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Original Article

Digital skill level and perceived quality in the use of food delivery apps

Nível de habilidade digital e a qualidade percebida no uso dos aplicativos de delivery de comida

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ABSTRACT

Porpuse: The objective of this research is to examine the relationship between digital skills and satisfaction in the use of food delivery apps, when mediated by perceived quality. This quality is influenced by high demand and, consequently, by complaints and dissatisfaction with the use of these apps during the global crisis of the Covid-19 pandemic.
Design/method/approach: A structural model was developed and empirically tested, based on digital skills and satisfaction with food delivery apps, mediated by quality, using data collected from 170 Brazilians between January and February 2023.
Findings: The results showed that respondents only demonstrate satisfaction with food delivery apps if they perceive the quality of the apps, and for this to happen, the user must have digital skills. In other words, there is no satisfaction without perceived quality, and for quality to be perceived, digital skills are necessary.
Originality/value: A first and second-order model encompassing digital skill level, perceived quality, and satisfaction can offer significant contributions to the literature. This is particularly true when considering digital skill level as a second-order construct, which can be reflective-formative or reflective-reflective. This construct is composed of dimensions such as platform navigation, functional use, creative skills, online problem-solving, social media engagement, and operational aspects. This approach enables a more comprehensive and accurate representation of the concept, overcoming the common limitation in the literature that often treats it as a one-dimensional construct. From a practical standpoint, this model provides valuable insights for organizations, digital platforms, educational institutions, and governmental bodies that need to adapt their services to audiences with varying levels of digital literacy. Furthermore, it deepens the understanding of user experience by demonstrating that perceived quality and satisfaction do not solely depend on product or service characteristics, but also on the individual's digital competencies.

Keywords: Perceived quality; Digital skills; Food delivery apps; Satisfaction; Technology

RESUMO

Objetivo: Esta pesquisa objetiva examinar a relação entre habilidade digital e satisfação no uso dos aplicativos de *delivery* de comida, quando mediada pela qualidade percebida. Esta qualidade é influenciada pela alta demanda e, por conseguinte, pelas reclamações e insatisfação com o uso desses aplicativos, na época da crise global da pandemia da Covid-19.
Design/metodologia/abordagem: Foi elaborado e testado empiricamente um modelo estrutural baseado na habilidade digital e na satisfação com os aplicativos de *delivery* de comida, mediada pela qualidade com a utilização de dados coletados de 170 brasileiros, entre janeiro e fevereiro de 2023.
Resultados: Os resultados evidenciaram que os respondentes só demonstram satisfação com os aplicativos de *delivery* de comida se perceberem a qualidade dos mesmos e que, para que isso aconteça, é necessário que o usuário possua habilidade digital, ou seja, não há satisfação sem qualidade percebida e que, para que se perceba a qualidade, é preciso que se tenha habilidade digital.
Originalidade/valor: Um modelo de primeira e segunda ordem que envolva o nível de habilidade digital, a qualidade percebida e a satisfação podem trazer contribuições relevantes para a literatura, especialmente ao considerar o nível de habilidade digital como um construto de segunda ordem, reflexivo-formativo ou reflexivo-reflexivo, composto por dimensões como a navegação em plataformas, uso funcional, habilidades criativas, resolução de problemas online, engajamento em redes sociais e aspectos operacionais. Essa abordagem permite uma representação mais abrangente e fiel do conceito, superando a limitação comum na literatura que frequentemente o trata de forma unidimensional. Do ponto de vista prático, esse modelo oferece subsídios valiosos para organizações, plataformas digitais, instituições de ensino e órgãos governamentais que precisam adaptar seus serviços a públicos com diferentes níveis de alfabetização digital. Além disso, aprofunda a compreensão da experiência do usuário ao demonstrar que a percepção de qualidade e a satisfação não dependem exclusivamente das características do produto ou serviço, mas também das competências digitais do indivíduo.

Palavras-chaves: Qualidade percebida; Habilidade digital; Aplicativos de *delivery* de comida; Satisfação; Tecnologia

1 INTRODUCTION

E-commerce became widespread with the development of the internet. Currently, retail is characterized by the extensive use of high connectivity and contactless technologies, such as QR codes and mobile technologies (Pantano & Priporas, 2016). Many customers are attracted to online retail because online stores offer a variety of services and products tailored to their preferences, as well as convenience, 24-hour availability, flexible prices, discounts, and free delivery (Kumar et al., 2021).

Notably, technological consumption has been growing worldwide, reflecting an increase in both internet usage and the use of smartphones for various operations

(Baabdullah et al., 2019; Mshana et al., 2022). Another factor driving this increase was the Covid-19 pandemic, declared a global health emergency by the World Health Organization (WHO) in March 2020. This event led to a state of public health calamity (Walls et al., 2020), and with the imposition of social distancing, new consumption models, particularly digital consumption, were boosted (Da Silva Terres et al., 2020).

With the increasing popularity of tablets and smartphones in recent years, a wide variety of applications has been developed to meet the growing demands of users, who have become more demanding. Advances in mobile devices have made their associated apps essential for daily life (Huang, Lin, Fan, 2015). Companies are increasingly betting on internet services due to their greater interactivity and convenience (Park and Baek, 2007). Moreover, an online presence offers reduced costs and allows a higher level of customization and personalization for the end customer (Park and Baek, 2007). In recent years, the online food delivery sector has seen significant growth worldwide. The sector's revenues have increased from US$ 76,193 million in 2017 to US$ 122,739 million in 2020, representing an average annual growth of 17.2%, and are expected to reach US$ 164,002 million by 2025 (Statista, 2020). Additionally, during the COVID-19 lockdown, more online delivery providers have emerged, and more restaurants have adopted the delivery format (Dishman, 2020). Even restaurants that sell their products exclusively through delivery have appeared, a practice that offers opportunities for new entrants with low fixed costs. Thus, this activity has become relevant both for established companies and new businesses.

