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Empirical study of user satisfaction applied to Supply Chain logistics in the context of COVID-19

Joana Côrte-Real Machado Ventura

Dissertation

presented as partial requirement for obtaining the Master's degree in Information Management, with a specialization in Knowledge Management and Business Intelligence

NOVA Information Management School
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Advisor: Professor Carlos Tam

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Declaro ter realizado o presente trabalho académico com integridade. Confirmo que não recorri à prática de plágio ou de qualquer outra forma de utilização indevida de informação ou de falsificação de resultados durante o processo de elaboração deste trabalho. Declaro ainda que tenho conhecimento das Regras de Conduta e do Código de Honra da NOVA Information Management School.

Joana Côrte-Real Machado Ventura

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RESUMO

Desde que a pandemia COVID-19 começou, o mundo foi afectado não só em termos de saúde pública, como também enfrenta uma crise económica. Os impactos da pandemia têm sido sentidos globalmente e muitas empresas viram as suas realidades viradas do avesso. Para lidar com esta realidade as empresas tiveram de se adaptar: algumas mudaram o foco da sua produção, outras alteraram ou estenderam os seus negócios para o comércio electrónico. No entanto, estas alterações na supply chain trouxeram um esforço adicional na parte logística. A adopção do comércio electrónico como uma forma mais comum de fazer compras em Portugal veio pôr em evidência a logística envolvida no processo, daí surgiu a necessidade de estudar a satisfação do utilizador. Com a combinação do modelo Delone and McLean e a teoria do comportamento planeado, esperamos perceber melhor como é que as disrupções provocadas pelo COVID-19 afectaram a satisfação do consumidor associada à logística do e-commerce. Com base em 203 respostas de indivíduos portugueses, testámos empiricamente o modelo criado e conseguimos explicar 53.3% da variância da satisfação do utilizador.

ABSTRACT

Since the beginning of COVID-19 pandemic, the world has been affected not only in public health matters but also faces an economic crisis. Across the globe, the impacts of the pandemic have been being felt and many companies have seen their realities turned upside-down. To cope with this reality companies had to adapt: some shifted their production focus, others switched or extended their businesses to e-commerce. However, these alterations across supply chains (SC) put an added strain on logistics. The adoption of e-commerce as a more common way of shopping in Portugal has come to evidence the SC logistics involved, thus the need to study the users' satisfaction arose. With a combination of the Delone & McLean model and theory of planned behaviour (TPB), we expect to gain a better understanding of how the disruptions caused by COVID-19 affected the consumer's satisfaction regarding the logistics associated with e-commerce. Based on the responses of 203 Portuguese individuals, we tested empirically our model and were able to explain 53.3% of the variance of user satisfaction.

KEYWORDS

COVID-19; Supply chain; Logistics; User satisfaction; Theory of Planned Behaviour; DeLone and McLean model

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ABBREVIATIONS AND ACRONYMS LIST

ATT   Attitude

AVE   Average variance extract

BI   Behaviour intention

CA   Cronbach's alpha

CR   Composite reliability

D&M   DeLone and McLean

HTMT   Heterotrait-monotrait ratio

IS   Information system

PBC   Perceived behavioural control

PLS-SEM   Partial least squares – structural equation modelling

SC   Supply chain

SERQ   Service quality

SN   Subjective norm

TPB   Theory of planned behaviour

US   User satisfaction

USE   Use/behaviour

VIF   Variance inflation factor

1. Introduction

In today's world, we face a never-seen situation to which we must adapt to survive. On March 11th, 2020 the World Health Organization (WHO) declared the COVID-19 outbreak that originated in Wuhan, China a pandemic (Sohrabi et al., 2020; WHO, 2020). In an annual report on global preparedness for health emergencies, in 2019 the Global Preparedness Monitoring Board stated that in an eight-year period, between 2011 and 2018, 1483 epidemic events were tracked by WHO, and adds besides the loss of life epidemics and pandemics' economies are devastated as well (Board, G. P. M., 2019). Since the beginning of this outbreak, the world has been affected not only in public health matters, but it also faces an economic crisis in proportions not seen since World War II (Farooq et al., 2021; Xu et al., 2020). Ivanov et al. (2019) define disruptions to the supply chain (SC) as *high-impact-low-frequency events* such as a fire, tsunami, or pandemic, that alter the structural design and affect substantially the performance of SCs. By February 21st, Fortune (2020) reported 94% of the Fortune 1000 were seeing supply chain disruptions due to coronavirus. As a result of the disruptions being felt in SC, and to avoid shutdown and keep businesses running, some manufacturing companies shifted their focus to produce protective personal equipment (PPE), while some retail businesses switched or extended their businesses to e-commerce (Hudecheck et al., 2020; Raza & Khan, 2021; Xu et al., 2020). This paradigm twist has come to put an added strain on logistics (Ikram et al., 2021).

