------------------------------------|----------------------|---------|----------|-------|-------|
| <b>Technology-Based Service Innovations (TBSIs)</b>                                                  |                      |         | 0.881    | 0.882 | 0.653 |
| This restaurant offers new apps or online ordering tools.                                            | 0.81                 | 21.11   |          |       |       |
| This restaurant has integrated innovative technologies into services.                                | 0.84                 | 22.63   |          |       |       |
| This restaurant delivers cutting-edge services.                                                      | 0.79                 | 20.52   |          |       |       |
| The procedure for ordering menu items at this restaurant is innovative.                              | 0.79                 | 20.47   |          |       |       |
| <b>Service Quality (SQ)</b>                                                                          |                      |         | 0.868    | 0.854 | 0.593 |
| Employees served me food exactly as I ordered it.                                                    | 0.79                 | 20.28   |          |       |       |
| Employees provided prompt and quick service.                                                         | 0.78                 | 19.96   |          |       |       |
| Employees are always willing to help me.                                                             | 0.75                 | 18.83   |          |       |       |
| Employees made me feel comfortable in dealing with them.                                             | 0.76                 | 19.23   |          |       |       |
| <b>E-Service Quality (E-SQ)</b>                                                                      |                      |         | 0.910    | 0.911 | 0.632 |
| This QR menu is easy to connect and use.                                                             | 0.69                 | 17.35   |          |       |       |
| The information about the products is enough for me to make a purchase decision.                     | 0.81                 | 21.63   |          |       |       |
| This QR menu is visually appealing.                                                                  | 0.84                 | 22.78   |          |       |       |
| Information about products and payment methods in this QR menu is sufficient.                        | 0.82                 | 22.25   |          |       |       |
| The restaurant provides prompt service to their customers with the QR menu.                          | 0.80                 | 21.45   |          |       |       |
| This QR menu seems to be up to date.                                                                 | 0.80                 | 21.29   |          |       |       |
| <b>Perceived Risk (PR)</b>                                                                           |                      |         | 0.833    | 0.834 | 0.626 |
| I worry about my personal information being stolen when using a QR menu.                             | 0.76                 | 18.57   |          |       |       |
| I worry about safe transactions when using a QR menu.                                                | 0.76                 | 18.58   |          |       |       |
| I worry about how restaurants might use the personal information they obtain when I use the QR menu. | 0.85                 | 21.24   |          |       |       |

Table 2. Cont.

| Variables/Items                                                    | Standardized Loading | t-Value | $\alpha$ | CR    | AVE   |
|--------------------------------------------------------------------|----------------------|---------|----------|-------|-------|
| <b>Customer Satisfaction (CS)</b>                                  |                      |         | 0.888    | 0.887 | 0.723 |
| I am very satisfied with my overall experience at this restaurant. | 0.86                 | 23.49   |          |       |       |
| Overall, this restaurant puts me in a good mood.                   | 0.86                 | 23.45   |          |       |       |
| I have really enjoyed myself at this restaurant.                   | 0.83                 | 22.31   |          |       |       |

$p < 0.05$ ;  $\chi^2 = 416.27$ ;  $df = 159$ ;  $\chi^2/df = 2.62$ ; RMSEA = 0.056; NFI = 0.98; GFI = 0.92; CFI = 0.98.

When examining the overall goodness-of-fit (GOF) statistics, it is evident that the measurement model demonstrates good and acceptable fit. Subsequently, three indicators were assessed to test construct validity, namely standardized factor loadings, composite reliability (CR), and average variance extracted (AVE). Standardized factor loadings represent the relationship of each item with the factor, while composite reliability (CR) measures the reliability of the factor scale. The average variance extracted (AVE) indicates the proportion of the total variance explained by the factors. According to Hair et al. [109], the factor loading of each item should be 0.50 or above, and the composite reliability of each construct (latent variable) should be 0.70 or higher. Fornell and Larcker [110] further suggest that the AVE value of the constructs should exceed 0.50. As shown in the CFA results summarized in Table 2, the factor loadings of the items range from 0.69 to 0.86, the composite reliability values range from 0.83 to 0.91, and the AVE values range from 0.59 to 0.72. All of these values indicate that the factor structures demonstrate convergent validity, meaning the measurement is both valid and reliable. Convergent validity refers to the degree to which a measurement instrument accurately reflects the intended constructs and yields consistent results with similar instruments.