During the pandemic, the use of mobile devices increased dramatically and was widely adopted. According to a report by the Global Association of Mobile Operators, global mobile phone users exceeded 5.1 billion in 2020, with more than 1.2 billion users in China alone (GSMA, 2020). In Brazil, the trend was similar, with the country leading Latin America in mobile device usage, followed by Mexico, Colombia, and Chile. The number of Brazilians who access the internet solely through mobile devices reached 77.9 million; those accessing via desktop devices alone numbered 14.5 million, and those using both types of devices comprised 34.1 million users (Comscore, 2021).

The pandemic caused lockdowns and the closure of establishments, leading to a significant increase in demand for online food delivery services, which deliver food and drinks directly to customers' homes (NPD, 2020). Food delivery services refer to systems for ordering and delivering food based on internet communication, connecting customers to partner restaurants through websites or mobile applications (Ray et al., 2019).

Comparing the periods between March 2019 and March 2020, there was a 16% increase in the use of food delivery apps (STATISTA, 2022). This surge in usage has prompted many scholars to research the growth of online platforms for purchasing food (Habib et al., 2022; Sharma et al., 2021; Wen et al., 2022).

Despite the significant increase in the use of the internet and mobile devices, access to these technologies is far from universal. While more than 90% of individuals in classes A and B are internet users, in classes D and E, this number drops to only 42% (Ipea, 2021). The Brazilian Institute of Geography and Statistics (IBGE, 2022) divides social classes into five basic categories based on monthly family income: Class A (above 20 minimum wages), Class B (10 to 20 minimum wages), Class C (4 to 10 minimum wages), Class D (2 to 4 minimum wages), and Class E (up to 2 minimum wages).

Alongside the growth in Brazilian demand, there has also been a rise in complaints regarding these services. From March 2020 to July 2020, complaints about iFood services increased from 13.7 thousand to 18.6 thousand, a rise of 35.8%. Complaints about Rappi services jumped from 5.6 thousand to 7.4 thousand, an increase of 26.1% (Reclame Aqui, 2021). One of the major current challenges for marketing professionals in these services in Brazil is managing service quality and ensuring customer satisfaction in e-commerce (Hung et al., 2003).

Previous studies have identified a positive association between customer perceptions of service quality and customer satisfaction. It has also been concluded that ensuring service quality leads to higher levels of customer satisfaction (Taylor

& Baker, 1994). Customer satisfaction is influenced by perceived value, and loyalty is affected by satisfaction (Kim et al., 2013).

To ensure superior service quality, managers of companies with an online presence must initially understand how consumers perceive and evaluate the quality of the service on the internet (Parasuraman, Zeithaml, and Malhotra, 2005). Service quality is a crucial factor for the sustainable success of a company, and providing excellent service is essential for gaining a competitive advantage (Caro and Garcia, 2007).

What remains unclear is whether the level of experience with mobile devices can influence perceived quality and, hence, satisfaction. However, empirical studies on differences in the levels of digital skills among internet users have highlighted the role of socioeconomic, generational, geographic, and gender inequalities (Scheerder, Van Deursen, & Van Dijk, 2017).

Research on online food delivery providers is still limited and recent in marketing literature. Studies have focused on various aspects, such as consumer attitudes towards these services (Cho, Bonn & Li, 2019; Yeo, Goh & Rezaei, 2017), intentions to use (Alagoz & Hekimoglu, 2012; Okumus, Ali, Bilgihan & Ozturk, 2018; Yeo et al., 2017), adoption of online delivery platforms (Okumus & Bilgihan, 2014), and the final action of placing an online order (Kapoor & Vij, 2018). These investigations primarily focus on the pre-consumption phase.

Despite the growing popularity and widespread adoption of food delivery applications in the food industry, there remains a significant gap in the literature regarding the technological factors that influence perceived quality and, in turn, customer satisfaction—particularly among the Brazilian population. Existing studies have addressed various aspects of food delivery apps (Pigatto et al., 2017; Maimaiti et al., 2018; Francioni et al., 2022; Roh & Park, 2019; Pal et al., 2021; Gani et al., 2023; Trivedi et al., 2023).

However, few investigations have specifically examined the technological factors and marketing strategies that influence the acceptance and satisfaction with

food delivery apps among Brazilian users. Furthermore, although some research has explored the impact of these apps on customers' perceived quality and brand satisfaction, it is still necessary to identify which technological skills effectively contribute to enhancing consumers' perceived quality and satisfaction.

Therefore, this study proposes such an approach, as there is evidence that digital skill influences perceived quality and, consequently, satisfaction with the use of food delivery apps. It employs a second-order model involving these constructs, as this approach allows for a more comprehensive and accurate representation of the concept—overcoming the common limitation in the literature that often treats it as unidimensional—and thus contributes to a deeper understanding of the relationships between digital skills, perceived quality, and consumer satisfaction.

2 THEORETICAL FRAMEWORK AND HYPOTHESES

2.1 Food delivery apps

Food delivery applications integrated into people's daily lives have facilitated connections between service providers and customers through their platforms (Ray et al., 2019). When a customer places an order via the application at a restaurant or other establishment, the company promptly receives the order, prepares it, and delivers it through a delivery person-typically a motorcycle courier-to the customer's desired location (Hong et al., 2021).