Supply chains are complex and dynamic systems by nature, therefore their networks are susceptible to failure and disruptions at any point in the SC (Wu et al., 2007). In the last decades SC and its logistics have been a hot topic. From SC design and planning to risk analysis and management to SC disruptions, researchers have delved into the supply chain management (SCM) umbrella. Throughout the years global SC logistics have been affected by epidemic events and financial crisis amongst other disruptions, one of the latest disruptions being the COVID-19 pandemic (Mefford, 2009; WHO, 2020).

Much has been written about the impacts of the disruption caused by COVID-19 in global SC. Hudecheck et al. (2020) and Xu et al. (2020) explored how companies altered their focus to produce personal protective equipment (PPE) such as medical masks, goggles, gowns, protective gear, and respirators; Grida et al. (2020) studied the nine main policies governments all around adopted to contain the virus; Ibn-Mohammed et al. (2021) wrote a critical analysis of COVID-19 impacts on the global economies and ecosystems, and inferred on companies' short/long term position when facing the current situation caused by the pandemic; Tsai et al. (2021) evaluated logistics companies amid pandemic; Sheth (2020) covered the impact of COVID-19 on consumer behaviour; Ivanov & Dolgui (2021) and Li et al. (2021) mention the bullwhip and ripple effect on

SC to understand the implications in the different SC nodes; and, Magableh (2021, p. 1) examined the disruptions, accompanying difficulties, and trend of the COVID-19 pandemic on SCs, to name a few examples.

Wu et al. (2007, p. 3) wrote "the research area of supply chain disruption management is an area of interest both in academic research and industry practice due to the fact that failure at any one point in the supply chain can cause the entire network to fail", moreover Levy (1995) remarks the tendency managers have to treat each SC crises as *one-time events* instead of understanding that these events may arise from instability inherent in the SC. The motivation for this study is to gain a better understanding of how the consumers were affected by the SC disruptions caused by COVID-19, especially from the logistics node of SC. Our main goals are to (i) understand the main impacts COVID-19 had in SC, more specifically in logistics, and (ii) understand how the ripple effect of these disruptions affected the consumer's satisfaction regarding the logistics associated with e-commerce. To do so, we look into the literature to understand the factors that caused the disruptions and propose a research model to explore our second goal. The theoretical support for this study is a combination of theory of planned behaviour (TPB) (Ajzen, 1991) with the Delone & McLean adapted model (Delone & McLean, 2003).

The main contribution of this study is a conceptual model that uses social and behavioural concepts from one of the most influential models of human social behaviour as a starting point to understand: what leads a user to engage in a certain behaviour, their experience, and consequent satisfaction. By exploring use and behaviour as one, and how it relates to user satisfaction, future researchers may also apply human social behaviour components to further explore users' experiences and satisfaction with other technologies, products, and services. Hence, it poses a valuable base for other IS studies as it can be applied to other contexts and research topics.

Chapter 2 presents the literature review. Further on we describe the methodology and results, present the analysis based on the data collected, and discuss limitations and possible future work. The last chapter is reserved for conclusions.

2. Literature Review

2.1. Supply Chain

Supply chains are complex and dynamic systems by nature, therefore their networks are susceptible to failure and disruptions at any point in the SC (Wu et al., 2007). Such disruptions lead to delays in delivery, increased costs and ultimately increased prices (Levy, 1995; Tsai et al., 2021).

