

# Interactions between e-commerce users during the COVID-19 pandemic period: What came and what remained

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## Abstract.

**BACKGROUND:** During the COVID-19 pandemic, the online sales industry experienced record-breaking growth. The number of businesses that decided to enter the e-commerce market for the first time was enormous. At the height of the quarantine, Brazil was registering a new virtual store every minute. This was an unanticipated and unplanned expansion.

**OBJECTIVE:** This study aims to identify existing challenges in human interactions with e-commerce, such as the difficulties faced during the pandemic and improvements to ensure growth of, and confidence in, this type of business.

**METHODS:** An exploratory study of e-commerce data and an online survey using the snowball non-probabilistic method were developed to research the growth of, and issues in, Brazilian users' interaction with e-commerce, comparing findings before and after the pandemic restrictions.

**RESULTS:** Some businesses were not prepared, and the lack of experience among workers contributed to businesses not delivering on their promises. The acceleration of e-commerce demonstrates the need to guarantee that Brazil can effectively use e-commerce to capitalize on digital supply chain opportunities and enhance their role in its economic expansion, while remaining human-centered.

**CONCLUSIONS:** For users' needs to be met, companies and online workers must understand people's needs and behaviors in order to provide excellent service.

Keywords: COVID-19, e-commerce, consumer behavior, quality in services, Brazil

## 1. Introduction

COVID-19 has had negative consequences for various aspects of society [1]. During the COVID-19 pandemic, non-pharmacological measures, such as social isolation and lockdowns, were the most com-

mon response by healthcare systems to prevent the spread of the disease. Therefore, people had to adjust their behavior to a new normal and associated processes; however, to do so, people require a supportive context to develop new skills [2], including online shopping using e-commerce tools. Moreover, risk-taking in terms of avoiding social isolation measures is mediated by the sense of unfairness and expected benefits of the new behavior [3], which in the case of online shopping, depends on the trust and reputation of e-commerce. Consumer behavior research has

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already described the extent to which the effects on consumers and businesses can be predicted [4, 5].

In Brazil, e-commerce continues to thrive despite insecurity, delivery delays, poor efficiency, and inadequate service support [6], as well as other failures. Following the COVID-19 pandemic, the situation compelled Brazilian society to put aside insecurity and reclaim its sense of self in the face of the threat. Online shopping, delivery services, and other local services have all gained popularity as viable alternatives.

In theory, e-commerce refers to all forms of economic activity conducted through electronic links [7] for the buying and selling of goods and services over the internet. Transactions are carried out at two levels: retail, which serves the company's needs; and wholesale, which involves bulk purchasing. E-commerce transactions can be completed in various ways, including cash or installment payments [8]. These transactions are classified as B2B transactions (business to business), B2C transactions (business to consumer), and C2C transactions (consumer to consumer).

Further, the rapid development of information and communication technologies, the steady growth of internet users, the increasing number of people using online shopping, and lower prices than those offered face-to-face, are all driving forces behind e-commerce.

Both customers and businesses benefit from the adoption of strategies and the use of e-commerce. Customers can shop whenever and wherever they want, without having to physically visit stores, and they have more time to choose and compare product features and pricing from multiple online businesses at the same time, as well as more personalization options [3, 4]. For companies, possibilities include accessing a larger number of customers, reducing the number of physical stores, mapping customer behavior, and developing a direct communication channel [4]. However, companies that choose to use e-commerce must cope with a slew of difficulties, including distribution, inventory management, and delivery execution [9]. It is also necessary to understand consumer behavior, which includes human factors and ergonomics, especially in relation to usability, decision making, and satisfaction.

The rise of e-commerce during the pandemic suggests that more research is required into this phenomenon. Over the last 10 years, the term "e-commerce" has appeared in 4,878 documents and 16,015 citations in the Web of Science database (we

obtained data from the Web of Science Core Collection database, from 2011 to 2021, on 20 March, 2022). However, when using a search that includes the topic "ergonomics," we only found only one document. Including the term "human factors," the number of documents was 46, and including the term "usability" revealed 92 documents. These figures are very low, considering that the human factor and interactions with the system are essential for the success of digital e-commerce systems.