Since the onset of the Covid-19 pandemic, food delivery services have gained prominence as they facilitate necessary social distancing measures (Maida, 2020). Therefore, using food delivery apps has become a preferred method to maintain social distancing, providing a safer alternative to in-person transactions (Botelho et al., 2020).

Mobile food ordering applications can be defined as smartphone programs that users install and use as a practical and innovative means to access restaurants,

browse menus, place orders, and make payments—all without the need for face-to-face interaction with restaurant staff (Okumus et al., 2014; Alalwan, 2020).

Through these apps, consumers can place their orders efficiently and conveniently, choosing from a variety of available restaurants at times and locations that suit them. Additionally, these apps provide detailed, up-to-date, and accurate information about the restaurants and their menus. Users also have the ability to track the progress of their orders throughout all stages of the process (Aksenova et al., 2017).

In Brazil, food delivery applications operate through digital platforms that connect consumers, restaurants, and delivery personnel. These services offer convenience and speed, enabling users to order meals from different establishments using their smartphones or computers. The main delivery apps in the country include iFood, Rappi, Uber Eats, and Zé Delivery, each operating under distinct business models.

According to a survey conducted by the Brazilian Association of Bars and Restaurants (ABRASEL), in partnership with the Brazilian Service of Support for Micro and Small Enterprises (Sebrae), orders placed through delivery apps account for approximately 33% of the total revenue of bars and restaurants in Brazil. This percentage positions the country as the global leader in delivery's share of sector sales (ABRASEL, 2025).

The factors influencing customer satisfaction in online environments differ from those in physical establishments (Botelho et al., 2020). Furthermore, satisfaction with the application can drive greater engagement with the provider and foster increased customer loyalty (Zeithaml, 1996).

2.2 Digital skill level, perceived quality and satisfaction

Digital technologies have transformed the way companies operate, how individuals interact, and the functioning of societies. These technologies offer unprecedented opportunities for accessing, producing, and disseminating information, as we now live in a reality where the entire economy is centered on the internet (Neto et al., 2019). We

find ourselves in an environment characterized by the intensive use of Information and Communication Technologies (ICT) and a digitalized economy (Van Laar et al., 2017). As technological resources advance, challenges arise regarding their various uses. Whether using a desktop interface or handling mobile devices, users must possess at least the minimum capacity to keep up with such advances (Immonen & Sintonen, 2015).

Information and Communication Technologies (ICTs) have been identified as crucial tools for achieving development objectives, such as reducing social inequalities and improving individuals' quality of life (Dameir, 2016; Han & Hawken, 2018). ICTs provide access to important information, creating opportunities in education and employability, and promoting citizen involvement and participation in the economy (Han & Hawken, 2018).

However, ICTs are not available to everyone, which exacerbates social inequalities (Han & Hawken, 2018). Scholars have identified inequalities not only in access to these technologies but also in the ability to use them and produce meaningful results, thus generating the "digital divide" (Lythreatis, Kumar Singh, & El-Kassar, 2022).

Currently, about 33% of the world's population—equivalent to approximately 2.6 billion people—still live without internet access, according to 2023 data from the International Telecommunication Union (ITU, 2025). In Brazil, around 12% of the population aged 10 years or older live without internet access, which corresponds to approximately 22.4 million people (IBGE, 2025). These figures highlight the persistence of a digital divide, especially among vulnerable populations such as the elderly, people with low education levels, and residents in rural areas, underscoring the need for public policies aimed at digital inclusion in Brazil.

Studies show that digital skills mastery and internet use are unevenly distributed among users. In Brazil, there is a significant inequality in internet access across different social classes, revealing that individuals in higher social classes are more accustomed to internet use, while those in lower classes face greater barriers to connectivity. According to data from the 2020 TIC Domicílios survey

conducted by CETIC.br, internet access varies considerably by social class. While 100% of households in classes A and B have internet access, this rate drops to 64% among households in classes D and E (CETIC, 2025).

Digital skills in the context of Information and Communication Technologies (ICTs) consist of six fundamental dimensions: information and data, communication and collaboration, digital content creation, digital security, problem-solving, and operational use of ICTs (DigComp 2.2, 2025; UNESCO's Digital Literacy Global Framework, 2025; ICDL, 2025). This is a multidimensional construct encompassing a diverse set of competencies required for individuals to interact effectively, critically, and safely with digital technologies. Several international and academic institutions, such as UNESCO, the European Commission (via DigComp), and the OECD, propose established frameworks to systematize and assess these competencies (ICDL, 2025).

Despite the popularity of ICTs, there is little consensus among scholars on the definition of their quality (DeSarbo et al., 1994). The most important works on the topic address the definition from the customers' perspective (Grönroos, 1990; Johnson & Fornell, 1991). Customers generally evaluate the performance of a service or product by analyzing its main attributes. Thus, quality is conformity to customer specifications, and what counts is what customers perceive as quality (Oliver, 1997).

Quality is understood as the current perception that the customer has about the performance of the service or product (Johnson & Fornell, 1991). It must be seen as an intrinsic potential of the attributes of services or products that provide satisfaction to those who use or purchase them. Therefore, perceived quality depends on the utility function in relation to the level of quality or performance provided to the customer (Anderson & Fornell, 1994).

Perceived quality is a widely explored construct in the literature on marketing, consumer behavior, and information systems, often treated as a multidimensional concept whose composition varies depending on the application context, such as

products, services, digital platforms, websites, or experiences. The dimensions that make up this construct differ according to its purpose and usage environment. Among the main focuses are the perceived quality of physical products (Zeithaml, 1988; Garvin, 1987), perceived service quality (Parasuraman, Zeithaml, and Berry, 1988), perceived quality of websites and digital platforms (Aladwani & Palvia, 2002; Wixom & Todd, 2005; Parasuraman et al., 2005 – E-S-QUAL), and more recently, perceived quality in mobile applications (Kim et al., 2013).

