

Article

Customer Satisfaction in e-Commerce during the COVID-19 Pandemic

Galina Ilieva ^{1,*} , Tania Yankova ¹ , Stanislava Klisarova ¹  and Yulia Dzhabarova ² ¹ Department of Management and Quantitative Methods in Economics, University of Plovdiv Paisii Hilendarski, 4000 Plovdiv, Bulgaria² Department of Marketing and International Economic Relations, University of Plovdiv Paisii Hilendarski, 4000 Plovdiv, Bulgaria

* Correspondence: galili@uni-plovdiv.bg

Abstract: The declared state of emergency and the measures taken against the spread of coronavirus by governments have increased Internet shopping. All companies, regardless of size and type of business activity, had to adapt their business models to the new circumstances through transformation of their business processes and offering products or services tailored to the changing customer behavior. This study aims to analyze the peculiarities of online sales during the COVID-19 health crisis via the integration of classic and modern data analysis methods. The purpose of the paper is to identify the main factors determining user behavior and examine their impact on customer satisfaction in e-commerce. The survey method and structural equation modeling (SEM) were used to recognize the dependencies between variables from the online users' perspective. The satisfaction determinants indicated and described in the paper affect differently the perceived value for the customers. As this value is subjective and dynamic, this study developed a reliable system for e-commerce factor evaluation. Using the proposed methodology, companies can constantly monitor and assess indicators influencing customer satisfaction and gain awareness of consumer behavior's dynamics in online shopping. e-commerce marketers can employ the obtained results to decide how to organize order execution and optimize supply chains. Identifying the most important components of the e-commerce value, managers of online retailers can better run online sales platforms, increase customer loyalty, and thus, improve company's online performance.

Keywords: e-commerce; consumer purchase behavior; customer satisfaction; customer satisfaction measurements; customer satisfaction index; structural equation modeling; COVID-19 pandemic



Citation: Ilieva, G.; Yankova, T.; Klisarova, S.; Dzhabarova, Y. Customer Satisfaction in e-Commerce during the COVID-19 Pandemic. *Systems* **2022**, *10*, 213. <https://doi.org/10.3390/systems10060213>

Academic Editors: Jinan Fiaidhi, Aboul Ella Hassanien and Hye-jin Kim

Received: 15 October 2022

Accepted: 8 November 2022

Published: 10 November 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The COVID-19 pandemic and subsequent social distancing have changed the habits and lifestyle of population and accelerated the digitization of the economy and society. On a global level, the pandemic has dramatically decreased international trade [1].

Some industries, such as the manufacturing of drugs, medical supplies, personal protective equipment, and hygiene products, where purchases have increased rapidly, have quickly recovered. However, in many other sectors, shortages and supply-chain disruptions have arisen and demand is severely constrained [2,3].

All companies, regardless of size and type of business activity, had to adapt their business models to the new circumstances through transformation of business processes and offering products or services tailored to the changing customer behavior. As a response to these new challenges, many companies have preferred to switch to electronic commerce or expand their investments in online channels [4].

1.1. Context of the Adoption of e-Commerce during the COVID-19 Pandemic

Electronic commerce (e-commerce) is the process of buying and selling goods and services over the Internet between and among organizations and individuals [5]. As a form

of distance shopping over the Internet, it is widely spread in the 21st century, facilitating access to the global market and offering deals with competitive pricing in a convenient way.

The declared state of emergency and the measures taken against the spread of coronavirus by governments have forced many consumers to buy online, thus, changing their shopping and spending habits. Stay-at-home restrictions have turned many offline buyers to new users of online e-commerce platforms, and they continue to shop online even after the end of all restrictions. Some employees still work from home, although physical distance restrictions are lifted. Consequently, the residence area of office workers can be independent from their workplace and often they move to live in small cities or villages. In this case, online purchases can compensate for limited choice of goods and lifestyle change [6]. The lack of physical interaction makes online stores more desirable to consumers than physical stores in pandemic times. Nowadays, business-to-consumer (B2C) e-commerce continues to grow rapidly and the pandemic crisis has further strengthened this trend.

On the other hand, the pandemic has forced businesses to change their business models and offer customers additional digital communication channels. This has affected sectors such as tourism and services (events, tickets, etc.), restaurants (food delivery), healthcare (telemedicine) and some retail categories (fast-moving consumer goods) to a greater extent. The COVID-19 pandemic has forced sectors lagging behind in digitization to launch transformations of their business processes.

Statistical data also support the claim that worldwide rapid penetration of e-commerce has transpired during the COVID-19 pandemic with some specifics by region, industry, or country. Before the pandemic, e-commerce, especially retail, has already taken the path to radical changes. In the last five years, from 2016 to 2020, information technologies have contributed to the increase in online sales from 8.6% to 17.8% [7]. According to the analysis of eMarketer, the market research company, the share of Internet sales worldwide has increased during the pandemic year 2021 and reached 20.3% of total retail sales. By 2025, this share is expected to become nearly a quarter (23.6%) of global total retail sales [8].

In Europe, COVID-19 has also boosted e-commerce, however, a sharp decline in online sales in the tourism and services sector (events, tickets, etc.) during the pandemic, holds back overall growth. According to the recent European E-Commerce Reports [9,10], published by Ecommerce Europe and Euro Commerce, turnover indicators have been growing by 10% and 13% in 2020 and 2021, respectively. They are expected to reach the same numbers or higher at the end of 2022, still slightly lower compared to the pre-pandemic 2019 (14%). As was the recent trend, developing countries from Eastern Europe have experienced higher growth rates in B2C e-commerce sales than many Western European countries. However, Western Europe still holds the largest share of total European turnover at 63% compared to Eastern Europe's 2%.

The last report has outlined two opposite trends in e-commerce turnover. On the one hand, despite the lifting of lockdowns and consumers' being able to visit offline stores again, turnover of online shopping continues to grow. Sales are normalizing and stabilizing compared to the last successful pre-pandemic year (2019). On the other hand, a tendency to slow down turnover growth was also identified. Consumers are more cautious of their spending due to disrupted global supply chains, the war in Ukraine, inflation, and a general sense of uncertainty. Regardless of these adverse effects, e-sales are growing, making B2C e-commerce an indispensable and sustainable part of the retail industry.

1.2. Customer Satisfaction as an Essential Aspect of e-Commerce

Customer satisfaction is a measure of overall customer experience with the product or service purchased from a company. Additionally, it reflects how well products or services resonate with buyers' needs and preferences. Satisfaction is an indicator of both the quality of service to existing customers and the ability to attract new customers [11]. Customer satisfaction in e-commerce is determined by the interaction with the merchant at the online contact point (visiting a website, purchasing a product, talking to technical

support, delivery, using a mobile application) and depends on the match between customer expectations and his experiences [12].

Since satisfied customers are more likely to become loyal customers, customer satisfaction is an important performance indicator of the company's effectiveness. In summary, customer satisfaction in e-commerce measures competitive advantage and financial success of organizations in providing products and services in the online marketplace.

In recent years, much research has focused on customer satisfaction in e-commerce, and a variety of models were built based on existing indices [13] or new formulas for calculating customer satisfaction for a product or service [14,15]. Other aspects of the problem were also studied, such as peculiarities for specific countries, especially for developing countries [16–19], subsectors [20,21], or sales platform [22–24].

This study is aimed at establishing and examining a new model for customer satisfaction involving customers' attitudes and perceptions toward security, information availability, shipping, quality, price, and time saved in B2C e-commerce during the pandemic times.

The main tasks of the research are as follows:

1. Identify the key factors affecting customer satisfaction in B2C e-commerce and existing methods for their determination according to the review of results obtained from similar previous research.
2. Collect customers' datasets concerning their experience and preferences in online buying (age, residential area, purchasing cost, attitudes, characteristics of customers' behavior, specific problems).
3. Propose a research methodology that facilitates the systematic analysis of the collected data and reveals hidden relationships in the customers' data.
4. Determine and assess the factors from the existing literature influencing customer satisfaction in e-commerce during the COVID-19 pandemic.
5. Provide some recommendations and measures for improving the online channels for sales of goods and services enhancing customer experience.

To determine the main factors affecting customer satisfaction, we employed structural equation modeling (SEM). The SEM method tests cause–effect relationships between the variables of interest (latent variables) and their indicators. One of its important parts is its structural component (path model), which shows how the latent variables are related. In comparison with other structural modeling techniques, SEM can estimate complex models with many constructs (including unobserved variables), indicator variables, and structural paths without requirements on input data distribution [25].

The main contribution of the paper is the development of a structural model for evaluation, comparison, and prediction of customer attitudes towards e-commerce during the COVID-19 crisis based on classic and intelligent methods for datasets analysis. The verification results indicate that the obtained model for data exploration objectively assess customers' perceptions for online shopping.

The remainder of this paper is organized as follows: Section 2 introduces some related research on the customer satisfaction in electronic commerce during COVID-19 pandemic. Section 3 describes the problems that need to be solved, puts forward the measurement indicators, and compares them with those from similar previous research. Section 4 analyzes the collected dataset, establishes a mathematical model, and verifies it. The obtained results are compared with those from similar previous studies. Finally, this paper is concluded and research plans are outlined in the last section.

2. Related Work

2.1. Theoretical Foundations

Customer Satisfaction in e-Commerce and Its Measurement

Over the last two decades, the customer attitude to e-commerce has gathered interest from both academic researchers and practitioners engaged in online sales channels. In general, customer satisfaction is a person's feeling of pleasure or disappointment that results from comparing a product's perceived performance (or outcome) to expectations [26].

In e-commerce, customer satisfaction is of critical importance when measuring perceived customer delivered value [27]. Junardi and Sari have stated that e-customer satisfaction is when online purchase experiences exceed customer expectations [28].

Nowadays, the ubiquitous connectivity, the availability of information and knowledge, and online products' offering are forming the tastes, preferences, and even habits of Internet users. This situation further complicates the study of online user behavior and requires exploration of additional dimensions such as brand, user type, or customer situation. There is a plethora of online customer satisfaction metrics, such as churn or retention coefficients, customer service satisfaction, customer effort score, etc. Unfortunately, these measures evaluate only a particular aspect of customer satisfaction. Many researchers have proposed new models trying to overcome this problem. Vasić et al. have developed a theoretical model, consisting of 6 constructs (security, information availability, shipping, quality, pricing, time) and 26 variables. The empirical study has confirmed the research hypothesis that Customer satisfaction in online shopping on the Serbian market directly depends on the six given constructs [29].