To understand the motivations that drive people to make a purchase, professionals in this field must understand human interactions with digital systems and deepen their understanding of consumer behavior. However, uncertainties have been created due to the potential consequences of the COVID-19 pandemic, including the possibility of diminished purchasing power due to adverse economic conditions.

The variables for digital systems concerning ergonomics come from human-system interaction, which can be defined in terms of the system's usability. The usability referred to here is related to the process that motivates the customer to achieve his or her goals of buying a given product, effectively, efficiently, and with satisfaction with the company [10]. A positive attitude towards online stores increases adherence and return rates, and ultimately encourages online purchases [11]. Chiou, Lin, and Perng reviewed a set of 83 articles related to usability and highlighted critical success factors for customer satisfaction with the system, including security and topics related to information ergonomics as the main factors [12].

During the pandemic, public authorities denied workers suffering from COVID-19 access to employment through legislation. Some rules reduced the production capacity and supply of certain goods and services. This occurred in parallel with the accelerated growth of e-commerce and associated technologies. These factors combined can lead to frustration among consumers who have made a purchase and require the product or service, but who may be forced to wait for the company to overcome the difficulties they are experiencing.

In this scenario, fundamental questions arise. What impact will the pandemic have on the overall quality of e-commerce services? What was the process by which the Brazilian market reinvented itself? What is Brazilians' level of satisfaction with online services, and how do they conduct themselves? Is it possible to maintain new behaviors in the new normal? Is there

any effect on consumer behavior and the Brazilian e-commerce market from the restrictions imposed due to COVID-19?

These questions guide the present study, which aims to help companies respond to problems of customer dissatisfaction and ensure the successful delivery of their services. Furthermore, we investigate the quality of service, delivery safety, and consumer satisfaction to better understand the impact of COVID-19 on consumer behavior and the Brazilian online marketplace. Service quality is directly related to safety, delivery, and human interaction, which affect consumer behavior and lead to satisfaction with the company. Studying these human factors can help both consumers and companies [13].

It is possible to measure customers' satisfaction with their e-commerce experiences in several ways. Customers demand a higher frequency of promotions and discounts, as well as more payment alternatives. Another consideration is delivery, which must both be quick and secure. An additional factor that benefits the consumer is the system's usability, which makes decision making and word-of-mouth advertising easier. Regarding security, this usually relates to the presence of open communication channels, which mitigates perceptions of fraud [14–16].

An internet survey [6] was conducted to determine the effectiveness of the e-commerce system. Many people could respond and share their experiences despite the pandemic restrictions by answering an online questionnaire. This investigation was initiated by researchers who constitute a Cooperation Network involving BRICS countries [7]. In 2021, partial results from Brazil were presented at the 21st Congress of the International Ergonomics Association [17], expanding research by using a larger sample

and generating new discussions. These findings will aid the understanding of country-specific scenarios that will influence the use of e-commerce in Brazil and help entrepreneurs to avoid making the same mistakes in a lucrative market.

## 2. Materials and methods

We present the research flow, including identifying gaps and trends, in Fig. 1. In terms of objectives, this research is classified as exploratory [18]. The aim is to reveal an audience's characteristics in the face of an experience. We used an internet-based survey [6] and non-probabilistic procedures [19] to collect quantitative data through a snowball sampling design [20]. This method has the advantages of being able to be developed at low or no cost, applied in a faster and more efficient manner, with a readily available sample, fewer rules to follow, and with a better capacity for distinguishing and analyzing the variables due to the use of direct quantitative data. It can also be applied in a larger geographic area and is more cost-effective than other methods. The main disadvantage is that the response rate is low, usually less than 10%. This can be explained by the fact that people tend not to click a link that they are not familiar with for fear of downloading a malicious file that will steal data or damage the computer. Notably, alongside the increased use of mobile devices during the pandemic, there was also an increase in hacking attempts.