Perceived quality is widely recognized as an antecedent of customer satisfaction. In other words, the higher the perceived quality of a product or service, the greater the level of satisfaction experienced by the consumer tends to be. This causal relationship is supported by several well-established theoretical models, such as SERVQUAL, the expectation disconfirmation model (Oliver, 1980), and loyalty models proposed by Cronin and Taylor (1992).

Satisfaction is a construct that depends on the value function, defined by the relationship between the benefits received by the customer compared to the costs and sacrifices necessary to obtain them. Satisfaction can also be defined as the ratio between perceived quality and price (Anderson & Fornell, 1994). It is considered an indicator of success for companies, as it increases the behavioral intention to use the services or purchase the products offered (Annaraud & Berezina, 2020). Satisfaction has been the focus of studies related to consumer behavior in both offline and online environments (Al Amin et al., 2020b; Alalwan, 2020a; Annaraud & Berezina, 2020; Fida et al., 2020).

Satisfaction is related to the consumer's performance and expectations when making a purchasing decision and can be understood as the customer's evaluation of the results of the services they expected (Mpwanya, 2022). Satisfaction and expectations are related; once the customer becomes satisfied, they begin to consider purchasing and using the same provider again (Groß, 2018).

Ensuring service quality will lead to an increase in customer satisfaction levels, as there is a positive association between customers' perceptions of service quality and customer satisfaction (Taylor & Baker, 1994). Satisfaction is generally influenced by three factors: product quality, service quality, and price, with overall satisfaction being a function of multiple transactions (Parasuraman et al., 1994).

Several researchers have noted a positive association between customer perceptions of service quality and customer satisfaction, concluding that ensuring service quality will lead to an increase in the level of customer satisfaction (Taylor & Baker, 1994). Satisfaction is generally influenced by three factors: product quality, service quality, and price, with overall satisfaction being a function of several transactions (Parasuraman et al., 1994).

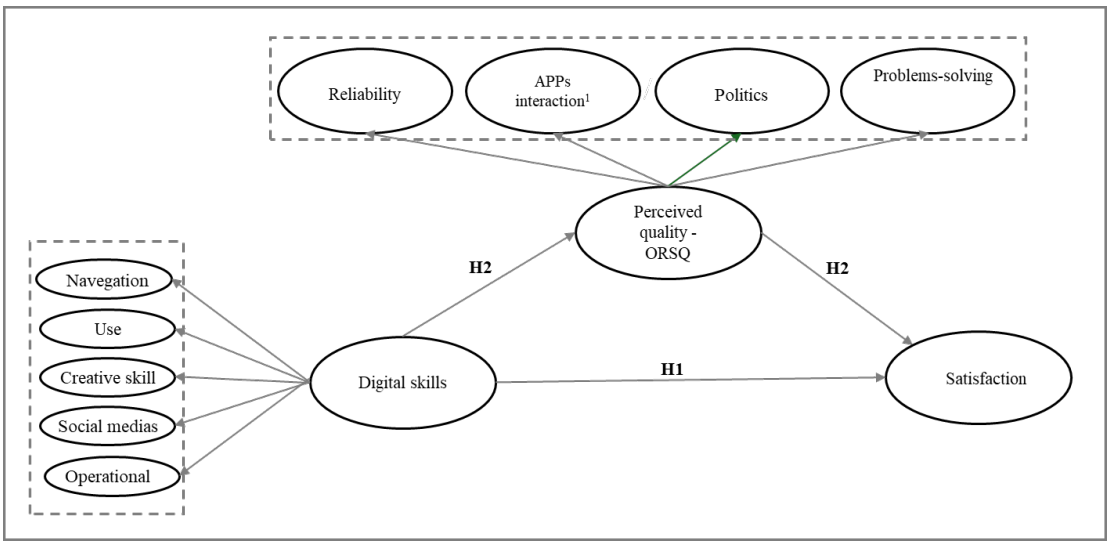
According to the Technology Acceptance Model (TAM), ease of use is determined by the degree to which users believe a given system is easy to use (Davis, 1989). Ease of use directly affects user satisfaction, as it generates positive sensations and feelings regarding the use of technology; the more practical and easier it is, the more satisfied the user will be (Venkatesh & Davis, 1996). Given the above, we propose the hypotheses of this study.

H1: There is a positive relationship between the level of digital skills and customer satisfaction with food delivery apps.

H2: The perceived quality of services in food delivery apps mediates the relationship between the level of digital skills and customer satisfaction, as proposed in hypothesis **H1**.

Based on the theory and hypotheses presented, the second-order research model is proposed, as shown in Figure 1.

Figure 1 – Research Conceptual Model



Source: the authors

3 METHOD

3.1 Sample and data collection

The method directing the empirical phase of this article comprises two phases: The first phase involved bibliographical research, surveying current literature on the topic (Creswell, 2010). The second phase was synthesized into hypotheses (Cooper & Schindler, 2016) and investigated cross-sectionally, as the data were collected within a specific period and statistically analyzed (Hair et al., 2005).

Data collection was carried out using the survey method, which acquires information via questionnaires distributed to a convenience sample (Edmonds & Kennedy, 2017). This type of research employs direct questions to individuals related to the target audience and based on quantitative analysis, obtains results from the collected data (Gil, 2018).

A sample is a part of the whole, a portion of the universe that represents the population selected for the research application. When well-calculated and coherent, samples provide accurate information for administrative decisions (Hair et al., 2005). In

this research, the sample of food delivery app users was obtained from January to March 2023, and after applying exclusion criteria, a final sample of 170 respondents was achieved.