As a result of the countless disruptions of supply chains caused by unforeseeable events like natural disasters, epidemics and financial crisis (Mefford, 2009; WHO, 2020), over the last two decades the topic of supply chain management has grown to a mature research topic. From SC design and planning to risk analysis and management to SC disruptions, researchers have delved into the supply chain management (SCM) umbrella. However, it is believed that the COVID-19 pandemic is a new type of disruption like no other seen before – it is characterized by an unpredictable scaling and long-term existence of disruptions, and there are severe simultaneous disruptions across supply, demand, and logistics infrastructures with forward and backward disruption propagations (forward and reverse ripple effects) (Ivanov & Dolgui, 2021; Li et al., 2021).

Magableh (2021, p. 4) considers that changes in supply, fluctuations in demand, and the response of countries and governments to the pandemic were the three major linked factors that contributed to the disruption of the SC operations (see annex 1). Regarding the governmental policies, Grida et al. (2020, p.2) remarks that such measures have the unintended consequences of disrupting global supply chains, halting business operations, and decreasing revenues; and Guan et al. (2020) reports that the impact of the policies taken to control the propagation of the virus, and to alleviate the strain put in healthcare systems, is greater the more time they are in force, not how strict they are.

The global SC suffered both backward (caused by the buyers) and forward disruptions (from an upstream end of SC) provoked by panic buying, factories shutdown, and retailers going into layoff (Farooq et al., 2021; Ibn-Mohammed et al., 2021). From the supplier side of the equation, on the one hand, to avoid shutdown and keep the system working, thus helping their SC partners and the healthcare industry, some companies shifted their focus to produce personal protective equipments (PPE). Amongst many other possible examples, Tesla and General Motors shifted their focus from manufacturing motors to manufacture ventilators, the Kering Group known for luxury brands like Gucci started manufacturing face masks, and L'Oreal started producing hand sanitizer (Hudecheck et al., 2020; Xu et al., 2020). On the other hand, numerous businesses "have

switched to or extended their buying and selling online sites to deliver their offerings to consumers while retaining social distances" (Raza & Khan, 2021). This shift of modus operandi was possible; however, e-commerce still maintains the need for physical distribution and shipping, thus adding pressure on logistics and transportation (Ikram et al., 2021). Moreover, there are also increased costs in logistics that reflect on increased business costs (Tsai et al., 2021). Ikram et al. (2021, p. 3) points out that "about 44% of companies worldwide do not possess any plan to deal with supply chain disruptions (SCD) along with the COVID-19 pandemic". Given the high impact on global supply chains and economy, it is likely that companies will take short-term views (short-term product development and immediate profit) and put on hold or cancel medium and long-term research and development (R&D), as was the case for aerospace and automotive sectors in past recessions (Ibn-Mohammed et al., 2021).

From the consumer side of the equation, Sheth (2020) argues that consumption is not only habitual but also contextual, and that the major contexts that affect consumer habits are: (i) social context; (ii) technology; (iii) rules and regulations; and (iv) *ad hoc* natural disasters. Due to the pandemic, and consequent governmental policies imposed to control and prevent contagion, consumers had to adapt to the *new normal*, which is characterized by e-commerce and business-customer relationships facilitated by online technologies (Ikram et al., 2021), contactless, quick delivery options, social distancing, and other safety measures in physical spaces (Sharma et al., 2021). In this *new normal* era, the consumer sees its habits being disrupted by the pandemic (*ad hoc* natural disaster) and governmental policies (rules and regulations); and adapts to govern its new habits through e-commerce (technology) and services with shortened working hours, limited physical interaction, and social distancing whenever possible (social context).

2.2. Theory of Planned Behavior (TPB)

In 1991, Ajzen evolved a conceptual framework he developed in 1985 that covers concepts from both behaviour and social sciences: Theory of Panned Behavior (TPB). This theory derives from the theory of reasoned action (Ajzen & Fishbein, 1973; Richard J. Hill, 1977), and has been used to describe and predict behaviour in a variety of behavioural areas with great effectiveness, as it can be used to any behaviour that the investigator is interested in (Ajzen, 2020). Since its appearance over two decades ago, TPB has become one of the most influential models of human social behaviour studies with its number of citations growing every year. From internet purchasing and consumer behaviour to technology adoption, to demonstrate a few examples, TPB is widely used across the literature (George, 2004; Koufaris, 2002; Venkatesh et al., 2007). This theory's main dependent constructs are the *behaviour* and *behavioural intention*, while its

independent constructs are the *attitude towards a behaviour*, the *perceived behavioural control,* and the *subjective norm*.