In order to establish discriminant validity in the measurement model, the square root of the AVE for each construct must be greater than the correlation between that construct and any other construct [110]. Discriminant validity refers to the ability of a measurement instrument to distinguish between different concepts. It demonstrates that a measurement tool reliably measures distinct concepts and does not overlap with other constructs. Table 3 presents the correlation coefficients and AVE square root values for the scales. As observed in the table, the square root of the AVE for each construct exceeds the correlation coefficients between constructs. Therefore, the measurement model achieves discriminant validity.

Table 3. Test of discriminant validity.

|                    | Mean  | S.D.  | 1        | 2        | 3         | 4      | 5     |
|--------------------|-------|-------|----------|----------|-----------|--------|-------|
| 1. TBSI            | 5.322 | 1.280 | 1        |          |           |        |       |
| 2. SQ              | 5.208 | 1.228 | 0.533 ** | 1        |           |        |       |
| 3. ESQ             | 5.494 | 1.174 | 0.558 ** | 0.655 ** | 1         |        |       |
| 4. CS              | 5.312 | 1.246 | 0.515 ** | 0.660 ** | 0.562 **  | 1      |       |
| 5. PR              | 3.894 | 1.776 | 0.019    | 0.023    | −0.205 ** | −0.063 | 1     |
| Square root of AVE |       |       | 0.808    | 0.770    | 0.795     | 0.850  | 0.791 |

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

#### 4.4. Structural Equation Model and Hypothesis Testing

After confirming the reliability and validity of the measurement model, the research hypotheses were examined using the structural equation model (SEM). As shown in Table 4,

the overall model fit indices indicate that the conceptual model demonstrates good and acceptable fit. According to the structural equation model results presented in the table, TBSI (technology-based service innovation) positively and significantly impacts e-service quality, service quality, and customer satisfaction, respectively. Additionally, the results reveal a significant and positive effect of e-service quality on service quality and of service quality on restaurant satisfaction. However, e-service quality does not have a statistically significant direct effect on restaurant satisfaction.

**Table 4.** Structural equation model results.

| Hypotheses | Path        | Standardized Factor Loadings | t-Value | Result        |
|------------|-------------|------------------------------|---------|---------------|
| H1         | TBSI → SQ   | 0.28                         | 5.40 *  | Supported     |
| H2         | TBSI → E-SQ | 0.62                         | 11.41 * | Supported     |
| H3         | TBSI → CS   | 0.14                         | 2.56 *  | Supported     |
| H4         | SQ → CS     | 0.63                         | 8.36 *  | Supported     |
| H5         | E-SQ → SQ   | 0.57                         | 9.61 *  | Supported     |
| H6         | E-SQ → CS   | 0.07                         | 1.04    | Not Supported |

\*  $p < 0.01$ .  $\chi^2/df = 334.06/112 = 2.98$ ; RMSEA = 0.061; NFI = 0.98; GFI = 0.93; CFI = 0.99; SRMR = 0.034.

Instead, the effect of e-service quality on restaurant satisfaction is indirect, mediated through service quality. In other words, e-service quality positively influences restaurant satisfaction via its impact on service quality. In this case, service quality acts as a mediator between e-service quality and restaurant satisfaction, demonstrating an indirect relationship.