The following procedures were used to reach the final sample: (i) exclusion of respondents who did not complete the survey; (ii) exclusion of respondents who are not users of food delivery apps; (iii) exclusion of respondents who work in food delivery app companies; (iv) exclusion of respondents who work in marketing research; (v) exclusion of respondents under the age of 18. Among the respondents, 98% use the iFood app, with most using online food delivery services regularly, and 67% using the apps up to three times a week. Regarding demographics, 70% of respondents are women, 38.2% are between 25 and 35 years old, 52.4% are married, 38.2% have higher education, and 72.35% have a monthly family income of R$ 12,120.01 to R$ 24,240.01 or more.

Women make up a slightly larger share of iFood's active user base and, overall, show higher frequency in using delivery apps, especially in major urban centers. This behavior suggests that women are more inclined to use online services as a way to streamline their household and food routines, which includes, among other practices, the use of meal delivery platforms (Opinion Box and Kantar, 2025).

The research was conducted exclusively in Brazil, given that it leads the region in number of users, order volume, and revenue compared to other Latin American countries. In Brazil, iFood stands out as the undisputed leader, holding over 80% market share, operating in more than 1,700 Brazilian cities, and recording more than 60 million monthly orders between 2023 and 2024. These figures support the findings mentioned above. Conversely, outside Brazil, the Rappi platform holds the leading position in most Latin American countries.

The sample size was calculated using the G-Power 3.1 software, which calculates a priori the number of responses needed to analyze the test (Ringle et al., 2014). Following the guidance of Hair et al. (2019), the number of predictors, effect size of 0.15, error probability of 5%, and statistical power of 80% were considered. The f^2 value was used to calculate the number of participants needed to detect the effect

with a certain level of confidence (statistical power). In this case, the chosen $f^2 = 0.15$ indicates the expected effect size. The result showed a critical F of 2.32, as shown in Table 1, indicating that the minimum sample size should be 92 valid responses.

Although some studies omit this information, the present study considers it valuable, since the sample used was larger than the previously calculated required size. A post hoc test was performed using the same parameters for the calculation after data collection, based on the total number of valid responses (Cohen, 2013). For the post hoc test, a sample of 170 respondents was used, with an effect size $f^2 = .15$ and number of predictors = 5, resulting in a critical F of 2.26 and a test power (1−β err prob) = .98. It can be observed that the statistical power increased from 80% to 98% (Table 1). Therefore, the sample size achieved can be considered adequate.

Table 1 – Sample calculation

Premises	A priori	Post Hoc
Effect Size (f^2)	.15	.15
Significance Level (α)	.05	.05
Statistical Power (1 – β err prob)	.8	.98
F Critical	2.32	2.26
Number of Predictors	5	5
Sample size	92	170

Source: data extracted from G-Power 3.1 software by the authors (2023)

3.2 Measures

This research was conducted with users of food delivery applications through a survey, using scales that had been previously tested and validated in earlier studies. The scales to measure the quality of the food delivery service were of the five-point Likert type, anchored by 1 (totally disagree) and 5 (totally agree) (Weijters et al., 2010). The reliability of these scales exceeded the recommended alpha cutoff of .70 (Hair et al., 2013).

In the questionnaire, respondents were asked to name their most frequently used application and to answer the subsequent questions based on this application. All food delivery applications available in the Brazilian market were analyzed to ensure greater data variability and generalization of results.

To evaluate service satisfaction, only consumers who met the following exclusion criteria were considered: (i) active users of food delivery applications; (ii) not employed by food delivery App companies; (iii) not involved in marketing research; and (iv) aged 18 and above.

The questionnaire was administered online using the QuestionPro platform and distributed via LinkedIn, Facebook, Instagram, and WhatsApp, with an access link to ensure anonymity and adherence to the code of conduct. This approach aimed at addressing the research question, as well as the general and specific objectives of this study.

A pre-test was conducted to ensure the clarity and accuracy of the questions and responses, thereby eliminating potential issues in execution, semantic analysis, and correcting any deficiencies in the research instrument (Marconi & Lakatos, 2003). This pre-test was administered to a restricted audience of 30 people to ensure the quality of the questionnaire and future results. The pre-test also aimed to evaluate the average time required to complete the responses and to test the research's semantics to understand any difficulties encountered by the respondents (Marconi & Lakatos, 2003). This pre-test was randomly conducted prior to the main study with a limited audience of 30 individuals, including researchers, professors, and marketing students, using the QuestionPro platform to ensure the quality of the questionnaire and future results.

The theoretical model was validated through the development and use of the collection instrument, which measured the following constructs: Digital Skill Level, Perceived Quality (ORSQ), and Customer Satisfaction. The scales, originally in English, were translated by two experts and then back translated from Portuguese

to English to validate the initial translation. This process, known as back-to-back translation (Jr & Federal, 2016), ensured semantic accuracy. The scales were adapted to the context of food delivery applications (Cha et al., 2007).

To measure the perceived quality construct, the ORSQ - Online Retail Service Quality scale was used, adapted from the combination of RSQ - Retail Service Quality (Dabholkar et al., 1996) and the TAM model – Technology Acceptance Model (Davis et al., 1989), as presented in Panda et al. (2021). To measure the satisfaction construct, the scale adapted from Panda et al. (2017) was used. To measure the digital skill level construct, the scale adapted from Van Deursen et al. (2015) was used.