We developed an online questionnaire using a cross-sectional survey design. A pilot test showed that completing the questionnaire took an average of five minutes. We subsequently sent the survey to

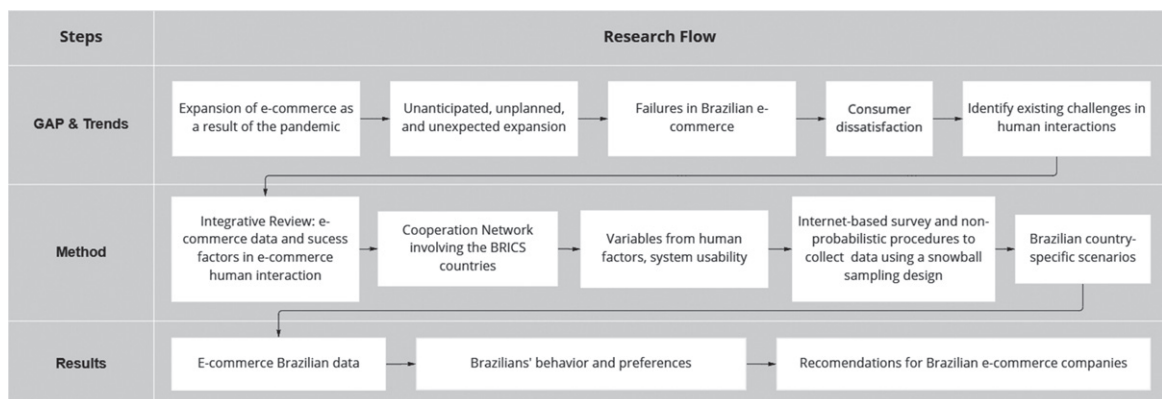


Fig. 1. Research flow.

participants via a link on social media and via the researchers' contacts.

We gathered a non-probabilistic sample using the snowball method, considering that the Brazilian universe is very large, impossible to reach through a probabilistic sample, and that not everyone in the universe has the same chance of receiving the questionnaire. The snowball method is considered representative and fit for extrapolation, being a method used frequently, legitimately, and effectively [20, 21]. The name snowball refers to how a respondent can send the questionnaire to one or more people, making the sampling behave like a snowball, representing an accumulative character when choosing the respondents.

We analyzed 1,230 questionnaires in this study. We asked participants whether they intended to respond spontaneously to the survey by accepting the free and informed consent terms, following the ethics protocols established by the National Research Ethics Commission in Brazil, at the beginning of the questionnaire, although it was not necessary to identify the respondents.

In various surveys, questionnaires are frequently used interchangeably [22]. We used a single questionnaire designed by the BRICS Ergonomics Network to develop the questions, customized for each country, and used this as a pre-test. We then modified the questionnaire for use in Brazil, with 18 main questions divided into two sections, and two sections for follow-up questions. The first section included general information, such as age, gender, city, state, and occupation, and the second section dealt with preferences, satisfaction, difficulties, and feelings.

The variables were assessed in two scenarios: before the restrictions imposed by the pandemic, which refers to the three months before social restrictions and the general closure of trading; and during social and commercial restrictions, which refers to the period following the previous scenario.

The questionnaire revealed Brazilian society's behavior in terms of purchasing more online, but it also identified several issues not mentioned in previous studies' findings. We therefore compared our findings with information obtained from surveys conducted by data collection agencies in the industry. This involved a straightforward search using descriptors such as data AND e-commerce AND Brazil, and we narrowed the results to official ones.

We adopted technical dimensions derived from the BRICS Ergonomics Network's questionnaire, as well

as an ideological dimension relating to the necessary adaptations to each of the participating countries, in this case Brazil. These two aspects form the scientific dimension, as outlined in this study's methodology, which is adequately described and derived from reputable information sources.

Possible biases were investigated to ensure that the databases did not contain any commercial or media-related information. The purpose of this second part of the research was to compare and contrast the study's findings with previous survey findings to establish a more concrete position from which to answer the guiding questions. We analyze the survey results in Section 3, linking participants' responses to the current e-commerce environment, which also serves as a validation strategy for the findings. Simultaneously, was also establish a more open scenario.