#### 4.5. Moderating Effect Analysis

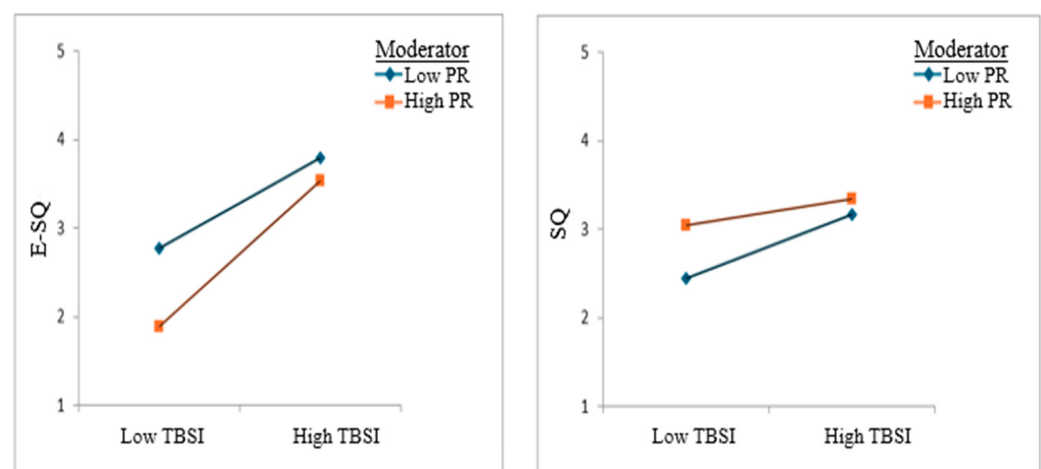
To test the moderating effect of perceived risk, which is another hypothesis of the study, Process Macro version 4.1 was employed. In this context, the moderated serial multiple mediation model, Model 85, was applied. The analysis results, conducted using a 95% confidence interval and 5000 bootstrap samples, are summarized in Table 5 below. As shown in the table, the interaction effect (TBSI  $\times$  PR) on e-service quality ( $\beta = 0.156$ ,  $p < 0.001$ ) and on service quality ( $\beta = -0.106$ ,  $p < 0.005$ ) was found to be statistically significant. However, the interaction effect on customer satisfaction was not statistically significant ( $\beta = -0.030$ ,  $p > 0.005$ ). This indicates that perceived risk has a moderating effect on the relationship between TBSI and both e-service quality and service quality. Therefore, hypotheses H7 and H8 are supported. However, perceived risk does not have a moderating effect on the relationship between TBSI and customer satisfaction, meaning that hypothesis H9 is not supported.

The interaction graph in Figure 2 is drawn to illustrate the direction and severity of the regulatory impact. In the figure, two different graphs show the interaction between technology-based service innovation (TBSI) and e-service quality (left graph) and overall service quality (right graph) in the context of QR menus. Both graphs include TBSI as the independent variable and risk perception (PR) as the moderating variable. As can be seen from the left graph, as the TBSI perception of participants with low and high risk perception increases, their perception of e-service quality also increases. However, this increase is much higher for participants with high risk perception. In other words, the impact of TBSI on e-service quality is higher for participants with high risk perception than for those with low risk perception. In other words, risk perception strengthens the effect of TBSI on e-service quality. The results suggest that customers with high risk perception may

have a more positive perception of e-service quality after experiencing the technology, thus feeling the benefits of technological innovations more strongly. In the right graph, a similar relationship is observed on overall service quality. However, this effect is not as strong as in e-service quality. For customers with low risk perception, the impact of TBSI on overall service quality is limited, whereas for customers with high risk perception, although an increase is observed, this effect is more moderate. This finding suggests that risk perception has a more significant moderating effect on the perception of digital service quality, while its contribution to overall service quality is more limited.