The questionnaire followed this structure: the first stage included exclusionary questions. The second stage addressed questions about the perceived quality of food delivery applications, followed by questions about satisfaction. Finally, questions about digital skills were presented. The last stage of the questionnaire included demographic questions (gender, age, marital status, family income, and education) to analyze the profile of food delivery app users.

3.2 Data Analysis

In addition to the descriptive analysis of the data, statistical assumptions must be verified before conducting statistical tests. As regression models are used in this work, the assumptions of multicollinearity, homoscedasticity, and normality were checked (Hair et al., 2014).

The Variance Inflation Factor (VIF) is used to check for multicollinearity between the variables. A VIF limit of 10 is suggested, with values lower than 5 being considered ideal (Hair et al., 2014). In this research, all variable values are below 5, indicating that the criterion was met. SmartPLS 4 software was used for verification.

To check the assumption of normality, the Shapiro-Wilk test was employed. Samples lacking normality can significantly impact on the results of a study, particularly in terms of statistical validation, test selection, result interpretation, and the reliability

of inferences. However, these effects can be mitigated with careful selection of appropriate tests (such as non-parametric tests), data transformation (if necessary), and a clear justification of the chosen methodology.

If the p-value is less than 0.001, the hypothesis that the data has a normal distribution is rejected (Hair, 2018). As the sample does not have a normal distribution, non-parametric methods were used to analyze the data, which is why PLS was chosen as the model estimation method (Ringle et al., 2014). For these analyses, Jamovi software was used.

The Harman test was used to verify the assumption of homoscedasticity (Bido et al., 2018). In surveys, there may be biases in the data, which occurs when the respondent tends to respond with perceived coherence between responses (Fernandes, 2021). To perform the Harman test, the principal components method is used without rotation (Podsakoff et al., 2003). If the test indicates that a single factor accounts for 50% or more of the variance, it suggests common method bias in the sample (Fernandes, 2021). The data shows that this research did not suffer from common method bias, as the variance is 18.42%. SPSS software was used for this analysis.

4 Analysis of results

Before starting the analysis of the proposed structural model, it is necessary to confirm whether the chosen scales are appropriate for the selected survey sample—that is, whether the measurement model is valid. For the analysis and validation, reliability, convergent validity, and discriminant validity of each variable from the selected scales were considered (Ringle et al., 2014; Bido & Silva, 2019).

A second-order latent variable is measured by two or more first-order latent variables. To measure the model using PLS-SEM, it is necessary to reuse the indicators of the first-order latent variables in the second-order latent variable (Bido et al., 2019).

For models with second-order latent variables, it is recommended to present the results in three steps:

1. the measurement model of the first-order latent variables (Tables 2 and 3);
2. the measurement model of the latent variables included in the structural model (Tables 4 and 5);
3. the structural model, in Table 6.

For the analysis, the suggested sequence is:

1. convergent validity (Table 2) and
2. discriminant validity (Table 3).

This order is important because reliability analysis assumes the construct is unidimensional, and if there is an issue with convergent or discriminant validity, the reliability assessment cannot proceed (Bido & Silva, 2019).

Step 1: Measurement model of the first-order latent variables

The Composite Reliability and AVE indicators were used to assess whether the sample presents bias and whether the results are reliable. According to Hair et al. (2019), Composite Reliability values should be greater than 0.70. For Fornell and Larcker (1981), AVE values should be greater than 0.50 (Table 2).

Table 2 – Reliability and Validity Indicators of the Measurement Model

	1	2	3	4	5	6	7	8	9	10
Composite Reliability	.809	.857	.832	.828	.832	.782	.769	.913	.821	.77
AVE	.587	.548	.504	.546	.501	.545	.526	.725	.544	.544

Source: extracted from SmartPLS 4.0 software by the authors (2023)

The diagonal values represent the square root of the AVE and are greater than the correlations between the latent variables (off-diagonal values), indicating discriminant validity (Bido & Silva, 2019).

Table 3 – Discriminant Validity Fornell-Larcker Method of the Measurement Model

	1	2	3	4	5	6	7	8	9	10
1- RELIABILITY	**.766**									
2- CREATIVE SKILLS	.021	**.74**								
3- APP INTERACTION/EASE OF USE	.613	.081	**.71**							
4- SOCIAL MEDIA	.194	.531	.184	**.739**						
5- NAVIGATION	-.005	-.055	-.034	-.277	**.708**					
6- OPERATIONAL	.26	.329	.168	.574	-.332	**.738**				
7- POLITICS	.573	.178	.585	.243	.045	.133	**.725**			
8- SATISFACTION	.662	.024	.802	.157	.023	.127	.603	**.851**		
9- PROBLEM-SOLVING	.419	.125	.488	.067	.13	.044	.595	.471	**.738**	
10- USABILITY	.221	.198	.188	.464	-.375	.66	.052	.106	-.021	**.738**

Source: extracted from SmartPLS 4.0 software by the authors (2023)

Note. Values on the diagonal are the square root of the AVE

Step 2: Measurement model of the latent variables included in the structural model

Following the validation of the measurement model, the next step was to validate the structural model. Since the proposed model includes both first- and second-order constructs, it is recommended that the validation be conducted in two stages. This is advised because the number of indicators for the latent variables is similar (3, 4, 5, and 6). If the number of indicators varied significantly, the latent variable with more indicators would tend to have higher factor loadings due to the repetition of indicators in the second-order latent variable (Bido et al., 2019).

The measurement model for the latent variables can be accepted, as the Composite Reliability values are greater than 0.70 and the AVE values exceed 0.50 (Table 4).