Sanyala and Hisamb have analyzed the important factors affecting customer satisfaction for e-commerce, websites, and online purchases in Oman. The research indicated that price (Price and offers), ease of use, and the availability of multiple payment options are important factors that can influence customer satisfaction [18]. This research shows that price has the maximum impact on customer satisfaction, followed by ease of use and multiple payment options. However, the impact of safety and access are not statistically significant.

Wilson and Christella have analyzed the effect of website design, reliability, time saved, product variety and delivery performance towards customer satisfaction in the Indonesian e-commerce industry. The analysis of survey data has revealed that four constructs (reliability, time saved, product variety and delivery performance) have a significant impact on customer satisfaction [17].

In order to determine the level of use and satisfaction of e-commerce customers in the COVID-19 pandemic period, Dirgantari et al. have employed the information system success model (ISSM) approach [30]. SEM results have confirmed the basic research hypotheses that customer satisfaction in online shopping on the Indonesian market depends on the following factors: system quality (adaptivity, availability, reliability, response time, and usability), information quality (completeness, easy of understanding, personalization, relevance, and security), and service quality (assurance, empathy, and responsiveness) [31].

Nguyen has proposed and verified a new SEM model [20] with five main constructs (online shopping experience, customer service, external incentives, security/privacy and personal characteristics) and one outcome construct (customer satisfaction) for the beauty and cosmetics e-commerce sector. The input variables of four input constructs are as follows: online shopping experience with beauty and cosmetics products; ordering, payment method, delivery fulfilment, guarantee, website design, service; price, promotion, product attributes, quality, brand, source of opinion; security and privacy, respectively. The obtained results show that the impact of four input constructs on customer satisfaction are statistically significant.

According to the study [24] by Ha Nam Khanh, the most influential factor on customer satisfaction is reliability, the second most influential factor is customer service, followed by web design and security. In addition, the results show no difference in customer satisfaction according to academic level, but in terms of occupation and income, gender, and age.

Dospinescu et al. have clarified the relevance of eleven factors that influence the satisfaction of e-commerce consumers in Romania and Moldova. The obtained results highlight the eight statistically significant aspects of customer satisfaction: Various payment methods, existing price comparator, product customization, loyalty programs, existing price comparator, existing previous reviews, package opening on delivery, and ease of use of web platform [19].

Liu and Kao have studied the influence of five factors on customer satisfaction in e-shopping of agricultural products: pre-purchase expectation, product quality, brand image,

e-commerce platform, and logistics and distribution using SEM [21]. The results show that product quality, brand image, e-commerce platform, and logistics and distribution have a statistically significant effect on customer satisfaction.

Griva has employed k-means method to create a customer satisfaction model. The author has identified 11 checkouts and 8 aftersales clusters based on product variety; availability; prices; security; usability; product presentation; recommendation likelihood and delivery time; shipping cost; product quality; delivery options; packaging, and customer service respectively [32].

Anh et al. have identified four important factors for customer satisfaction in e-commerce: information quality, product quality, reverse logistics, and perceived price. Delivery service and customer service are not statistically significant factors [33].

The abovementioned studies are based on factors from three seminal works in the area of customer satisfaction in e-commerce—DeLone and McLean (2004) [30], Yoon (2007) [34], and Guo et al. (2012) [35]. The majority of presented studies have applied partial least squares (PLS)-SEM, two models are built using multiple linear regression [18,19,24,35], one study has employed a classic literature review [30], and one study—modern ML technique (k-means) [32]. The main features of the aforementioned models of customer satisfaction are summarized in Table 1.

Table 1. Research comparison of customer satisfaction models.

Reference	Utilized Algorithm	Evaluation Metrics (Number)	Statistically Significant Factors (Number)	R ²
DeLone and McLean 2004 [30]	Literature review	System quality, Information quality, Service quality (3)	System quality, Information quality, Service quality (3)	
Yoon 2007 [34]	PLS-SEM	Customer Service, Fulfillments/Reliability, Product/service portfolio, Ease of use, Security and privacy (5)	Customer Service, Fulfillments/Reliability, Product/service portfolio, Ease of use (4)	0.580
Guo et al., 2012 [35]	MLR	Website design, Security, Information quality, Payment methods, E-service quality, Product quality, Product variety, Delivery services (8)	Website design, Security, Information quality, Payment methods, E-service quality, Product quality, Product variety, Delivery services (8)	0.403
Vasic et al., 2019 [29]	PLS-SEM	Security, Information availability, Shipping, Quality, Price, Time (6)	Security, Information availability, Shipping, Quality, Price, Time (6)	0.724
Sanyala and Hisamb 2019 [18]	MLR	Price and offers, Ease of use, and multiple payment options, Safety, Access (4)	Price and offers, Ease of use, and multiple payment options (2)	0.451
Wilson and Christella 2019 [17]	PLS-SEM	Reliability, Time saved, Product variety, Delivery performance, Website design (5)	Reliability, Time saved, Product variety, Delivery performance (4)	0.657
Dirgantari et al., 2020 [31]	PLS-SEM	System quality, Information quality, Service quality (3)	System quality, Information quality, Service quality (3)	-
Nguyen 2020 [20]	PLS-SEM	Online shopping experience, Seller service, External incentives, Security/privacy, Personal characteristics (5)	Online shopping experience, Seller service, External incentives, Security/privacy (4)	-
Ha Nam Khanh 2020 [24]	MLR	Reliability, Customer service, Web design, Security (3)	Reliability, Customer service, Web design, Security (3)	0.611
Dospinescu et al., 2021 [19]	MLR	In-app after sales services, Periodic notification system, Possibility to cancel the order, Live consultant support, Existing price comparator, Existing previous reviews, Various payment methods, Ease of use of web platform, Package opening on delivery, Product customization, Loyalty programs (11)	Periodic notification system, Existing price comparator, Existing previous reviews, Various payment methods, Ease of use of web platform, Package opening on delivery, Product customization, Loyalty programs (8)	0.799
Liu & Kao 2022 [21]	PLS-SEM	Product quality, Brand image, e-commerce platform, Logistics and distribution, Pre-purchase expectation (5)	Product quality, Brand image, e-commerce platform, Logistics and distribution (4)	-
Griva 2022 [32]	ML	Product variety, Availability, Prices, Security, Usability, Product presentation, Recommendation likelihood (7)	Customers' clusters	
Anh et al., 2022 [33]	PLS-SEM	Delivery service, Information quality, Product quality, Customer service, Reverse logistics, Perceived price (6)	Information quality, Product quality, Reverse logistics, Perceived price (4)	0.818

Notes: 1. The list ordering of evaluation metrics proposed by the authors is preserved. 2. Symbol “-” denotes missing data. 3. R² is the determination coefficient.

The frequencies of constructs in models are as follows: security (6/13), pricing (6/13), information availability (5/13), shipping (logistics and distribution, delivery service, reverse logistics) (5/13), quality (4/13), and time saved (2/13). The efficiency of the proposed models varies from 40.3% [35] to 81.8% [33]. The number of latent variables ranged from 3 to 11, with between 2 and 8 factors being statistically significant.

Despite numerous studies on customer satisfaction in e-commerce, there is a lack of a universally accepted formula for measuring it. In addition, the research referring to the key dimensions of online purchases in the Bulgarian e-market are insufficient and do not consider the changes in consumer behavior and preferences caused by the COVID-19 pandemic.

2.2. Main Factors Affecting Customer Satisfaction in e-Commerce

According to the literature review, the main factors influencing customer satisfaction can be reflected in a theoretical model with six constructs as follows: security and privacy, information availability, shipping, quality, pricing and time saved. The proposed combination integrates both the classic 4Ps marketing elements (product as quality, price, place and promotion as information availability) and several indicators, typical for online shopping (security, shipping, and time saved). In the next subsection, we present the preferred factors in detail.

1. Security and privacy

Cyber security is essential for e-commerce. A security problem in an online business can mean a loss of reputation for the e-store and high customer churn, while in a physical store, theft is limited to stolen items or lack of turnover for the day. The main purpose of security as a key factor for customer satisfaction is to use appropriate technologies to protect customers' personal information and to guarantee that this information is kept confidential and safe during online transactions [36]. In contrary, the lack of upgrades, payment frauds, ransomware, and denial of service (DoS) attacks show the growing danger of security breaches in Internet systems [37] during the COVID-19 pandemic and require urgent measures by online storeowners.

2. Information availability

Visitors arrive at transactional websites either to purchase a specific product or to browse for information. Websites and other e-commerce channels should offer both options [38]. In some modern 3D websites, multi-media and shopping cart functionalities are merged to give the shopper the complete atmosphere of a physical store and its surrounding area [39]. Visual commerce is another technological innovation in online shopping where product presentations involve a variety of interactive content, including augmented reality [40]. Social networks are also an important source of information for e-commerce. Here, individuals and societies communicate by exchanging various types of user-generated content. In addition to being a source of useful market information, social networks are also a feedback source for online retail companies concerning consumer attitudes and preferences [41,42].

3. Shipping

e-commerce shipping encompasses all services required to transport products purchased online from the retailer to the customer's delivery destination on time. Searching for a balance between product price, quality of customer service and delivery time, e-sellers optimize their supply chain in different ways. Some rely on outsourced distribution that maintains the necessary stocks of high demand goods (warehousing services) and have well-functioning logistics channels (logistics services) [43]. Others achieve fast delivery of the purchased goods to the recipients by drop shipping with distribution services at a competitive price [44]. Today's omnichannel commerce puts increasing pressure on retailers in terms of inventory levels, location selection, transportation, and control over warehouse costs.

4. Quality

e-commerce quality is defined, according to Zeithaml et al., as the extent to which the e-shop's internet site allows the consumer to make problem-free purchases in delivering products and services [45]. The basic E-S-QUAL quality model, proposed by Parasuraman et al., is a 22-item scale of four dimensions: efficiency, fulfillment, system availability, and privacy [46]. According to Rita et al., three dimensions of e-service quality, namely, website design, security, and fulfillment affect overall e-service quality. Meanwhile, customer service is not significantly related to overall e-service quality [47].

5. Pricing

The interests of sellers and buyers in pricing are opposite. Therefore, the actual price should be a reasonable compromise between the merchant's offer and the buyer's willingness to pay. Setting the right price for the product affects the overall revenue of the business. According to the research on consumer attitudes towards online commerce of Pragmatica (the market research company), price is one of the leading criteria in online store selection. According to the respondents, the low price is the most important element of their ideal online store [48]. Ali et al. have established that perceived price and delivery quality have a significant impact on perceived value, and perceived value has a significant impact on repurchase intention [49].

6. Saving Time

Customers prefer e-transactions because of the convenience of the shopping process, thus, reducing the inconvenience of traveling to high street stores and eliminating congestion in crowded city areas. The researchers emphasize that convenience is not only physical rest but also the main factor of time, where the customer can place an order for a product on the Internet at any time [50]. According to the study on consumer preferences for online shopping of Pragmatica, time is the most important factor in online shopping (59%) [48].