### 3. Results and discussion

#### 3.1. Brazilian data

Statistical reports from institutions in the sector indicate that Brazilian e-commerce will continue to be successful. According to the Neotrust Report [23], the preferred source of e-commerce statistics since it uses actual data on purchases made and has the broadest coverage of transactions in the Brazilian online market (rather than drawing estimates from sample data), the sales increase that began in 2020 and 2021 is expected to continue. According to the report, Brazilians made 301 million online purchases in 2020, representing a 68.5% increase compared to the previous year. Revenue therefore also increased significantly: income generated increased by 68.1% compared to the previous year. The report also highlighted that 64.8% of total purchases were made in the southeast region.

#### 3.2. Brazilians' behavior and preferences

Due to the limitations enforced during the pandemic, as well as companies' significant efforts in this scenario, there was a significant shift in consumer behavior. B2B enterprises were the most adaptable; they saw internet and communication channels as helpful tools for customers, especially since B2B purchases are frequently personalized and negotiations are unique to each client and provider.

Regarding shopping preferences, 52% of people preferred to shop online. By examining the data

regarding the most common reasons for purchasing items via the internet, we can see that most of these reasons increased during the pandemic, except for low prices, which was one of the reasons that decreased during the pandemic.

Electronic products sales decreased by 4%. On the other hand, there was an increase in other products, such as 30% in shoes and clothing. Other products also saw an increase in online purchases, such as food (100%), medicine (30%), digital services (e.g. TV channels) (50%), enrollment in education courses (40%), and supermarkets (70%). The increase in clothing purchases (clothes and shoes) may be linked to a shift in consumer profile, as women hold most purchasing power. In this category, the most frequently mentioned purchases were fashion and accessories (22%), followed by beauty, perfumery, and health.

The number of people using e-commerce is growing every day. According to the survey results, more than half of the respondents (combined with the indifferent ones) believe that e-commerce is the future of business. The pandemic led to an increase in the number of payment options available, the number of product types available, and the frequency with which Brazilians made purchases. It is therefore necessary to invest in customer retention systems to ensure long-term viability.

The majority of responses came from people aged between 36 and 45 years. More than half (72%) were women. The female gender is associated with the predominance of purchases in the market, and it alludes to a more favorable cultural setting. Females are always the most reliable sources of information when shopping. This segment must be well-targeted in marketing and user experience efforts [5].

The Neotrust Report [23] explains this situation as follows: women consume more, but in lower ticket categories such as fashion and accessories or beauty and perfume. Men make fewer purchases than women, but in categories with higher average ticket values, such as electronics and telephony.

### 3.3. Brands

The participants were asked what factors increase their confidence when purchasing goods and services over the internet. Most respondents (78%) stated that they trust leading brands or websites, followed by a national or international market reference, and the local market (22%). People still trust leading brands more than local vendors, which grew in popularity



Fig. 2. Leading companies accessed in the pandemic.

during the pandemic but only represent a minor portion of consumer preference.

Many businesses already had an online presence, such as their own website, but they were mostly utilized for other purposes, such as brand promotion (marketing). As a result, they had to rethink their investments in order to meet the demand for virtual shopping. Magalu, Americanas, Mercado Livre, and Amazon were among the e-commerce sites that saw rapid growth, especially throughout the pandemic. As the migration of consumers from physical stores to the virtual world intensified, e-commerce sales channels became more common in the daily lives of businesses. Since March 2020, when the pandemic began, the number of individuals making their first online purchase has increased significantly.

Results varied across major companies, as illustrated by the word cloud in Fig. 2. Amazon, Americanas, and Magalu were the most frequently mentioned businesses.