**Table 5.** The multiple moderating effect of perceived risk (Model 85).

| Variable                                                                                                               | $\beta$ | se    | t       | p     | LLCI   | ULCI   |
|------------------------------------------------------------------------------------------------------------------------|---------|-------|---------|-------|--------|--------|
| Constant                                                                                                               | 5.491   | 0.041 | 133.219 | 0.000 | 5.410  | 5.572  |
| TBSI                                                                                                                   | 0.666   | 0.041 | 16.139  | 0.000 | 0.585  | 0.748  |
| PR                                                                                                                     | −0.289  | 0.042 | −6.839  | 0.000 | −0.372 | −0.206 |
| TBSI $\times$ PR                                                                                                       | 0.156   | 0.039 | 4.006   | 0.000 | 0.079  | 0.232  |
| Dependent Variable: E-Service Quality. $R = 0.614$ ; $R^2 = 0.377$ ; $F = 101.847$ ; $p = 0.000$ ; $\Delta R^2 = 0.02$ |         |       |         |       |        |        |
| Constant                                                                                                               | 1.868   | 0.234 | 7.987   | 0.000 | 1.409  | 2.328  |
| TBSI                                                                                                                   | 0.249   | 0.048 | 5.189   | 0.000 | 0.155  | 0.343  |
| E-SQ                                                                                                                   | 0.608   | 0.042 | 14.478  | 0.000 | 0.526  | 0.691  |
| PR                                                                                                                     | 0.194   | 0.042 | 4.670   | 0.000 | 0.113  | 0.276  |
| TBSI $\times$ PR                                                                                                       | −0.106  | 0.037 | −2.855  | 0.004 | −0.179 | −0.033 |
| Dependent Variable: Service Quality. $R = 0.704$ ; $R^2 = 0.495$ ; $F = 123.355$ ; $p = 0.000$ ; $\Delta R^2 = 0.008$  |         |       |         |       |        |        |
| Constant                                                                                                               | 1.990   | 0.254 | 7.840   | 0.000 | 1.491  | 2.489  |
| TBSI                                                                                                                   | 0.229   | 0.050 | 4.544   | 0.000 | 0.130  | 0.328  |
| E-SQ                                                                                                                   | 0.157   | 0.051 | 3.078   | 0.002 | 0.057  | 0.258  |
| SQ                                                                                                                     | 0.472   | 0.046 | 10.356  | 0.000 | 0.382  | 0.562  |
| PR                                                                                                                     | −0.052  | 0.043 | −1.197  | 0.232 | −0.137 | 0.033  |
| TBSI $\times$ PR                                                                                                       | −0.030  | 0.038 | −0.773  | 0.440 | −0.105 | 0.046  |
| Dependent Variable: Customer Satisfaction. $R = 0.699$ ; $R^2 = 0.489$ ; $F = 95.909$ ; $p = 0.000$                    |         |       |         |       |        |        |



**Figure 2.** The moderating effect of perceived risk in the relationship between TBSI, E-SQ, and SQ. (TBSI: technology-based service innovation; E-SQ: e-service quality; SQ: service quality; PR: perceived risk).

In order to test the moderating effect of perceived risk, which is the other hypothesis of the study, the results of the analysis conducted with the Process Macro extension at a 95% confidence interval and using the 5000 bootstrap method are summarized in Table 5. Looking at the data in the table, it is determined that the effect of the interaction value (TBSI  $\times$  PR) on e-service quality is significant. On the other hand, the same interaction value does not have a significant effect on service quality and restaurant satisfaction.

In order to interpret the direction and severity of the moderating effect, an interaction graph was drawn. The graphs show how the moderating effect of the participants' risk perception changes. As can be seen from the graphs, as the TBSI perception of the participants with low and high risk perception increases, the perception of e-service quality also increases. However, this increase is much higher for participants with high risk perception. In other words, the effect of TBSI on e-service quality is stronger for participants with high risk perception. To summarize, the effect of TBSI on e-service quality is stronger for participants with high risk perception than for those with low risk perception.

## 5. Discussion

This study aimed to investigate the impact of QR menus, a technology-based service innovation applied in restaurants, on service/e-service quality and customer satisfaction, as well as the moderating role of perceived risk in the effect of QR menus on service/e-service quality and customer satisfaction using a structural equation model. The number of studies in the literature examining the effect of QR menus on service/e-service quality and customer satisfaction is quite limited. The analysis results revealed that QR menus have a significant positive impact on both service and e-service quality, as well as on customer satisfaction.

QR menus shorten waiting times by allowing customers to browse the menu and place orders without waiting for a server. Additionally, they provide access to detailed information and visuals that may not be feasible in traditional printed menus, influencing the customer's decision-making process and facilitating their choices. For these reasons, QR menus enhance perceived service/e-service quality and customer satisfaction. The use of such technological applications that generate customer satisfaction as part of the service process in restaurant businesses may be beneficial for fostering customer loyalty and gaining a competitive advantage.

When analyzing the other hypotheses of the study regarding the effect of service and e-service quality on customer satisfaction, it was found that while service quality directly affects customer satisfaction, e-service quality impacts customer satisfaction indirectly through service quality. The significant and positive effect of service quality on customer satisfaction has also been confirmed in previous studies. This finding is consistent with other studies in the literature [111–114].