The abovementioned indicators reflect different aspects of consumer behavior. A holistic approach was used to explore the role of these main factors affecting customer satisfaction. The degree of their influence varies and depends on many external parameters including characteristics of business environment. By harnessing these factors, online retailers can provide consistent customer experiences and create long-lasting customer loyalty.

3. Research Methodology

3.1. Questionnaire Design and Data Collection

The survey method was considered the most appropriate method in this study because it is objective and not expensive, the target audience is geographically dispersed, and the researchers can communicate with the respondents using online communications. We have created an online questionnaire to register data on customer attitudes to e-commerce during the COVID-19 pandemic. The questionnaire was developed using previous theoretical and applied studies on customer satisfaction [30,34,35]. The design of the questionnaire is similar to that proposed by Vasic et al. [29]. As this research concerns the pre-COVID-19 period, some questions about the impact of the pandemic on customer behavior were additionally included using business managers' suggestions [51]. The information about this research with a link to the online questionnaire was distributed to the potential respondents using different online channels.

3.2. Measurements and Scales

A significant part (8 out of 21) of the questionnaire is "multiple choice grid" questions with a five-point Likert scale (ratings ranging from "Strongly disagree" to "Strongly agree"). Another part (10 out of 21) is presented through "multiple choice" questions and a Likert scale, three questions require plain text in text fields ("paragraph" type in Google Forms), and one question is formulated using checkboxes.

3.3. Data Analysis Methods

The existing methods for analysis of customer satisfaction data could be divided into three main groups: classic statistical methods, intelligent statistical methods, and hybrid methods combining methods from the two abovementioned groups.

To measure objects' properties (descriptive statistics) and sustainability; summarize and visualize main characteristics (exploratory data analysis); and test the relationship between items, groups of items, and datasets, we employed traditional statistical methods. For the analysis of collected customers' datasets, we utilized analysis of variances (ANOVA), chi-squared test, correlation analysis, Student's t-test, factor analysis, and regression analysis.

To reveal hidden relationships between variables, we applied modern ML methods—SEM, cluster analysis, and sentiment analysis. SEM is one of the most widely used methodologies to study systems whose parameters cannot be evaluated directly. As a set of statistical techniques, SEM can test research hypotheses to measure and analyze the relationships of observed and latent variables. Similar but more powerful than regression analysis, it examines linear causal relationships among variables, while simultaneously accounting for measurement error [52].

In this study, we employed PLS-SEM to design a structural regression model, which quantifies the strength of factors affecting consumer behavior. PLS-SEM as a structural regression method encompasses a set of statistical methods such as correlation and confirmatory analysis. The advantages of the PLS-SEM method in comparison with other existing methods for hierarchical structural modeling are as follows:

1. The method is strictly based on data structure.
2. It overcomes the multicollinearity problem.
3. Several output variables can be represented simultaneously, taking into account their inner structure.
4. The obtained models can be interpreted easily, as they are presented graphically [53].

4. Data Analysis

To demonstrate the proposed methodology for the processing of the dataset for customer satisfaction data, a list of tasks was formulated and solved.

Task 1. Collect data from an online survey concerning customer opinions about the impact of customer satisfaction from the e-buying process during the COVID-19 pandemic.

Solution

Customers' data collection

A link to the online survey was shared through partners' websites, social media (Facebook groups), and email. The respondents were Bulgarian online customers who filled out the questionnaire (voluntary response sample). The questionnaire was designed using Google forms and contained 21 questions to measure the customers' perceptions about the variables used in the study [51]. The data about the attitude to e-commerce were collected during the period from 17 March to 30 June 2022. The questionnaire was correctly filled in by 207 respondents. However, 27 observations should be omitted since these respondents do not shop online (Question #7). A duplicate check has shown that there are no identical values in the dataset rows (Figure 1).

In Figure 1, the closer distance means the smaller difference between the individuals. The degree of similarity is visualized with different colors: from full coincidence (0—blue color) to maximum difference (10—orange color). There are no duplicate records in the dataset, and all records will participate in the further analysis. To build the dissimilarity matrix, we have applied the `fviz_dist` function in R programming language.

Data storage

The collected survey data are available online in a data repository [51].

Data coding

The coding scheme and coded data are also accessible online. Out of all 21 answers, 18 are coded [51]. The rest of the answers (respondent's municipality, preferred websites for

e-buying, and experience in e-commerce during COVID-19 pandemic) are stored in their original form for further processing.

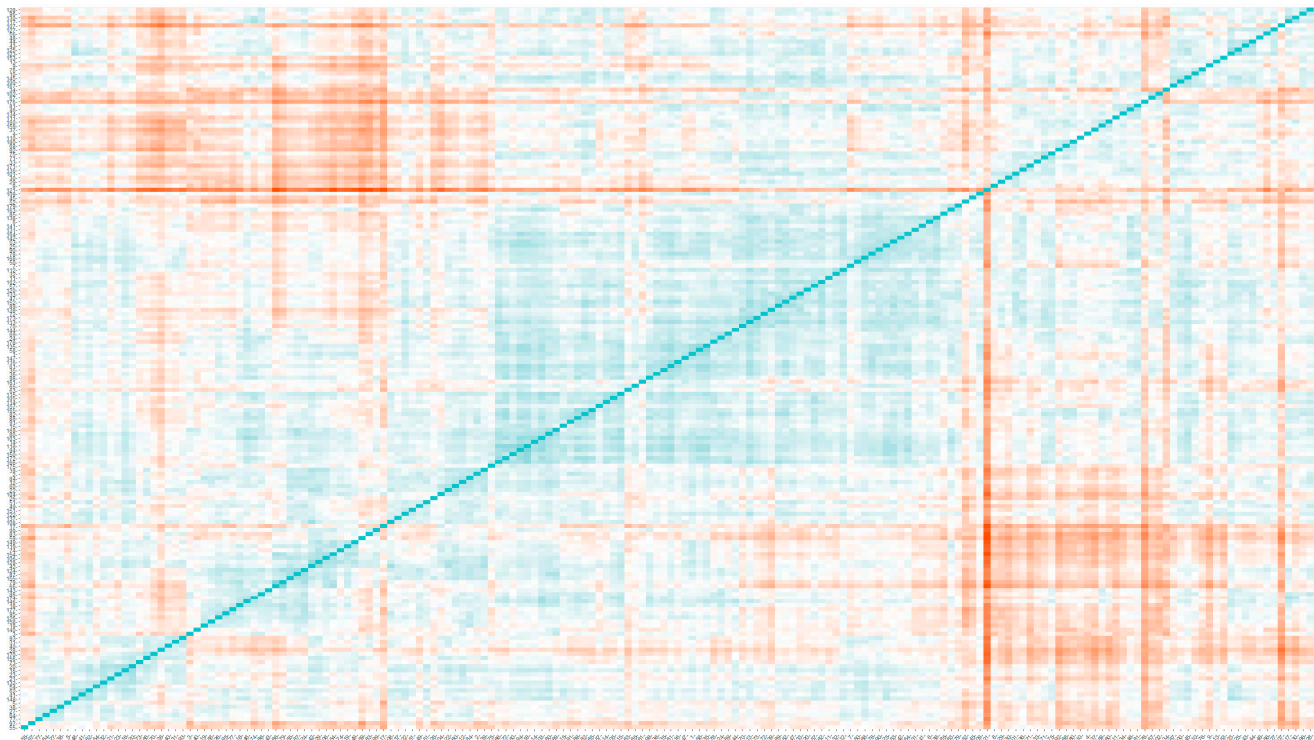


Figure 1. The matrix of distances between respondents' answers.

Task 2. Determine the main characteristics of survey respondents.

Solution

To clarify the profile of survey respondents, we performed data pre-processing and traditional statistical analysis (percentage distribution of responses, descriptive statistics, and correlation analysis).

Main Characteristics of Respondents in the Sample

Table 2 displays the profile of the survey participants. A significant part of the respondents was female (73%) (Question #1). Of the 207 respondents, almost 70% were under the age of 40 (Question #2). The sample was dominated by respondents with at least a university degree (65.2%) (Question #3) and living in urban areas (92.27%) (Question #4).

Table 2. Profile of customers in sample ($n = 180$).

Variables of the Sample		No. of Consumers	Percentage (%)
1. Gender	Male	56	27.05
	Female	151	72.95
2. Age	Under 20	38	18.36
	Between 21 and 30	71	34.30
	Between 31 and 40	35	16.91
	Between 41 and 50	40	19.32
	Over 50	23	11.11
3. Education	Elementary school		
	Secondary school		
	Polytechnic school	70	33.82
	University	66	31.88
4. Place of residence	Master and Doctoral studies	71	34.30
	Town	191	92.27
	Village	16	7.73

Table 2. Cont.

Variables of the Sample		No. of Consumers	Percentage (%)
5. Municipality/Province		-	-
6. Frequency of Internet usage per day	Less than 1 h	14	6.76
	1–2 h	38	18.36
	2–3 h	49	23.67
	3–4 h	38	18.36
	More than 4 h	68	32.85
7. Do you shop online?	Yes	180	86.96
	No	27	10.04
8. Maximum amount per purchase	Less than 20 BGN	2	1.11
	From 20 to 50 BGN	27	15.00
	From 50 to 100 BGN	54	30.00
	From 100 to 200 BGN	38	21.11
	More than 200 BGN	59	32.78
9. Maximum amount per year	Less than 100 BGN	11	6.11
	From 100 to 200 BGN	33	18.33
	From 200 to 500 BGN	62	34.44
	More than 500 BGN	74	41.11
10. List of most frequently used online shopping websites	Site 1	56	31.11
	Site 2	7	3.89
	Site 3	18	10.00
	Site 4	20	11.11
	Site 5	107	59.44
	Site 6	39	21.67
	Site 7	5	2.78
	Site 8	6	3.33
	Site 9	53	29.44
	Site 10	53	29.44
	Site 11	8	4.44
11. Preferred payment method	Miscellaneous	55	30.56
	Cash on delivery	126	71.11
	Debit card	39	21.67
	Credit card	13	7.22
12. Expenses to pay at delivery	Bank transfer	2	1.11
	I always decide for the product with the free shipping option	46	25.56
	I always decide for the reduced product shipping rate, so I believe to be given the best price for both the product and the delivery	26	14.44
	I am willing to pay any product delivery expense which makes my total purchase pricing the lowest	108	60.00
13.1. Maximum shipping time (domestic)	3 days	142	78.89
	4 days	16	8.89
	5 days	14	7.78
	1 week	8	4.44
	More than 1 week	-	-
13.2. Maximum shipping time (international)	3 days	3	1.67
	4 days	2	1.11
	5 days	24	13.33
	1 week	103	57.22
	More than 1 week	48	26.67

The distribution of participants by geographical districts and regions shows that the greatest share of respondents was from the Plovdiv district (54.6%), followed by Pazardzhik (11.1%) and Haskovo (7.7%), and the South Central region (81.2%), followed by the South Eastern region (7.7%) (Question #5).