Because of the high demand from consumers, the number of virtual stores has increased to keep up with orders. There were 930,000 such transactions in August 2019, rising to 1.3 million in August 2020, representing a 40% increase, the largest since PayPal's Brazilian E-commerce Profile report in 2011 [24]. However, the Big Data Corp report [25] pointed out that online sales account for only 6.19% of all retail sales in Brazil. Among the other findings of the report were that spending was concentrated in restaurants and food (70%), supermarkets (13%), and pharmacies (4.7%), and that offers/ promotions continue to be the top priority for Brazilian consumers.

It is notable in the responses that, when comparing the previous period to the pandemic period, the three most frequently cited companies were the ones that experienced the most significant increase in access. Those associated with the hotel industry (Booking.com, Hotel Urbano, Hotels.com, Accor

Hotels) and companies such as AliExpress suffered the most significant losses.

Data from the SEBRAE (Brazilian Support Service for Micro and Small Businesses) survey on the impact of the pandemic on small businesses, which was conducted in 2020, pointed out that 64% of companies changed their way of selling [26]. Americanas, Amazon, and Magalu, the three most-cited companies, highlights the return on investment that these companies had already been making in e-commerce before the pandemic. They were prepared and grew even more due to the pandemic, despite the possibility of a general economic downturn in the population. The decline in the hotel industry is evident, as tourism was one of the industries most severely affected by the pandemic. The survey results, which included companies such as Americanas and Magalu, are consistent with the findings of the Brazilian Society of Retail and Consumer Affairs [27], which in 2019 named the companies Magalu, Mercado Livre, and Americanas as the most notable. Magalu continued to invest heavily in e-commerce in 2020, and despite the closure of its physical stores, the company's sales increased by approximately 46% in 2021. Comparing sales data from 2016 to 2017, the increase was by nearly 1,800 times. This company serves as an example of a Brazilian company that was already following in Amazon's footsteps.

### 3.4. Satisfaction with the system

In terms of customer satisfaction, the survey revealed that product deliveries have improved, with a reduction in late delivery and packaging quality complaints. Furthermore, there was an increase of approximately 20% in the price and variety of products offered by online stores. As a result, customer satisfaction with the service decreased by 20%, exacerbating the pandemic situation. Among the main reasons for dissatisfaction was the process of canceling and returning products.

There was an improvement in compensation and in service delays for items during the pandemic. It appears that communication with the company has become more complicated, which has become worse since the pandemic. The source of this dissatisfaction lies in a diverse set of difficulties. The respondents reported a 70% increase in the number of products that were not available and a 50% increase in the price of the available products. There has, however, been an improvement in payment options, with more payment options now being made available.

The most secure items to purchase were food, medicine, cleaning products, electronics, television, and internet service subscriptions, followed by jewelry and watches. Respondents were more apprehensive when purchasing clothing in general, perishable items, and furniture, among other items. If possible, they preferred to use couriers offering adequate personal protection in addition to airtight packaging.

We did not find product pricing to be a decisive factor. The purchase decision was influenced by the quality of human interaction in customer service before purchase, on-time delivery, and human interaction in customer support after the sale. This shows that online stores must understand their customers' needs and provide excellent service, with maximum interaction.

Improvements in Brazilian e-commerce can be made by examining the interactions between consumer behavior changes caused by social and commercial restrictions, such as those imposed by the pandemic, and changes in consumer behavior. These recommendations can be beneficial, efficient, and practical, resulting in new markets and a more prosperous economy. In this context, the present study has investigated the audience's perceptions of variables that influence service delivery quality, efficiency, safety, and dependability. The study has also examined the most popular products and the advantages and disadvantages of e-commerce in the region.

### 3.5. Challenges

According to JPMorgan [28], several Brazilian regions lack digital and physical infrastructure, and annual spending is still low. More than 40% of users stated that internet instability has prevented them from purchasing, and delivery times are among the difficulties they have encountered. Brazilian internet speeds average 18 megabits per second (Mbps), nearly three times slower than the global average of 49 Mbps. As a result of the vastness of the country's geography, logistical issues arise that e-commerce companies must work to resolve.

Product deliveries are subject to various problems, ranging from inadequate security to delivery companies not operating in certain areas. Consequently, given that Brazil accounts for nearly half of Latin America's e-commerce, when 5G technology is introduced in the country, the potential for e-commerce is likely to grow exponentially.