Table 4 – Reliability and Validity Indicators of the Structural Equation Model

	Composite Reliability	AVE
Digital Skill Level	.744	.5
ORSQ	.915	.73
Satisfaction	.913	.725

Source: extracted from SmartPLS 4.0 software by the authors (2023)

The diagonal values represent the square root of the AVE and are greater than the correlations between the latent variables (off-diagonal values), indicating discriminant validity (Bido & Silva, 2019).

Table 5 – Discriminant Validity Fornell-Larcker Method of the Structural Model

	1	2	3
Digital Skill Level	.706		
ORSQ	.231	**.854**	
Satisfaction	.154	.921	.851

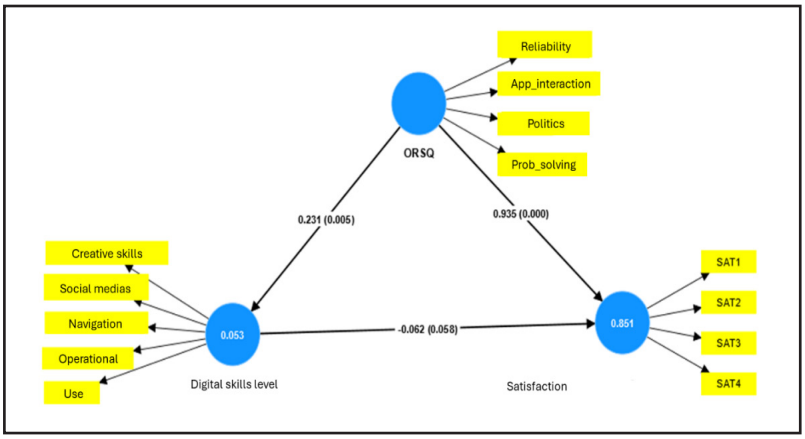
Source: extracted from SmartPLS 4.0 software by the authors (2023)
Note. Diagonal values are the square root of the AVE

Step 3: Structural model

The bootstrapping analysis by Partial Least Squares (PLS), using the SmartPLS 4 statistical software, was employed to test the two hypotheses in this study. Specifically, it aimed to test the mediating effect of perceived quality on the relationship between digital skills and customer satisfaction using food delivery applications, with a sample size of n=170, 3000 samples, and 1000 iterations per subsample.

To interpret the analysis results, the t-test was used, where significance is indicated by values above 1.96 (Ringle et al., 2014; Hair et al., 2018). The final model can be observed in Figure 2.

Figure 2 – Final Structural Model



Source: extracted from SmartPLS 4.0 software by the authors (2023)
Note 1. Digital Skill Level and Perceived Quality are second-order latent variable

5 DISCUSSION OF RESULTS

Data analysis using bootstrapping allows evaluating the significance of the paths, that is, the relationships of the hypotheses, through factor loadings, as shown in Table 6.

Hypothesis H1 – "There is a positive relationship between the level of digital skills and customer satisfaction with food delivery apps" was partially confirmed ($t = 1.89$; $p < 0.058$). This indicates that digital skills lead consumers to feel more satisfied with the services provided by food delivery applications.

Users with greater digital proficiency tend to have more satisfying experiences with apps due to the increased ease of use and the perceived usefulness of the platforms' features. According to Ridzuan et al. (2021), the more digitally skilled a user is, the more intuitive the app becomes, directly contributing to higher satisfaction. Choi (2020) also states that the perception that the app meets the user's needs is positively associated with satisfaction, and this relationship is strengthened by digital proficiency.

In addition, factors such as satisfaction, familiarity with the technology, and perceived usefulness directly influence the intention to continue using the app (Hoang, 2023). In the specific context of food delivery apps, Luthfia et al. (2021) highlight that user acceptance is significantly influenced by their level of digital skills — the higher the skill level, the greater the acceptance and engagement with the platform.

Hypothesis H2 – "There is a positive relationship between the level of digital skills and customer satisfaction, mediated by perceived service quality of food delivery apps" was *confirmed* ($t = 2.818$; $p < 0.005$). Thus, it can be concluded that digital skills lead to satisfaction only when there is perceived quality — in other words, when customers are satisfied with the quality of service provided by the delivery app.

Table 6 – Assessment of Hypothetical Structural Relationships

Structural Relationship	Hypotheses		Standardized structural coefficient (β)	Test-t		Result
Digital Skill Level -> Satisfaction	H1(+)	There is a positive relationship between digital skill level and customer satisfaction on food delivery apps	-.062	.033	1.899	.058	Partially Confirmed
Digital Skill Level -> Perceived Quality (ORSQ) -> Satisfaction	H2(+)	There is a positive relationship between the level of digital skill and customer satisfaction, mediated by the perceived quality of services in food delivery apps	.216	.077	2.818	.005	Confirmed

Source: extracted from SmartPLS 4.0 software by the authors (2023)
Note: critical limits for t-test: 1.65 = p<.10; 1.96 = p<.05; 2.53 = p<.01

In a study applied to the public sector, it was found that IT competence has a positive impact on both the perception of service quality and user satisfaction. Moreover, the results showed that perceived quality acts as a mediating variable, strengthening the relationship between digital competence and satisfaction (Ahmad, 2023).

In the banking sector, digital quality significantly contributes to increased customer satisfaction, which in turn reinforces brand loyalty. Additionally, the perceived quality of digital channels proved to be more influential on satisfaction than traditional factors, highlighting the central role of the digital experience in this sector (Ezepue et al., 2018).

Findings from Panda and Swar (2017) also support this: the constructs of reliability, problem-solving, policy, and ease of use — which comprise the ORSQ

— are positively associated with customer satisfaction. The significant association between reliability and satisfaction is consistent with prior research (Ninh Nguyen et al., 2016; Yasser Mahfooz, 2014).