The top three of the most visited international websites for online shopping include Site #1 (AliExpress.com)—56 (31.11%), Site #3 (eBay.com)—20 (11.11%), and Site #2 (Amazon.com)—18 (10.00%). The most widely used Bulgarian e-commerce websites are the following: Site #5 (eMAG.bg)—107 (59.44%), Site #9 (SportDepot.bg)—53 (29.44%), and Site #10 (FashionDays.bg)—53 (29.44%). There is increased interest in food, non-prescription medicine, and nutritional supplements websites: Site #11—Remedium.bg, Site #7—eBag.bg, and Site #8—Glovo.bg (Question #10). Without a doubt, the pandemic has increased the sales of the biggest online retailers and websites for over-the-counter drugs and food delivery.

For more than 70% of the participants, cash on delivery is a preferred method of payment. Almost 1/3 of respondents pay with a debit or credit card (Question #11). In recent years, the number of users paying with credit cards has slightly increased. One of the reasons for such an increase in credit card payments is the fact that most of the banks have a mandatory “credit card” option when taking out a loan. Only 2% of respondents use bank transfer. This ratio is completely different from the situation in developed countries, for example, the United States, where payment cards (credit or debit) are utilized by 78% of the online shoppers, with the most popular online payment alternative being PayPal [5]. This ratio is similar to the ratio of the world as a whole [54].

Feature selection

To visualize the attitudes of participants to online shopping, we have employed the hierarchical clustering (heat map) method. Figures 2 and 3 depict the similarity between customers’ opinions and attributes (variables) respectively. To create heat maps, we have applied Orange 3.22 software.

Task 3. Identify groups of consumers who share similar buying characteristics and groups of variables with a similar impact on customer attitudes and opinions.

Solution

The solution to Task 3 was found using the k-means method for cluster analysis. To determine the optimal number of clusters, we employed the Silhouette method, and the result revealed that the optimal number of clusters is two. As can be seen in Figure 4, when $k = 2$, there is no overlap between clusters. This means that the k-means method offers a feasible solution to the problem of identifying clusters of online shoppers with a similar attitude to e-commerce during the COVID-19 pandemic.

The first cluster consists of 115 “dissatisfied” customers—with lower ratings on customer satisfaction (Question #20) (Table 3). Indicators with the strongest influence on overall dissatisfaction were price (Question #15), quality (Question #16), time (Question #18), and information availability (Question #19). Information availability and time requirements are the most significant factors for the dissatisfaction of the first group of users. In contrast, the consumers from the second cluster demonstrate greater satisfaction in online shopping. In Table 3, the average estimates of indicators for two clusters, as well as the absolute differences between these estimates, are also depicted.

Task 4. Build customer satisfaction model and verify it.

Solution

According to the previous research (Section 2), there is no consensus on what should be considered inputs and outputs when evaluating consumer satisfaction in e-commerce purchases. In order to solve this problem, we employed iteratively the PLS-SEM method in SmartPLS software [55].

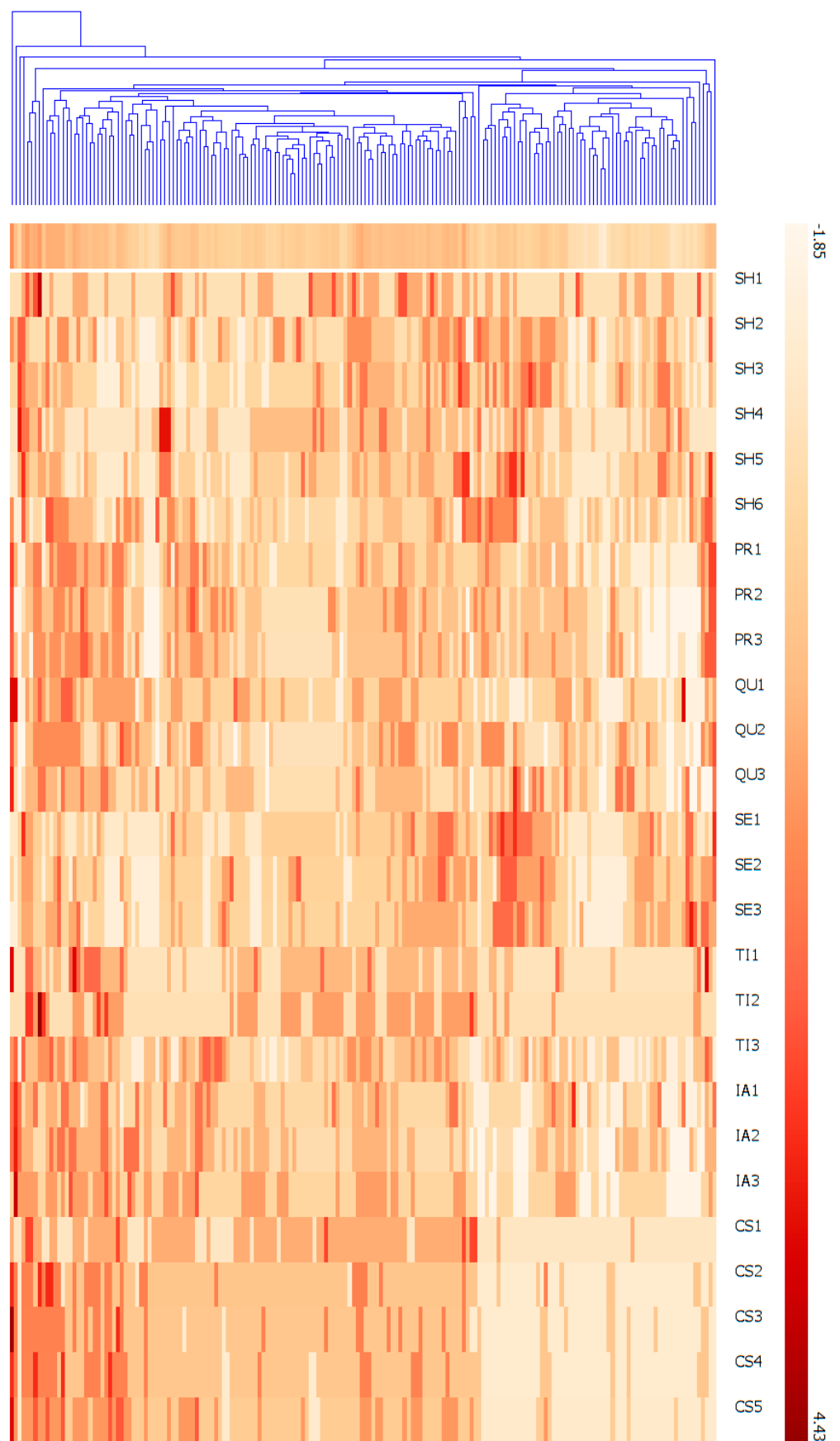


Figure 2. Hierarchical group heat map by customers.

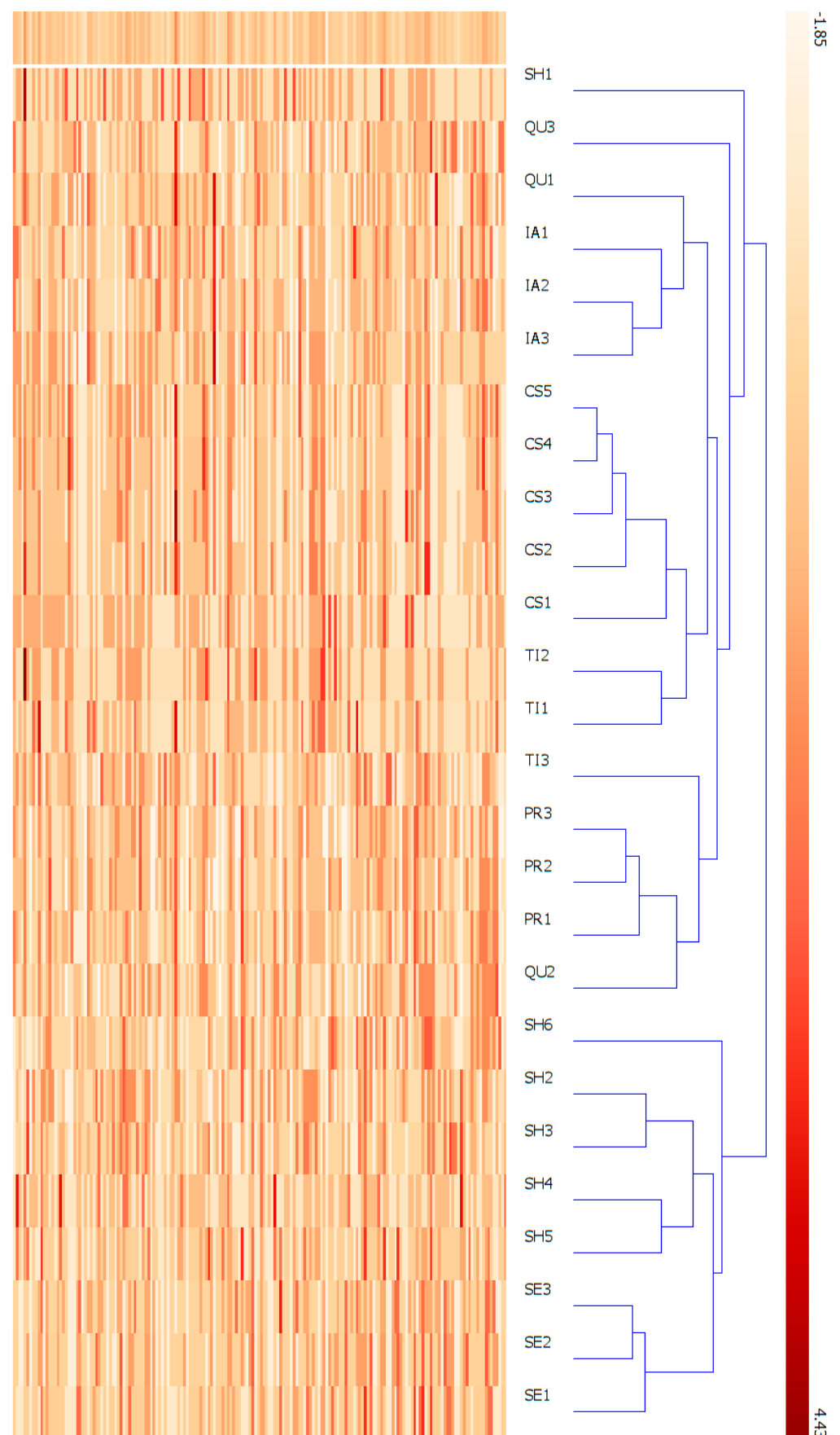


Figure 3. Hierarchical group heat map by variables.