When it comes to purchasing more online, there are noticeable differences in Brazilian society's behavior, but respondents also identified many issues. When asked about their online purchases and reliance on the internet for news, health-related information, and digital entertainment during the pandemic, more than half of those who responded said they had increased their use of the internet.

In addition to high shipping costs and long delivery times, other factors such as time-consuming registration and interface usability issues, as well as the fear of being scammed, continue to discourage online purchases in Brazil. If these challenges can be overcome, Brazil will see an increase in the number of e-commerce users.

The delivery aspect of e-commerce is essential in relation to items arriving undamaged. This must be facilitated by the increase in the number of "moto boys" and other delivery services; delivery is no longer solely reliant on the Post Office, a Brazilian state-owned corporation. On the other hand, dissatisfaction with the service is a bad sign, and this may be related to companies' lack of preparation for expansion. Commerce was prepared to sell, but not prepared to deliver. During the pandemic, when online shopping was essential for the population, some companies could not cope.

The overall scenario is extremely optimistic, but many traditional, brick-and-mortar shopkeepers are not well prepared to face the enormous competition from e-commerce. Knowledge of technology, logistics, customer relations, pre-sales, and post-sales is crucial and must be carefully integrated. The main challenge is reconciling costs, skilled people, infrastructure, technology, and customer service in order to provide the consumer with a good shopping experience.

Other research findings point to the need for improvement in a variety of aspects, such as:

- Shipping is the highest cost in online business, and it is also one of the most challenging obstacles to overcome when making a sale.
- Google-sponsored links are the most widely used method for disseminating information in digital marketing. Another popular way of sharing knowledge is through email marketing. Additionally, social media networks and price comparison websites are widely used, and virtual stores should investigate these avenues further, although many businesses continue to eschew their use. Brazilian e-commerce still has

a long way to go to understand the operation and benefits of the most diverse digital marketing channels available.

- Finding what you are looking for can be difficult because only a few virtual stores provide filters for products based on brand, price range, and characteristics, as well as lists of similar products to the one being browsed.
- Small retailers insisting on selling well-known brand electronics will never be able to compete on price with the big players in the internet market.

Creating an online store on the internet is a simple process, but the tricky part is generating sales leads. Digital marketing is a sector that, in addition to being widely disseminated, currently has the most significant number of professionals who have received specialized training. Small and medium-sized enterprises (SMEs) should prioritize their investments in this area.

Contrary to expectations, the biggest threat to small and medium-sized virtual stores is not the big players in the market, but rather consumers' lack of confidence in purchasing online, the high cost of shipping, as well as the other factors discussed throughout this paper. Some SMEs recognize that, to succeed in e-commerce, they must have their own exclusive or niche products to sell. As a result, the major players are no longer considered the primary problem.

Consumer behavior appears as a process that includes a variety of factors that can be decisive when purchasing a product or service [29]. What we call motivation here refers to the human factors that influence a consumer's decision. The most significant challenges of human interaction in e-commerce are related to customer motivation and fidelity, which may be provided by a system with usability for different users at all levels of education and different ages. Usability of the system influences the consumer's satisfaction directly. A user-friendly interface provides a simple and safe experience, leading to customer fidelization.

Consumers have become more critical. Now, they can research the brand's reputation and choose the cheapest product. Online consumers perceive and assess the ease of making a purchase, the convenience of comparing products, the opinions of previous customers who have purchased at the store, and additional information, before buying the desired item.