According to the TPB, human behaviour is guided by three types of considerations: behavioural beliefs, control beliefs, and normative beliefs (Ajzen, 2006). These considerations are the foundation of the three independent constructs mentioned above, which define behavioural intentions. Behavioural beliefs influence whether a person has a positive or negative attitude toward a particular behaviour. Control beliefs occasion perceived behavioural control. "Each control belief contributes to perceived behavioural control in interaction with the factor's perceived power to facilitate or impede performance of the behaviour" (Ajzen, 2020, p. 2). Normative beliefs lead to subjective norm or perceived social pressure to perform a given behaviour.

2.3. Delone & McLean model

The Delone & McLean (D&M) model designed in 1992 comprises six theoretical dimensions/constructs: *individual impact, information quality, organizational impact, system quality, use* and *user satisfaction* (DeLone & McLean, 1992). In 2003, DeLone and McLean updated the success model, considering in this version *service quality* as a theoretical construct that influences use and user satisfaction, and individual impact and organizational impact as one dimension: *net benefits* (Delone & McLean, 2003). The dimensions of success of the updated model include *information quality,* which relates to the desired output characteristics of the system, such as relevance, usability, and accuracy; *service quality,* which depicts the level of service provided by the IS department and IT support professionals to system users, as in responsiveness, technical competence, and reliability; *system quality,* that concerns the information system's desirable properties, like response time, ease of learning, intuitive characteristics and sophistication; *use,* which concerns the extent to which employees and customers make use of an information system's capabilities, e.g. amount, frequency and purpose of use; *user satisfaction,* regarding the users' level of contentment; and *net benefits*, which refers to the level to which information systems contribute to people's success (Petter et al., 2008).

The D&M model is one of the most cited models in information systems (IS) studies and its applications across the literature are several. Recent studies have been conducted on topics like e-commerce, mobile payment and e-learning (Cidral et al., 2018; Franque et al., 2021; Tam et al., 2019), to name a few.

3. Research model

To the best of our knowledge, there are no studies of the impact of COVID-19 on SC logistics that focus on consumers' perspectives. Motivated by this research gap, we propose a combination of the Delone and McLean model and theory of planned behaviour (TPB) to answer our research question. Figure 1 portrays the proposed model for this study. We focus on the consumers' perception and engagement level with SC logistics to assess the impact of COVID-19-motivated disruptions had downstream of the SC. To this end, we consider, in our model, that use/behaviour is the engagement level and user satisfaction goes to the consumers' perception. We decided on an approach more focused on the consumer rather than on the e-commerce platforms systems, therefore dimensions as system quality and information quality were not considered in this study.
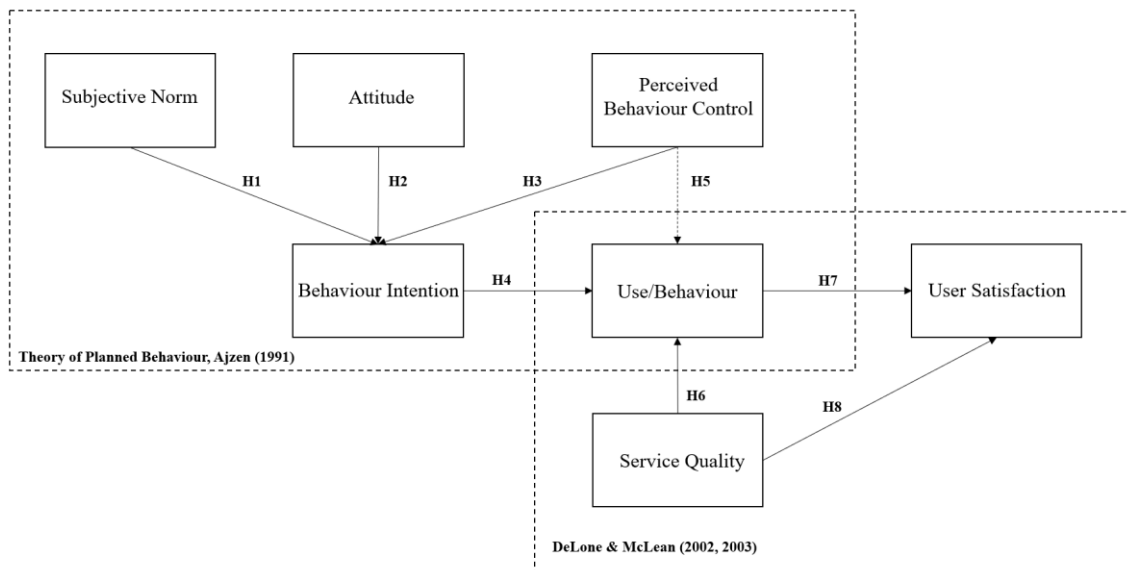
Figure 1 – Research model