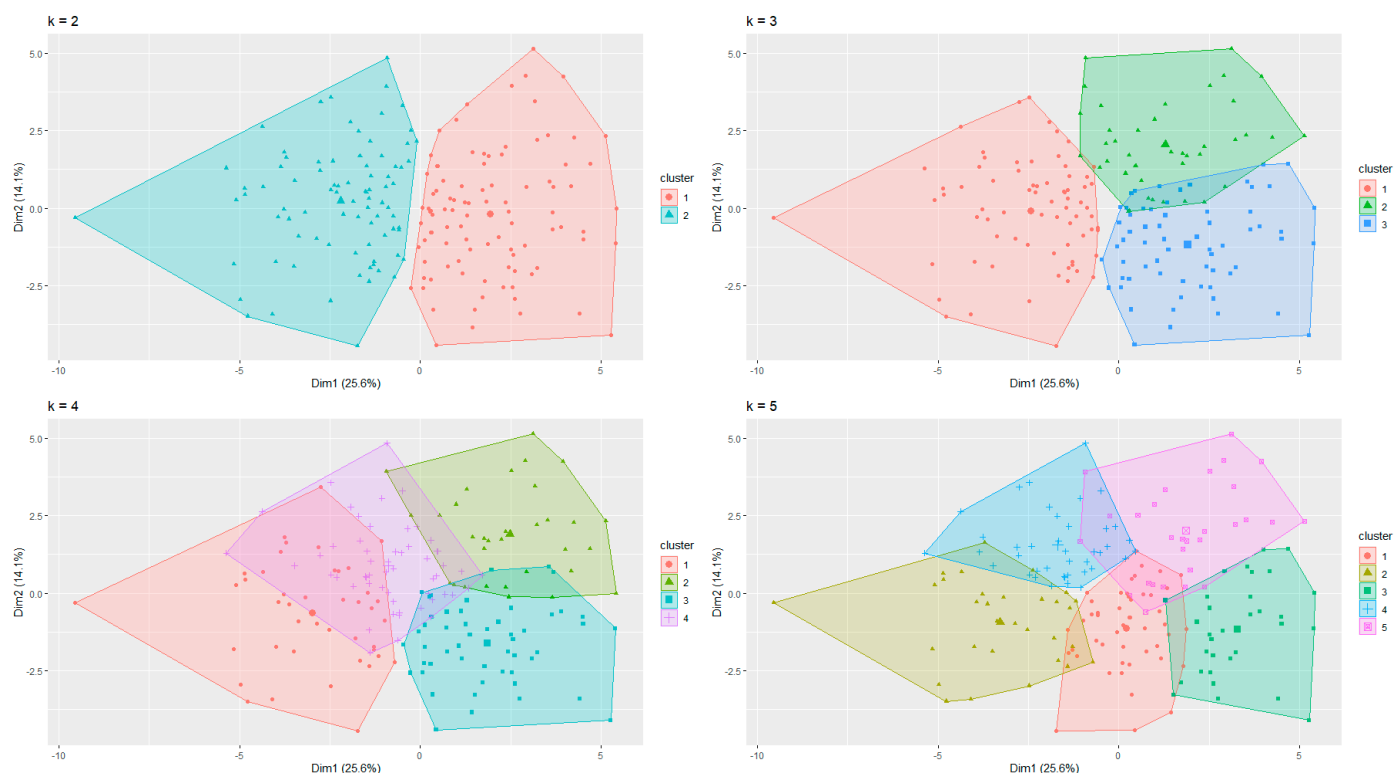


Figure 4. Customer clusters by k-means ($k = 2, 3, 4, 5$).

The algorithm for constructing a structural regression consists of the following steps:
 Step 1. Formulation of hypotheses about latent variables and the relationships between them.

Step 2. Determination of indicators for latent variables.

Step 3. Numerical modeling and assessment of model quality.

Step 4. Examining model fit. If the model fits the data, then go to Step 5, else go to Step 3 to improve the model.

Step 5. Interpretation of obtained results.

Step 1. Hypotheses creation about latent variables and the relationships between them.

Based on the synthesis and comparison of existing models for customer satisfaction (Table 1), the research hypotheses in this study are as follows [29]:

H₁: There is a significant impact of security on customer Satisfaction.

H₂: There is a significant impact of information availability on customer satisfaction.

H₃: There is a significant impact of shipping on customer satisfaction.

H₄: There is a significant impact of quality on customer satisfaction.

H₅: There is a significant impact of price on customer satisfaction.

H₆: There is a significant impact of time on customer satisfaction.

H₇: Demographic characteristics have a statistically significant impact on customer satisfaction.

Note: The demographic characteristics include gender, age, educational level, and residence.

Step 2. Determination of indicators for latent variables.

Indicators of latent variables are available in the survey questionnaire—7 constructs with 26 indicator variables [51]. The measurement model consists of 21 input indicator variables: SE1, SE2, SE3 from the latent variable security (SE); IA1, IA2, IA3—from information availability (IA); SH1, SH2, SH3, SH4, SH5, SH6—from latent variable shipping (SH); QU1, QU2, QU3—from latent variable quality (QU); PR1, PR2, PR3—from latent variable price (PR); TI1, TI2, TI3—from latent variable time (TI) and 5 output indicator variables CS1, CS2, CS3, CS4, CS5—from output variable customer satisfaction (CS), represented in Figure 5.

Table 3. Average values by clusters and absolute differences between clusters by indicators.

	SH1	SH2	SH3	SH4	SH5	SH6	PR1	PR2	PR3
Cluster #1	1.600	2.609	2.243	1.757	2.139	2.470	2.600	2.948	2.948
Cluster #2	1.277	2.769	2.508	1.554	2.154	2.523	1.954	2.354	2.462
Difference	0.323	−0.161	−0.264	0.203	−0.015	−0.054	0.646	0.594	0.486
	QU1	QU2	QU3	SE1	SE2	SE3	TI1	TI2	TI3
Cluster #1	2.452	2.878	2.574	2.035	2.157	2.183	1.791	1.609	2.887
Cluster #2	1.831	2.492	2.415	2.185	2.215	2.431	1.231	1.062	2.185
Difference	0.621	0.386	0.159	−0.150	−0.059	−0.248	0.561	0.547	0.702
	IA1	IA2	IA3	CS1	CS2	CS3	CS4	CS5	
Cluster #1	2.635	2.713	2.539	1.835	2.226	2.235	2.261	2.461	
Cluster #2	1.938	2.031	1.738	1.062	1.246	1.246	1.200	1.231	
Difference	0.696	0.682	0.801	0.773	0.980	0.989	1.061	1.230	

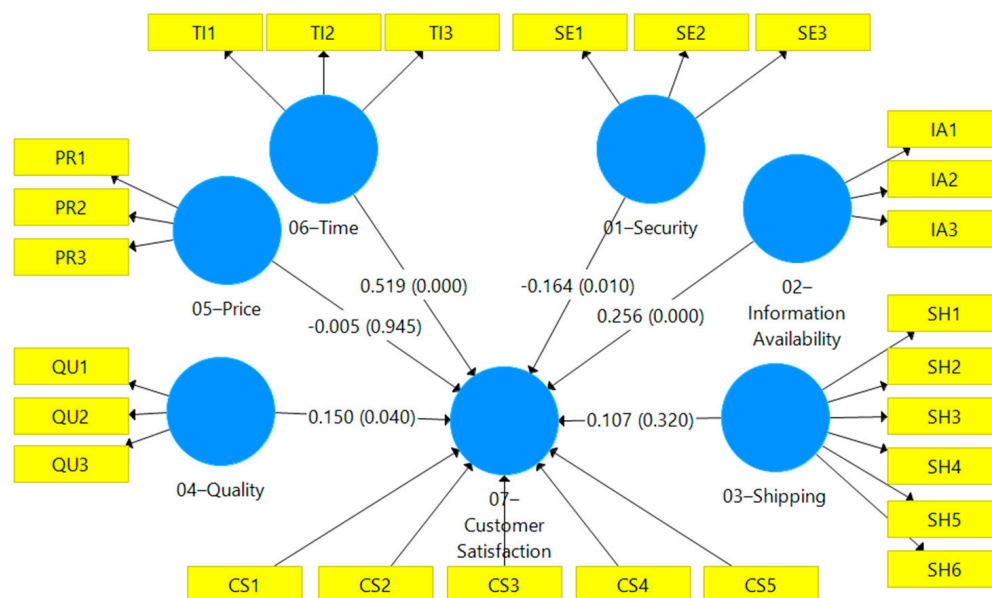
Step 3. Numerical modeling and assessment of model quality.

The PLS algorithm was employed, and model parameters were calculated.

Step 4. Examining model fit. If the model fits the data, then go to Step 5, else go to Step 3

The assessment of path coefficients shows that the model does not fit well, since *p*-values of shipping and price, 0.311 and 0.947, respectively, lie out of their acceptable limits (Figure 5). Therefore, the process goes back to Step 3, where the model settings are changed by removing the two constructs (shipping and price).

As *p*-values of path coefficients (Step 4) of the new model are correct, the examination continues with establishing the construct reliability and validity.

**Figure 5.** Measurement model with six latent variables with their path coefficients and *p*-values.

Validity and Reliability

The first part of the validity check is to assess the measurement and structural models. The measurement model establishes the validity and reliability of the construct. Its assessment consists of the evaluation of construct reliability, indicator reliability, convergent validity, and discriminant validity of the obtained components (endogenous and exogenous constructs). The structural model measures the significance of hypothesized relationships.

Factor Loadings

Factor loadings show “the extent to which each of the items in the correlation matrix correlates with the given principal component. Factor loadings can range from -1.0 to $+1.0$, with higher absolute value indicating a higher correlation of the item with the underlying factor” [56]. All items in the study had factors higher than the recommended value of 0.5 [57]. Factor loadings are depicted on Figure 6 and Table 4.