Personal characteristics, such as the level of skills in using technologies and the user's age, will have a

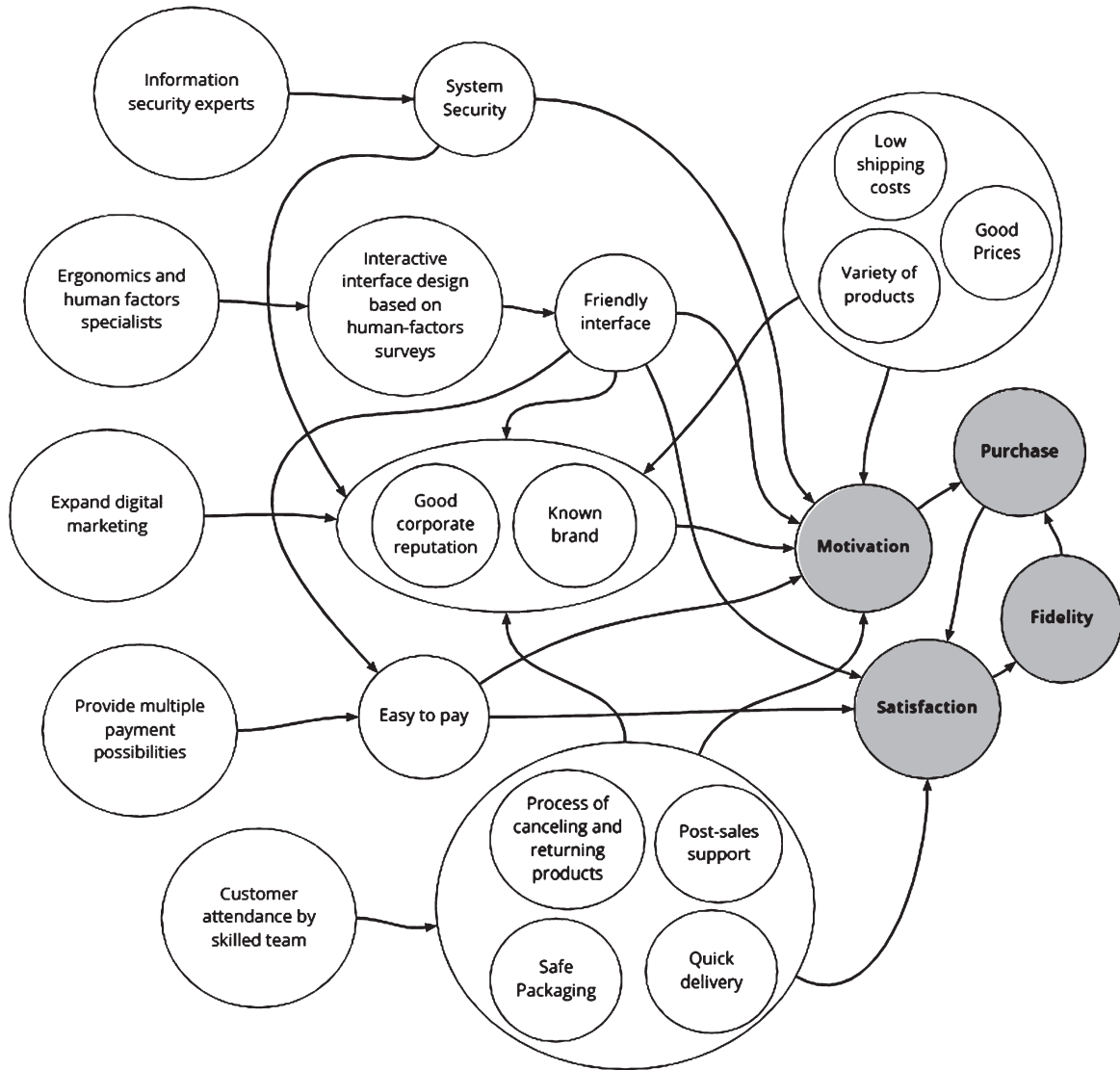


Fig. 3. Connections and interactions of critical success factors in e-commerce.

direct influence on shopping [30]. As a result, programmers and e-commerce workers must understand how to analyze human needs and plan the best strategies for attracting, serving, and retaining customers. The only way to promote truly relevant, enchanting, and sustainable experiences to consumers is to focus on human factors and their interactions with systems. This, not technological investment, will be the eternal challenge in the market. Technology has always been a way to improve people’s lives, and respect for users must always be human-centered.