Similarly, there is a positive relationship between problem-solving and customer satisfaction, supported by Ninh Nguyen et al. (2016). However, regarding the positive relationship between policy and satisfaction, findings are inconsistent with previous offline environment studies (Ninh Nguyen et al., 2016), which found policy not to be significant.

Lastly, the positive relationship between ease of use and customer satisfaction is supported by Panda and Swar (2014), Ribbink et al. (2004), and Morris and Turner (2001). These authors concluded that ease of use is one of the key technological factors that enhance customer satisfaction in online shopping contexts.

Therefore, if reliability, problem-solving, policy, and ease of use are positively associated with customer satisfaction, then the overall relationship between ORSQ and satisfaction is also supported.

6 FINAL CONSIDERATIONS

This study is significant because the results demonstrate that digital skills lead to perceived quality, which in turn leads to customer satisfaction with food delivery apps. With the transition to Industry 5.0 and the COVID19 pandemic, the importance of delivering highquality services and effective CRM in digital environments has become clearer. The pandemic brought severe socioeconomic consequences worldwide, prompting major shifts in consumer behavior.

During lockdowns and restricted mobility, people increasingly relied on ICT tools to meet their food needs. Online food delivery services via mobile apps became popular and cost-effective, especially in major urban areas—but using such apps requires a certain level of digital skill.

Therefore, this study aimed to analyze the relationships among digital skills (ICT), perceived quality, and customer satisfaction. To achieve this, a survey was conducted

among consumers who use food delivery apps. A conceptual model was developed to test direct relationships between the constructs—digital skills, perceived quality, and satisfaction—and to validate it with Brazilian users. The robustness of the proposed model was assessed using appropriate statistical techniques.

The findings provide a notable academic contribution, as the mediation pathway from digital skills perceived quality customer satisfaction has not been previously explored. Few studies treat digital skill level as a structured multidimensional construct; most consider it unidimensional. However, implementing a hierarchical model with firstorder and secondorder constructs allows for a more accurate representation of the complex digital competencies composed of multiple dimensions.

From a managerial perspective, the results can help eretailers enhance customer satisfaction in the online retail environment. By focusing on determinants of perceived service quality, managers can refine their strategies to deliver more satisfying experiences and thereby strengthen customer loyalty.

Additionally, these insights are valuable for companies, digital platforms, educational institutions, and governments that need to tailor their services to audiences with varying levels of digital literacy. User perceptions of quality and satisfaction depend not only on the product or service features but also on individual digital competencies.

Online retail managers can align strategies with each dimension of the ORSQ model to boost customer satisfaction, paying particular attention to service policy, reliability, problem-solving, and ease of use. Strengthening these aspects enhances the delivery of more efficient, higher-quality digital services and positively impacts user experience.

This work contributes to a deeper understanding of perceived quality and customer satisfaction. However, like all studies, it has limitations: it focuses solely on the positive relationships among constructs, was conducted only with Brazilian participants (without accounting for cultural effects), and data collection was online—likely attracting participants with some digital skill, which may have reduced response variability. Social class effects were not examined, meaning results may vary by

income level. The study also did not assess which construct—reliability, problem-solving, policy, or ease of use—has the strongest impact on perceived quality and thus satisfaction, nor did it determine which digital skill dimensions (navigation, usage, creativity, social media, or operational) most influence perceived quality.

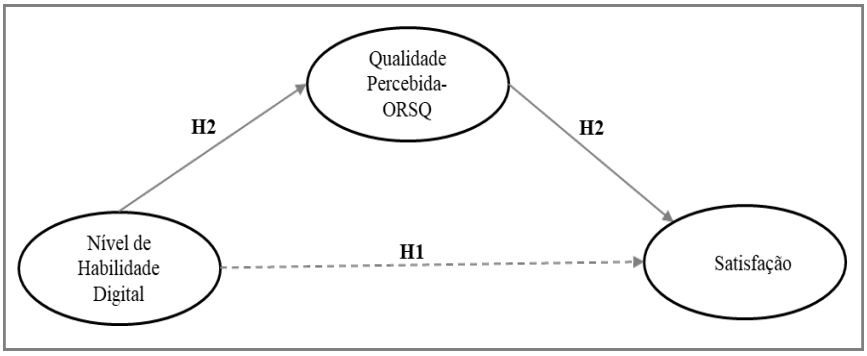
Given that this research explored quality perception from the end-user's perspective, future studies could investigate the quality perception from the business side—i.e., companies that use delivery apps to promote and sell their products. Another valuable perspective would involve the role of delivery drivers, who act as intermediaries between businesses and customers. Such comparative studies could highlight divergences in quality perception among different stakeholders.

Future research could also analyze the evolution of food delivery app use in relation to consumer loyalty, exploring characteristics that foster brand love and strengthen brand identity—such as recommendation intention, repurchase intention, and loyalty.

Researchers should examine which constructs most influence perceived quality (reliability, problem-solving, policy, ease of use) and, consequently, customer satisfaction. Additionally, it's important to identify which digital skill dimensions (navigation, usage, creative skills, social media, operational) exert the greatest influence, contributing both academically and practically to the study of these topics.

Finally, since Hypothesis H1 was only partially confirmed, a full mediation model could be considered—where digital skills influence satisfaction solely through perceived quality, rather than directly.

Figure 3 – Proposed Structural Model



Source: the authors

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4. Theoretical foundation / Literature review	√	√
5. Definition of methodological procedures		√
6. Data collection	√	
7. Statistical analysis	√	√
8. Analysis and interpretation of data	√	
9. Critical revision of the manuscript		√
10. Manuscript writing	√	√
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