Subjective norm arises from the perceived social pressure to perform a behaviour. There are injunctive and descriptive normative beliefs that establish a perceived norm to partake or not in a behaviour. An injunctive normative belief refers to the likelihood of other individual(s) approving or disapproving the performance of a behaviour. A descriptive normative belief is related with whether important others engage in the behaviour. If important others are believed to engage in such behaviour and the majority approves the performance of a behaviour rather than disapproving it, then perceived social pressure is higher (Ajzen, 2020; Fishbein & Ajzen, 2009). Nevertheless, given the context of SC logistics, we formulate the following hypothesis:

H1. Subjective norm does not significantly affect behaviour intention.

Attitude toward a behaviour is determined by the individual's behavioural beliefs. These beliefs concern the individual's perception of the positive or negative experiences that result from performing a given behaviour. The attitude toward the behaviour will be favourable if the outcome results in more positive than negative results (Fishbein & Ajzen, 2009). Thus, we propose the following hypothesis:

H2. Attitude positively affects behaviour intention.

Perceived behavioural control relates to the perception of difficulty or ease to perform a given behaviour. According to Bandura et al. (1980), people's behaviour is strongly influenced by their confidence in their ability to accomplish it. This construct is considered an exogenous variable since it has both a direct and indirect impact on behaviour via the behaviour intention. Thus, TPB predicts two probable behavioural outcomes of perceived behavioural control. In the first situation, perceived behavioural control represents motivational elements that influence behaviour indirectly through intentions, however in the second example, it depicts actual control and has a direct connection to behaviour that is not mediated by intentions (Madden et al., 1992). Furthermore, Ajzen (2002, p. 3) adds "when perceived behavioural control is veridical, it provides useful information about the actual control a person can exercise in the situation and can therefore be used as an additional direct predictor of behaviour". Therefore, we hypothesize the following:

H3. Perceived Behavioural Control positively affects behaviour intention.

H5. Perceived Behavioural Control positively affects use/behaviour.

In TPB, behaviour intention is the direct antecedent of the behaviour, and is preceded of the three determinants known as attitude toward a behaviour, perceived behavioural control and subjective norm. Thus, Ajzen (2020) explains that the stronger the intention to perform a given behaviour, the more probable the behaviour to follow. Hence, we hypothesize the following:

H4. Behaviour intention positively affects the use/behaviour.

Given the proposed research model, we parallelize the behaviour from TPB with the use construct from the D&M model and offer to study it as one in the context of this paper. Since one cannot evaluate user satisfaction without a source of such satisfaction; this use/behaviour dimension is related to the interaction with SC logistics. Curiously, the relationship between use and user satisfaction has received little attention, unlike the inverse relationship, between user satisfaction and use (Petter et al., 2008). For this reason, we propose the following hypothesis:

H7. Use/behaviour positively affects user satisfaction.

Service quality depicts the level of service provided by the supplier, like its responsiveness, technical competence, and reliability. On the one hand, there is little literature about the relationship between service quality and use. However few, studies of the London Ambulance System and of Portuguese SME, for example, indicate a positive link between them (Caldeira & Ward, 2002; Fitzgerald & Russo, 2005; Petter et al., 2008). On the other hand, the service quality-user satisfaction relationship has been depicted in several studies and their findings are not unified in one direction, positive or negative (Petter et al., 2008). Nonetheless, given the SC logistics related topic, we propose the following hypotheses:

H6. Service quality positively affects the use/behaviour.

H8. Service quality positively affects user satisfaction.