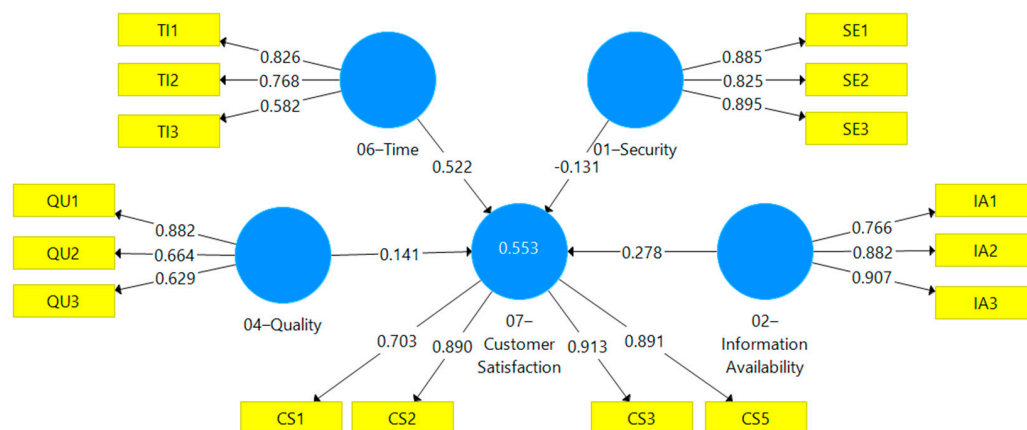


Figure 6. The SEM procedure’s result, the regression coefficient for each construct and coefficient of determination.

Table 4. Factor loadings and multicollinearity statistics (VIF) for indicators.

Indicator Variable	Factor Loading	Indicator Variable	Factor Loading	Indicator Variable	VIF	Indicator Variable	VIF
SE1	0.885	TI1	0.826	SE1	1.908	TI1	1.501
SE2	0.825	TI2	0.768	SE2	2.326	TI2	1.425
SE3	0.895	TI3	0.582	SE3	2.080	TI3	1.064
IA1	0.766	CS1	0.702	IA1	1.544	CS1	1.470
IA2	0.882	CS2	0.890	IA2	2.150	CS2	2.673
IA3	0.907	CS3	0.913	IA3	2.068	CS3	3.314
QU1	0.882	CS5	0.891	QU1	1.205	CS5	2.820
QU2	0.664			QU2	1.204		
QU3	0.629			QU3	1.194		

Indicator Multicollinearity

The variance inflation factor (VIF) statistic is utilized to access multicollinearity in the indicators [58]. Multicollinearity is acceptable if the value for VIF is below 5. Table 3 presents the VIF values for the indicators and reveals that the VIF for each indicator is below the recommended threshold.

Reliability Analysis

The two most used methods for establishing construct reliability (repeatability) include Dillon–Goldstein’s rho (DG rho, rho_A in SmartPLS) and composite reliability (CR). The criterion is that the DG rho and CR values should exceed 0.7 to indicate adequate reliability of the construct [57]. The measurement model results (Table 4) have shown that the DG rho and CR values were greater than 0.7, thus, confirming adequate construct reliability. The DG rho ranged from 0.560 to 0.912 whereas CR ranged from 0.773 to 0.914. Both indicators of reliability have reliability statistics over the required threshold, except the time construct, whose value is slightly lower than the threshold. Hence, the construct reliability is established. As a result, the DG rho and CR values for all factors in this study are acceptable.

Construct Validity

The construct validity is established when there is convergent validity and discriminant validity.

Convergent Validity

Convergent validity is the degree of agreement between multiple attempts to measure the same concept. The convergent validity of the construct was determined using average variance extracted (AVE), which should exceed 0.5 [58]. Since the result revealed that all constructs had substantial AVE, the convergent validity of constructs for this study was verified. The values of DG rho, CR, and AVE are depicted in Table 5.

Table 5. Construct reliability (DG rho and CR) and convergent validity (AVE).

Factor	DG rho	CR	AVE
Security	0.912 *	0.902 *	0.755 *
Information Availability	0.868 *	0.889 *	0.729 *
Quality	0.737 *	0.773 *	0.538 *
Time	0.560	0.773 *	0.537 *
Customer Satisfaction	0.897 *	0.914 *	0.729 *

* DG rho: Dillon–Goldstein’s rho, CR: Composite reliability (>0.6); * AVE: Average variance extracted (>0.5).

Discriminant Validity

Discriminant validity is the degree of distinction between measures of different concepts. Fornell and Larker Criterion

According to the Fornell and Larker criterion [59], discriminant validity is established when the square root of AVE for a construct is greater than its correlation with all other constructs. The obtained results show that square root of AVE (in italics) for each construct are greater than its correlation with other constructs (Table 6), hence, providing strong support for establishment of discriminant validity.

Table 6. Discriminant validity—Fornell and Larker criterion.

Factor	Security	Information Availability	Quality	Time	Customer Satisfaction
Security	<i>0.869</i>				
Information Availability	−0.161	<i>0.854</i>			
Quality	−0.104	0.492	<i>0.734</i>		
Time	0.039	0.265	0.273	<i>0.733</i>	
Customer Satisfaction	−0.171	0.507	0.434	0.629	<i>0.854</i>

Note: Italics represent the square root of AVE.

Cross Loadings

Cross loadings are used to test whether an item belonging to a particular construct loads strongly onto its own parent construct or onto other constructs in the model. Table 7 indicates that factor loadings of all items are greater (in italics) on the underlying construct to which they belong rather than on other constructs. Hence, based on the evaluation of cross loadings, discriminant validity is attained.

Heterotrait-Monotrait Ratio (HTMT)

HTMT is based on the estimation of the correlation between the constructs. Discriminant validity is established based on the HTMT ratio. The threshold for HTMT varies in the existing literature between 0.85 and 0.9. The HTMT results (Table 8) show that the HTMT ration for the constructs (except Time) is less than the required threshold of 0.9. The value of the time construct lies almost on the threshold and could be considered statistically significant.

Table 7. Discriminant validity—cross loadings.

Indicator Variable	Security	Information Availability	Quality	Time	Customer Satisfaction
SE1	0.885	−0.163	−0.068	−0.046	−0.165
SE2	0.825	−0.134	−0.075	0.088	−0.061
SE3	0.895	−0.125	−0.120	0.094	−0.168
IA1	−0.095	0.766	0.405	0.187	0.322
IA2	−0.109	0.882	0.457	0.175	0.412
IA3	−0.190	0.907	0.412	0.297	0.529
QU1	−0.205	0.500	0.882	0.251	0.447
QU2	0.087	0.308	0.664	0.198	0.227
QU3	0.014	0.183	0.629	0.129	0.198
TI1	0.010	0.218	0.198	0.826	0.462
TI2	0.027	0.106	0.166	0.768	0.480
TI3	0.050	0.265	0.237	0.583	0.431
CS1	−0.037	0.254	0.145	0.481	0.703
CS2	−0.167	0.455	0.367	0.602	0.890
CS3	−0.206	0.478	0.471	0.552	0.913
CS5	−0.142	0.506	0.443	0.513	0.891

Table 8. Discriminant validity—HTMT.

Factor	Security	Information Availability	Quality	Time	Customer Satisfaction
Security					
Information Availability	0.185				
Quality	0.206	0.639			
Time	0.136	0.400	0.454		
Customer Satisfaction	0.174	0.570	0.516	0.910	

Path Coefficients and evaluation of the structural model—hypotheses testing

The p -value of each pair of constructs is lower than 5% (for security and quality) or 1% (information availability and time), which suggests a strong effect on customer satisfaction (Figure 7 and Table 9). These results are consistent with our hypotheses and previous studies. All regression coefficients are positive, except that for security. The R^2 is 0.553, which means that approximately 55% of variance of customer satisfaction with e-commerce websites can be explained by the predictor variables security, information availability, quality and time. The remaining part is explained by various other factors.

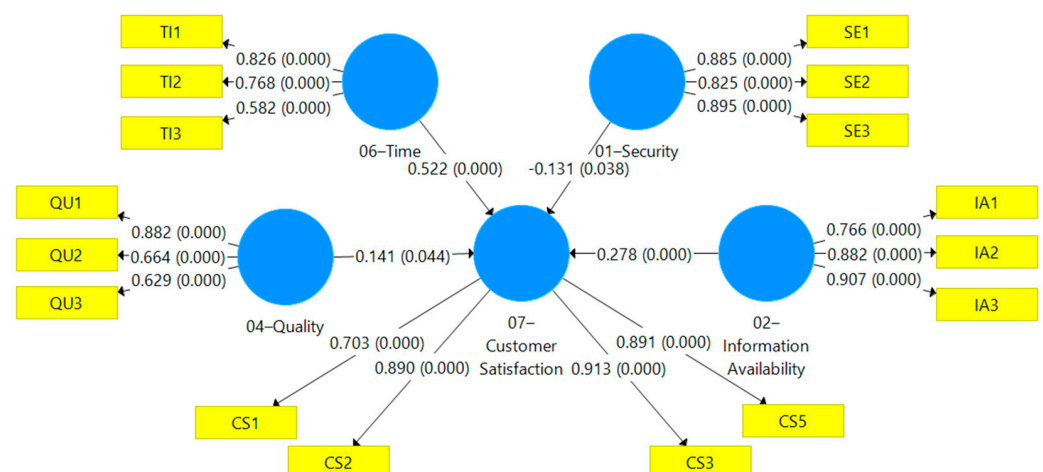
**Figure 7.** Path coefficients and p -values—inner and outer model.

Table 9. The path coefficient of relationship between latent variables.

Hypothesis	β	Sample mean	Mean	SD	t Statistics	p Values	R ²	f ²	Decision	Q ²
Security -> Customer Satisfaction	−0.131	−0.131	−0.131	0.064	2.060	0.038	0.553	0.037	Accept	0.390
Information Availability -> Customer Satisfaction	0.278	0.278	0.283	0.064	4.373	0.000		0.126	Accept	
Quality -> Customer Satisfaction	0.141	0.141	0.143	0.070	2.027	0.044		0.033	Accept	
Time -> Customer Satisfaction	0.522	0.522	0.522	0.046	11.365	0.000		0.545	Accept	

At the structural model level, the SE → CS and QU → CS pathways have a weak effect, while the relationships IA → CS and TI → CS have a moderate influence. According to the Q Square value, the model has a good prediction (Q Square is more than zero).

Step 5. Interpretation of obtained results.

The result of H₁ testing, which is the effect of security, shows that cyber security measures can increase user satisfaction ($\beta = -0.131$, $p < 0.05$). During the pandemic, many Internet users are spending more hours online for work and social interaction, which means that they are more vulnerable to cyber threats. Despite the large number of cyber threats (financial frauds, phishing, DoS attacks, etc.) in e-commerce, the security has the lowest (negative) impact on customer satisfaction. Multi-factor payment authorization and a relatively small share of credit card holders minimize the safety risks of online shopping.