We present a summary of the findings of this research in Fig. 3, which illustrates the connection between the need for companies to provide excel-

lent systems and services and users’ decision-making based on the achievement of critical success factors.

#### 4. Conclusion

This paper’s overall aim was to investigate e-commerce and Brazilians’ behavior during the COVID-19 pandemic. It has demonstrated a shift in how Brazilians consume from the perspective of the growth in consumption via e-commerce platforms by comparing the periods before and after the pandemic, as well as offering a reflection on the means to achieve human satisfaction using systems. It is possible to see



that the consequences of the COVID-19 pandemic have altered Brazilian online shopping behavior.

A spike in Brazilian e-commerce was observed, primarily due to the purchase of computational resources to establish home offices, do schoolwork from home, or even offer new services. Notably, the country's unemployment rose due to the economic crisis resulting from the COVID-19 pandemic. Additionally, the number of online scammers has increased, and several customer complaints regarding dissatisfaction have been confirmed. Some businesses were unprepared, and their lack of experience contributed to them not being able to deliver on their promises.

The connected world benefits society, but also creates problems that some may be unprepared to handle. People's relationships with one another and community life itself are changing due to the increased accessibility to information about products and technologies. The COVID-19 pandemic also led to a rapid change that was already predicted to take place, although not for a few years. Special attention must be paid to adapting to the needs of businesses and consumers so that Brazil can minimize these problems while revitalizing the economy with new products and services.

Given the growth in online shopping, Brazil must be prepared to take advantage of digitalization opportunities as it transitions through its economic recovery. More investment is required to improve services and marketing, and customers will develop new consumption patterns. Therefore, businesses must be aware of this trend to shape new consumer habits. Overall, the exponential growth of e-commerce will continue, and the constant digitalization will enable greater participation of the Brazilian population in this online purchasing model.

During the epidemic, Brazilian e-commerce grew significantly, providing several benefits both to companies and customers. Paying attention to the human aspects of this new business model in Brazil can assist in shaping and solidifying the development of professionals in the industry. These factors can be demonstrated using the data and statistics presented in the current study. However, as with every product development process, various barriers and challenges must be addressed during the structuring process, especially in this case because the COVID-19 pandemic was so quick and unexpected. It is necessary to understand the reasons that lead people to buy over the internet and the human factors and interactions with digital systems. Therefore, the study of

consumer behavior is of great importance. Companies, e-commerce workers, and programmers can use this information to plan how to serve their customers based on their expectations, needs, and desires. Using the results of this research, it will be possible for companies seeking to increase their profits to define effective and novel strategies. Thus, knowledge of interactions with the system, human factors, and the environments in which they live can facilitate the selection and application of appropriate strategies to meet customers' needs.

On the issue of the usability of Brazilian digital procurement platforms, companies could invest in experts in the field of ergonomics and human factors, which would considerably improve the interfaces and interactions with digital systems, the quality of the decision-making process, and the optimization of information and process flows.

Companies must also have specialists in the area of information security to enhance data protection. E-commerce systems need to safeguard customers' personal data and block any possible attacks, such as the cloning of bank cards, which is extremely common in Brazil. The system's security has to be perceptible to the user.

However, questions still remain regarding what the future of consumption will look like post-COVID-19. Will customers continue to put money into internet shopping as a potential new sales channel? Or will people's preferences go back to face-to-face consumption? The current study could serve as a foundation for future research that focuses on the role of e-commerce in the Brazilian retail sector, as well as for students of ergonomics and human factors who want to learn more about consumer behavior in relation to human-computer interaction systems.

In summary, despite the vast literature available on e-commerce, we are moving towards a deeper insertion in information and communication technologies, given the potential future scenarios of metaverses, pandemics, catastrophes, or even wars. Future research can contribute to, and complement, the arguments and ideas developed in this paper.

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## Author contributions

All authors contributed in the conceptual foundation of the study in terms of its rationale, design, data collection, analyses, discussion, and interpretation. All authors read and approved the final manuscript.

## Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

## Conflict of interest

The authors declare that they have no conflict of interest.

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