There is no significant positive effect of e-service quality on customer satisfaction. This finding contradicts other studies in the literature [115] online shopping experience [116]; e-service quality and waiting time have a positive and significant effect on customer satisfaction [117]. However, these studies are mostly studies on the use of websites. Studies that investigate the use of human service and technology together support the research results [118,119].

The effect of e-service quality on customer satisfaction is not direct but occurs through service quality. Several factors may contribute to this situation. First and foremost, restaurant businesses are an integral part of the service industry, and people do not visit restaurants solely to eat. Ambiance, quick and personalized services, and hedonic pleasure are also significant reasons for visits [120]. People want to feel valued, receive attention, and be warmly welcomed [121]. While technology offers operational benefits like speed,

convenience, and consistency, which are important to customers, it cannot replace the sense of trust or empathy provided by service staff [122]. The emotional connection that service staff establish with customers, along with their ability to anticipate and meet customer expectations, leads to greater customer satisfaction and enhances the overall quality of the experience [123]. A smile, eye contact, or a polite greeting can lead to positive emotions in customers and increase their loyalty to the business [124]. For instance, research conducted by Choi et al. [118], which compared perceptions of service quality between human workers, service robots, and a combination of human and robot services, found that human workers were preferred and performed better in both interaction quality and the physical service environment dimensions. Similarly, a study by Ariffin and Maghzi [119] indicated that close interaction between hotel guests and human staff significantly influenced customer satisfaction. Therefore, it is considered normal that in the service sector, the human factor has a greater impact on service quality, particularly for customers who have a need for social interaction or place importance on interpersonal relationships, potentially overshadowing e-service quality. It is important to remember that inappropriate and rude behavior by service staff can also lead to a negative experience [124].

Additionally, users above a certain age who are not as familiar with technology may have different attitudes toward technological services. Beyond age, the degree of technology adoption could also have contributed to the secondary importance of e-service quality perceptions. Although customers may view technology-based service applications as a positive development for businesses, their primary preference may still be to receive service from staff. It is also important to note that QR menus mainly influence the ordering process in a restaurant. The experiences encountered during this process significantly affect customer satisfaction. However, when the customer evaluates the overall service from a restaurant, they consider the entire experience, including the physical environment, food quality, price, and the holistic service received. The final assessment of the overall service quality has a stronger influence than process service quality [125].

This study also examined the moderating effect of perceived risk on the relationship between technology-based service innovation applications and service/e-service quality and customer satisfaction. The findings revealed that perceived risk has a significant impact on e-service quality, whereas it does not have a significant effect on service quality or restaurant satisfaction. The perceived risk scale used in this study was designed to measure the technological risks customers might face when using a technological service (e.g., access to personal information, security vulnerabilities of mobile devices, misuse of personal information by malicious third parties). Therefore, it is expected that perceived risk would have a significant effect on e-service quality.

However, the idea that the technological risks perceived when using QR menus do not affect overall service quality and satisfaction may stem from the fact that these risks are not viewed as highly significant by the customers. Today, nearly every application we access via mobile devices carries such risks. In a world where we are inevitably compelled to share our personal information or use these applications, such risks may be considered tolerable and not the most crucial factor influencing overall service quality and satisfaction. Consequently, the impact of QR menus on e-service quality is stronger among participants with a high perception of risk.

## 6. Conclusions

Restaurant businesses, a crucial component of the service sector and the hospitality industry, are increasingly prioritizing technological investments. Beyond enhancing operational efficiency and reducing staff needs, these technologies provide significant competitive advantages by shortening service delivery times, allowing easy access to detailed

information, facilitating payment processes, and enabling service personalization. QR menus have become much more widely used in businesses after the pandemic. However, it is unrealistic to expect that QR menus, which are now present in nearly every business with similar features, can substantially improve service quality or create a competitive advantage on their own.