The effect of information availability (H₂) shows that the available information can increase customer satisfaction ($\beta = 0.278$, $p < 0.001$). The customer online buying process is a complex information extensive process of multi-attribute decision-making. A consumer needs to understand all the options in the online market before making an informed decision. By understanding buyer's needs and preferences during the pandemic, businesses can set up the most adequate way to present their products and services, especially food, personal care and health products, entertainment products, and communication technology goods.

Hypothesis three (H₃) results concerning the effect of shipping on user satisfaction shows that shipping has no impact on user satisfaction (Figure 5, *path coefficient* = 0.107, $p = 0.320$). Often extra fees (taxes and shipping costs) make online transactions disappointing from the customer perspective. Additionally, the coronavirus pandemic exacerbated disruptions along the supply chains. To overcome these disadvantages of online purchases, many e-buyers prefer free shipping deals. Additionally, the pandemic has created a spike in last-mile delivery. This result is in accordance with the survey's outcome that 40% of survey participants prefer free or reduced shipping rates. Therefore, there is no surprise that shipping is an unimportant factor for e-customer satisfaction during the pandemic.

According to the H₄ testing, the quality has a positive effect on customer satisfaction with $\beta = 0.141$, $p < 0.001$. These values point out that during the pandemic, consumers were not inclined to compromise on the quality of the purchased goods and services.

The test of hypothesis H₅ concerning the effect of price leads to the conclusion that the price does not have a statistically significant impact on customer satisfaction (Figure 5, *path coefficient* = −0.005, $p = 0.945$). For online customers, the price does not matter in case of urgent product need. From the other side, online sellers employ different techniques (one-time promotions, flexible payment terms, or credit for future purchases) to meet their near-term needs while providing flexibility for the buyers.

Regarding the test of hypothesis H₆ concerning the impact of the time construct on customer satisfaction, the estimates are as follows: $\beta = 0.522$, $p < 0.05$. The effective time management is very important, especially when working remotely, and not surprisingly, the saved time is an important factor for online consumers.

The obtained results show a positive effect of the model constructs on customer buying process: Information availability and quality are associated with the information gathering and evaluation of alternatives stages, while security and time saved are linked with selecting an option and implementing the decision.

Additionally, the obtained results exhibit that in both cases—before and during a pandemic—the essential factors for customer satisfaction are information availability [29,31,33,35] and time saved [17,29]. The influence of factors quality [21,29,33,35] and security [20,24,29,32,35] also remains significant. While in the pre-pandemic period, price [19,20,29,32,33] and shipping [19–21,29,35] are determinants for inclusion in online transactions, in the pandemics—their influence is reducing.

The limitations of our study are as follows: (1) the subject of our study refers only to a part of the online e-commerce—e-retail industry; (2) the size of the sample is relatively small, and (3) the numbers of male and female participants are not equal. In addition, some factors (for example psychological characteristics and monetary costs) are missing from the model. Furthermore, our research was conducted only on the Bulgarian market; therefore, its findings may be not generalized for other countries. The data are collected from a third party (research university) instead from reports of e-commerce organizations.

Future research can expand the gained results including other markets and particular sectors of retail industry. As the proposed SEM model does not represent the whole picture, in future studies, more perspectives should be included.

Based on the obtained results, some suggested managerial implications for companies selling their production on electronic market are as follows: (1) harmonize the relationships between stakeholders in the supply chain; (2) create an integrated scheduling system for advance planning; (3) implement adaptive marketing strategies; (4) improve consumer database through regular data inputs; (5) and increase customer satisfaction including a broader set of determinants. The proposed approach for analyzing customer satisfaction should be applied periodically by companies. In this way, trends will be revealed in a timely manner and organizations will be able to react quickly even to circumstances beyond their direct control, such as negative reviews on social media.

5. Conclusions and Future Research

The strong competition in the retail industry forces companies to search for new ways to attract new users online and convert them into loyal customers. The COVID-19 pandemic has further strengthened the role of customer satisfaction in e-retail, as consumer preferences and expectations have undergone significant changes during the pandemic.

In the study, we employed customer data to develop and verify a new model, revealing dependencies in consumer perception and attitude towards online shopping, identifying good practices, and proposing measures for customer satisfaction in e-commerce.

The proposed model was applied to study the effect of the COVID-19 pandemic on the online shopping of Bulgarian consumers. Our research shows that information availability and time saved are the most significant factors for the satisfaction of e-commerce users in pandemic times.

The obtained results could be summarized as follows:

- A dataset was collected via an online survey of customer opinions concerning the impact of customer satisfaction on the e-buying process during the COVID-19 pandemic.
- According to the demographic analysis of the survey data, 92% of respondents originated from an urban residential area, 34% were under the age of 30, 73% were female, and 33% declared Internet usage more than 4 h daily. According to their educational level, the respondents formed three approximately equal sized groups (high school, bachelor's degree, and master and doctoral studies). A significant percent of respondents reported a relatively high amount spent per one online purchase (33%) and per year (75%). The sentiment analysis of customer opinions shows that the majority (86%) demonstrates a positive attitude to online shopping as a measure for coping with the COVID-19 health crisis.

- The customers were grouped into two statistically significant clusters with the main differences in information availability, time saved, price and quality.
- According to the obtained theoretical causal (SEM) model, hypotheses' testing showed that H_1 , H_2 , H_4 , and H_6 , assuming a significant impact on security, information availability, quality and Time on customer satisfaction in e-commerce were correct. Conversely, the hypotheses H_3 and H_5 were false, i.e., the constructs shipping and price do not affect online customer satisfaction. The testing of H_7 showed that there are no differentiations in customer satisfaction depending on demographic factors (age, gender, education level and area of residence).

In the future, we plan to: (1) extend the set of participants in our survey on online shopping during coronavirus pandemic; (2) compare the obtained results with those from similar studies from other countries by different attributes (age, academic degree, and region); (3) shed light on changes and the evolution of e-commerce in the time of COVID-19. Further analysis can also be carried out on implementation of fuzzy multi-criteria decision-making methods to find out multi-attribute cause-effect relationships between factors influencing customer satisfaction in e-commerce.

Author Contributions: Conceptualization, G.I., Y.D., S.K. and T.Y.; modeling, G.I., T.Y. and S.K.; validation, G.I. and T.Y.; formal analysis, T.Y.; resources, G.I., T.Y., Y.D. and S.K.; writing—original draft preparation, G.I.; writing—review and editing, G.I., Y.D. and T.Y.; visualization, T.Y. and S.K.; supervision, G.I.; project administration, Y.D.; funding acquisition, G.I., S.K., T.Y. and Y.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the University of Plovdiv, Grant No. YS21-FISN-020 'Integrated experimental approach to study the relationship between higher education and business organizations', by the National Research Programme 'Young Scientists and Post-Doctoral Researchers-2' (YSPDR-2), Grant No. YSPD-FESS-021 and by the Ministry of Education and Science and by the National Science Fund, co-founded by the European Regional Development Fund, Grant No. BG05M2OP001-1.002-0002 'Digitization of the Economy in Big Data Environment'.

Data Availability Statement: The data stored as csv and pdf files are publicly available at <http://dx.doi.org/10.17632/7jt3889sz3.1> (accessed on 13 October 2022).

Acknowledgments: The authors thank the academic editors and anonymous reviewers for their insightful comments and suggestions.

Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

Abbreviation	Full Form
ANOVA	Analysis of variances
AVE	Average variance extracted
B2C	Business-to-consumer
CR	Composite reliability
CS	Customer satisfaction
DC's rho	Dillon-Goldstein's rho
DoS	Denial of service
HTMT	Heterotrait-monotrait ratio
IA	Information available
ML	Machine learning
PLS	Partial least squares
PR	Price
QU	Quality
SE	Security
SEM	Structural equation modeling
TI	Time saved