The findings of this study contribute to the academic field by emphasizing the importance of human-delivered service in labor-intensive businesses like restaurants, alongside offering technological conveniences. The results show that e-service quality affects customer satisfaction indirectly through overall service quality. In other words, technological service quality alone does not have a direct effect on customer satisfaction. This outcome provides several managerial insights. For instance, while technological innovations like QR menus enhance operational efficiency and improve customer experience, restaurant managers should recognize that human interaction remains a vital component in fostering customer satisfaction and loyalty. Therefore, a balanced integration of technology and personalized human service is essential for gaining a sustainable competitive advantage.

Restaurant businesses should invest in technological innovations to attract customers with high technological literacy and interest in technology. Especially today, with the rise in individualism and increased time spent with technological devices, some individuals have developed a preference for minimal human interaction or even entirely self-service experiences. This customer segment should not be overlooked, and technological advancements should be continued to enhance both operational efficiency and cater to this tech-savvy customer group.

At the same time, for those who value human service and are hesitant to use technological devices or seek more interpersonal communication in social settings, improving the quality of human-delivered service can create a competitive advantage. Beyond simply meeting physical needs, restaurants are also spaces for social interaction. Therefore, while technology can provide convenience and speed in accessing certain services, communication with service staff remains crucial. It is well known that some individuals prefer face-to-face interaction to feel more special. A waiter's attention, wine recommendations, personalized touches to the offered products, or a small gesture from the staff can significantly enhance customer satisfaction. Moreover, technological applications can also serve as tools for service staff to improve their skills. By integrating technology with personalized service, restaurants can meet diverse customer preferences, enhance service quality, and ultimately achieve a balance that satisfies both tech-oriented and socially inclined customers.

One of the topics examined in this study is the effect of perceived risk on service/e-service quality and customer satisfaction. While perceived risk during the use of QR menus does not have a significant impact on service quality and customer satisfaction, it does have an effect on e-service quality. Those who perceive a higher level of risk experience a stronger impact on e-service quality. Therefore, it is important for restaurants to present technological applications like QR menus in a way that does not create trust issues for customers and clearly communicates the necessary precautions taken by the business. For example, some restaurants require customers to sign up for membership before using QR menus to personalize the service. However, this may be seen as time-consuming or inconvenient to some customers. In such cases, offering additional promotions, discounts, or other incentives could encourage greater participation. Alternatively, customers could be allowed to view the menu without requiring personal information. These approaches could help win over customers who have a high perception of risk, ultimately creating a competitive advantage for the business in the long term. It is thought that the business will be more successful if technological applications that increase the ease perceived by

the customer with a user-friendly interface are supported by a friendly welcome and warm communication.

This study is thought to contribute to the field in theoretical terms. Although there are sectors such as the banking sector where technological applications are widely accepted by customers, restaurant businesses are not yet within this scope. Many food and beverage businesses continue their service processes hybrid or only through their employees. For this reason, research on customer satisfaction, service quality, or technology acceptance proceeds with different theoretical foundations. It is not possible to talk about the existence of a single dominant theory in the field. In this study, it is predicted that the theoretical research to be conducted in the future will contribute to the clarification of the theoretical foundations of the subject and to reveal the dominant theories.

The main limitations of this study and suggestions for future research are outlined below. The first limitation of this study lies in the data collection, which was conducted from three full-service casual dining restaurants located in Antalya. This restricts the generalizability of the findings to other regions, cultures, or different types of restaurants. Future research could expand the geographic scope and include various types of restaurants, such as fast food, fine dining, and ethnic restaurants, to provide a more comprehensive analysis. Secondly, this study specifically focused on the effects of QR menus. The impacts of other technological innovations, such as robots, AI-supported systems, and self-order kiosks, were not examined. Future studies could explore the comparative effects of these technologies on service quality and customer satisfaction. A third limitation is that perceived risk was measured only in the context of QR menu usage. Other risk dimensions, such as data privacy or payment security, were not considered. Future research could investigate the effects of these factors on technology acceptance and customer satisfaction. Lastly, it is important to note that the sample of this study consists of restaurant customers. Customer–employee interaction in restaurant services can be intense and influential. Therefore, conducting similar studies from a different perspective, focusing on restaurant employees, would be important. Understanding both customer and employee experiences would provide a more comprehensive insight into the dynamics of service quality and customer satisfaction.

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