References

1. Gruszczynski, L. The COVID-19 pandemic and international trade: Temporary turbulence or paradigm shift? *Eur. J. Risk Regul.* **2020**, *11*, 337–342. [CrossRef]
2. Nicola, M.; Alsafi, Z.; Sohrabi, C.; Kerwan, A.; Al-Jabir, A.; Iosifidis, C.; Agha, M.; Agha, R. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *Int. J. Surg.* **2020**, *78*, 185–193. [CrossRef]
3. De Vet, J.M.; Nigohosyan, D.; Ferrer, J.N.; Gross, A.K.; Kuehl, S.; Flickenschild, M. *Impacts of the COVID-19 Pandemic on EU Industries*; European Parliament: Strasbourg, France, 2021; 86p.
4. Dumanska, I.; Hrytsyna, L.; Kharun, O.; Matviiets, O. e-commerce and M-commerce as Global Trends of International Trade Caused by the COVID-19 Pandemic. *WSEAS Trans. Environ. Dev.* **2021**, *17*, 386–397. [CrossRef]
5. Laudon, K.C.; Traver, C.G. *E-Commerce*; Pearson: Boston, MA, USA, 2013; 912p.
6. Goncharuk, I.V. Review of research on the impact of the COVID-19 pandemic on the development of global and Russian e-commerce. *Cust. Policy Russ. Far East* **2021**, *1*, 66–82. (In Russian) [CrossRef]
7. Statista. E-Commerce as Share of Total Retail Sales Worldwide 2015–2020, with Forecasts to 2025. Available online: <https://www.statista.com/statistics/534123/e-commerce-share-of-retail-sales-worldwide/> (accessed on 1 October 2022).
8. eMarketer. Worldwide Ecommerce Sales Set to Top \$5 Trillion for First Time in 2022. Available online: <https://www.insiderintelligence.com/insights/worldwide-ecommerce-sales-to-top-7-trillion/> (accessed on 1 October 2022).
9. Amsterdam University of Applied Sciences. Europe E-Commerce Report 2021. Available online: <https://ecommerce-europe.eu/publication/2021-european-e-commerce-report-light-version/> (accessed on 1 October 2022).
10. Amsterdam University of Applied Sciences. Europe E-Commerce Report 2022. Available online: <https://euagenda.eu/upload/publications/cmi2022-fullversion-light-v2.pdf> (accessed on 1 October 2022).
11. Gomez, M.I.; McLaughlin, E.W.; Wittink, D.R. Customer satisfaction and retail sales performance: An empirical investigation. *J. Retail.* **2004**, *80*, 265–278. [CrossRef]
12. Wijaya, I.; Rai, A.; Hariguna, T. The impact of customer experience on customer behavior intention use in social media commerce, an extended expectation confirmation model: An empirical study. *Manag. Sci. Lett.* **2019**, *9*, 2009–2020. [CrossRef]
13. Praseptiawan, M.; Gultom, M.O.N.; Untoro, M.C. The Evaluation of E-Commerce Using the Customer Satisfaction Index and Importance Performance Analysis. *J. Sisfokom (Sist. Inf. Dan Komput.)* **2022**, *11*, 60–65. [CrossRef]
14. Nisar, T.M.; Prabhakar, G. What factors determine e-satisfaction and consumer spending in e-commerce retailing? *J. Retail. Consum. Serv.* **2017**, *39*, 135–144. [CrossRef]
15. Rahman, S.; Fadrul, F.; Yusrizal, Y.; Marlyna, R.; Momin, M.M. Improving the satisfaction and loyalty of online shopping customers based on e-commerce innovation and e-service quality. *Gadjah Mada Int. J. Bus.* **2022**, *24*, 56–81. [CrossRef]
16. Agarwal, P.; Verma, A.; Malhotra, S.K.; Swami, S. The Impact of Service Quality on Customer Loyalty of Indian E-Commerce Industry: The Mediating Role of Customer Satisfaction. In Proceedings of the International Conference of the Indian Society of Ergonomics, Aligarh, India, 8–10 December 2021.
17. Wilson, N.; Christella, R. An empirical research of factors affecting customer satisfaction: A case of the Indonesian e-commerce industry. *DeReMa J. Manaj.* **2019**, *14*, 21–44. [CrossRef]
18. Sanyala, S.; Hisamb, M.W. Factors Affecting Customer Satisfaction with Ecommerce Websites-An Omani Perspective. In Proceedings of the International Conference on Digitization (ICD), Sharjah, United Arab Emirates, 18–19 November 2019.
19. Dospinescu, O.; Dospinescu, N.; Bostan, I. Determinants of e-commerce satisfaction: A comparative study between Romania and Moldova. *Kybernetes* **2021**, *51*, 1–17. [CrossRef]
20. Nguyen, T.T.N. Developing and validating five-construct model of customer satisfaction in beauty and cosmetic e-commerce. *Heliyon* **2020**, *6*, e04887. [CrossRef] [PubMed]
21. Liu, X.; Kao, Z. Research on influencing factors of customer satisfaction of e-commerce of characteristic agricultural products. *Procedia Comput. Sci.* **2022**, *199*, 1505–1512. [CrossRef]
22. Avania, I.K.; Widodo, A. Affect of E-Service Quality on E-Customers Loyalty through E-Customers Satisfaction on E-Commerce Shopee. *BIRCI-J. Humanit. Soc. Sci.* **2022**, *5*, 535–546.
23. Siswanto, D.; Triyonowati, T. Customer Satisfaction Level Analysis of E-Commerce Shopee Using Delon and Mclean Methods. In Proceedings of the 2nd International Conference of Business and Social Sciences, Surabaya, Indonesia, 5–6 March 2022.
24. Ha Nam Khanh, G. Customer satisfaction at Tiki.vn e-commerce platform. *J. Asian Financ. Econ. Bus.* **2020**, *7*, 173–183.
25. Hair, J.F.; Risher, J.J.; Sarstedt, M.; Ringle, C.M. When to use and how to report the results of PLS-SEM. *Eur. Bus. Rev.* **2019**, *31*, 2–24. [CrossRef]
26. Kotler, P.; Keller, K.L.; Brady, M.; Goodman, M.; Hansen, T. *Marketing Management*, 14th ed.; Prentice Hall: Hoboken, NJ, USA, 2012; 812p.
27. Lin, C.C. A critical appraisal of customer satisfaction and e-commerce. *Manag. Audit. J.* **2003**, *18*, 202–212. [CrossRef]
28. Junardi, J.; Sari, M. Analisis Pengaruh E-Service Quality Terhadap E-Loyalty Melalui E-Satisfaction Pelanggan Jd. Id Di Pontianak. *Obis* **2019**, *2*, 44–54.
29. Vasić, N.; Kilibarda, M.; Kaurin, T. The influence of online shopping determinants on customer satisfaction in the Serbian market. *J. Theor. Appl. Electron. Commer. Res.* **2019**, *14*, 70–89. [CrossRef]
30. DeLone, W.H.; McLean, E.R. Measuring e-commerce success: Applying the DeLone & McLean information systems success model. *Int. J. Electron. Commer.* **2004**, *9*, 31–47.

31. Dirgantari, P.D.; Hidayat, Y.M.; Mahphoth, M.H.; Nugraheni, R. Level of use and satisfaction of e-commerce customers in COVID-19 pandemic period: An information system success model (ISSM) approach. *Indones. J. Sci. Technol.* **2020**, *5*, 261–270. [CrossRef]
32. Griva, A. “I can get no e-satisfaction”. What analytics say? Evidence using satisfaction data from e-commerce. *J. Retail. Consum. Serv.* **2022**, *66*, 102954. [CrossRef]
33. Anh, T.; Yen, T.T.; Trang, N.T.T. Impact of E-Commerce Service Quality on Customer Loyalty: A Case of Vietnam. *Int. J. of Soc. Sci. Manag.* **2022**, *1*, 59–64. [CrossRef]
34. Yoon, S.H. Determinants of online service satisfaction and their impacts on behavioral intentions. *J. Korea Trade* **2007**, *11*, 23–52.
35. Guo, X.; Ling, K.C.; Liu, M. Evaluating factors influencing consumer satisfaction towards online shopping in China. *Asian Soc. Sci.* **2012**, *8*, 40. [CrossRef]
36. Masyhuri, M. Key Drivers of Customer Satisfaction on the E-Commerce Business. *East. Asian. J. Multidiscip. Res.* **2022**, *1*, 657–670. [CrossRef]
37. Nallainathan, S. Analysis onto the Evolving Cyber-Attack Trends during COVID-19 Pandemic. *Int. J. Sci. Res.* **2021**, *10*, 139–144.
38. Mou, J.; Zhu, W.; Benyoucef, M. Impact of product description and involvement on purchase intention in cross-border e-commerce. *Ind. Manag. Data Syst.* **2020**, *120*, 567–586. [CrossRef]
39. Billewar, S.R.; Jadhav, K.; Sriram, V.P.; Arun, A.; Abdul, S.M.; Gulati, K.; Bhasin, N.K.K. The rise of 3D E-Commerce: The online shopping gets real with virtual reality and augmented reality during COVID-19. *World J. Eng.* **2021**, *19*, 244–253. [CrossRef]
40. Uhm, J.P.; Kim, S.; Do, C.; Lee, H.W. How augmented reality (AR) experience affects purchase intention in sport e-commerce: Roles of perceived diagnosticity, psychological distance, and perceived risks. *J. Retail. Consum. Serv.* **2022**, *67*, 103027. [CrossRef]
41. Kaushik, K.; Mishra, R.; Rana, N.P.; Dwivedi, Y.K. Exploring reviews and review sequences on e-commerce platform: A study of helpful reviews on Amazon.in. *J. Retail. Consum. Serv.* **2018**, *45*, 21–32. [CrossRef]
42. Luo, C. Analyzing the impact of social networks and social behavior on electronic business during COVID-19 pandemic. *Inf. Process. Manag.* **2021**, *58*, 102667. [CrossRef]
43. Ponce, D.; Contreras, I.; Laporte, G. e-commerce shipping through a third-party supply chain. *Transp. Res. e-Log* **2020**, *140*, 101970. [CrossRef]
44. Pokhylyko, S.V.; Dvorianova, T.; Voloshyna, E.E. Drop shipping development under COVID-19 circumstances as the most common method of e-commerce. *Sumy State Univ. Bull. Econ. Ser.* **2021**, *2*, 108–117. [CrossRef]
45. Zeithaml, V.A.; Parasuraman, A.; Malhotra, A. Service quality delivery through web sites: A critical review of extant knowledge. *J. Acad. Mark. Sci.* **2002**, *30*, 362–375. [CrossRef]
46. Parasuraman, A.; Zeithaml, V.A.; Malhotra, A. E-S-QUAL a multiple-item scale for assessing electronic service quality. *J. Serv. Res.* **2005**, *7*, 213–233. [CrossRef]
47. Rita, P.; Oliveira, T.; Farisa, A. The impact of e-service quality and customer satisfaction on customer behavior in online shopping. *Heliyon* **2019**, *5*, e02690. [CrossRef]
48. Investor.bg. Logistics—The Most Common Problem for Online Merchants. Available online: <https://www.investor.bg/a/332-ikonomika-i-politika/290545-logistikata-nay-chesto-sreshtaniyat-problem-za-onayn-targovtsite> (accessed on 1 October 2022). (In Bulgarian)
49. Ali, A.; Bhasin, J. Understanding customer repurchase intention in e-commerce: Role of perceived price, delivery quality, and perceived value. *Jindal J. Bus. Res.* **2019**, *8*, 142–157. [CrossRef]
50. Abdul Aziz, A.; Mohd Rashid, R.; Adnan, W.H. The usage of Instagram and e-commerce platform during COVID-19 among mothers. *J. Media Inf. Warf. (JMIW)* **2021**, *14*, 107–122.
51. Ilieva, G.; Yankova, T.; Klisarova-Belcheva, S.; Dzhabarova, Y. Impact of COVID-19 Pandemic on Use and Customer Satisfaction in E-Commerce. In *Mendeley Data*; Elsevier: Amsterdam, The Netherlands, 2022.
52. Beran, T.N.; Violato, C. Structural equation modeling in medical research: A primer. *BMC Res. Notes* **2010**, *3*, 267. [CrossRef]
53. Shiau, W.L.; Sarstedt, M.; Hair, J.F. Internet research using partial least squares structural equation modeling (PLS-SEM). *Internet Res.* **2019**, *29*, 398–406. [CrossRef]
54. World Bank. COVID-19 Drives Global Surge in Use of Digital Payments. Available online: <https://www.worldbank.org/en/news/press-release/2022/06/29/covid-19-drives-global-surge-in-use-of-digital-payments> (accessed on 1 October 2022).
55. Ringle, C.M.; Wende, S.; Becker, J.-M. *SmartPLS 3*; SmartPLS GmbH: Bönningstedt, Germany, 2015.
56. Pett, M.A.; Lackey, N.R.; Sullivan, J.J. *Making Sense of Factor Analysis: The Use of Factor Analysis for Instrument Development in Health Care Research*; Sage Publications: Thousand Oaks, CA, USA, 2003.
57. Hair, J.F., Jr.; Black, W.C.; Babin, B.J.; Anderson, R.E. *Multivariate Data Analysis*, 7th ed.; Pearson: Edinburgh, UK, 2014.
58. Fornell, C.; Bookstein, F.L. Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *J. Mark. Res.* **1982**, *19*, 440–452. [CrossRef]
59. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]