4. Methodology

4.1. Measurement

The measurement items in Appendix A were adapted from the literature and tailored to the context of this study. Constructs as attitude (ATT), perceived behaviour control (PBC), and behaviour intention (BI) came from Tam et al. (2022); subjective norm (SN) was adapted from Shih & Fang (2004); and use/behaviour (USE), service quality (SERQ) and user satisfaction (US) from Tam & Oliveira (2016).

The research strategy adopted to test our hypotheses was quantitative data analysis. Our study targeted individuals who, since the beginning of COVID-19 pandemic, have used e-commerce platforms in Portugal.

4.2. Data

A questionnaire was elaborated in English and translated to Portuguese to facilitate the responsiveness of the target audience, then reviewed and validated. The questions in Portuguese were translated back to English to warrant consonance (Brislin, 1970). This is a descriptive research study, as we analyze the user satisfaction of a set of individuals. Since there is just one sample and the conclusions are drawn from a sole group of participants in a single point in time, this study is characterized as a single cross-sectional design. The survey was divided in two main sections; the first was to evaluate the items organized by each construct, the second pertained to the demographics. The items were evaluated in a seven-point Likert scale, with a range from completely disagree (1) to completely agree (7). Respondents were assured of the anonymity of their responses and the single purpose of academic research. It took less than 10 minutes to complete the questionnaire.

The data was collected using an online survey platform between October and November of 2022. This occurred in two stages; the first aimed to evaluate the instrument – a pilot study was run on a group of 32 individuals whose answers were not considered in the final survey; the second was the main study. 306 responses were gathered between October 24th and November 24th 2022, of which only 203 were complete and valid. Due to incompleteness, 103 responses were removed. To check for common method bias we used Harman's one-factor test and a marker variable technique (Lindell & Whitney, 2001; Podsakoff et al., 2003). The first factor explains 44% of the variance, which is less than the 50% threshold. Consequently, there was no significant common method bias detected using Harman's one-factor test. A theoretically irrelevant marker variable was added to the model, having a maximum value of shared variance with other variables

equal to 0.0137 (1.37%), which is considered a low value (Johnson et al., 2011). Therefore, the dataset showed no evidence of significant bias.

This study focuses on individuals who have used e-commerce platforms since the beginning of the pandemic. A total of 120 participants (59%) were women; 133 (66%) of the participants were younger than 35 years old; only 17 participants (9%) had an education degree lower than bachelor's degree. Regarding the usage of e-commerce platforms with associated purchases, only 11 participants (5%) said they didn't use e-commerce platforms prior to the pandemic. Detailed descriptive statistics of the sample are in Table 1.

Table 1 - Sample characteristics.

Distribution (n=203)					
Gender			Education		
Male	83	41%	Lower than bachelor degree	17	9%
Female	120	59%	Bachelor degree	98	48%
			Master's degree or higher	88	43%
Age					
<25	19	10%	Occupation		
25-34	114	56%	Employee	164	81%
35-44	39	19%	Self-employed	15	7%
>44	31	15%	Student	14	7%
			Other	4	2%
Use of e-commerce platforms prior to COVID-19			Unemployed	6	3%
Yes	192	95%			
No	11	5%			

5. Results

The collected data was analyzed using partial least squares structural equation modelling (PLS-SEM) (J. F. Hair et al., 2011; Sarstedt et al., 2014). This was the selected instrument because (i) this method's focus on prediction makes it appropriate for our exploratory type of model; (ii) the items do not require a normal distribution; and (iii) the research model is thought to be complex (Henseler et al., 2009).

In this chapter, we explore the measurement and the structural model. First, we evaluate the measurement model's strength by assessing its validity through the convergent as well as the discriminant validity of the constructs, and by testing the internal consistency of the results (J. F. Hair et al., 2011; Sarstedt et al., 2014; Tam et al., 2019). Then, we assess the structural model by testing the hypothesis defined in the research model (J. F. Hair et al., 2011; Sarstedt et al., 2014).

5.1. Measurement model

To assess the internal consistency, we looked into the long-established criterion Cronbach's alpha (CA) and, to overcome some of CA's limitations, we also looked into composite reliability (CR) (Hair et al., 2016; Tam et al., 2019). CA bases its estimate reliability on the intercorrelations of the indicator variables. CR does not presume all indicators as equally reliable, and its value should be higher than 0.7 to be deemed satisfactory (J. F. Hair et al., 2011). To appraise convergent validity, which describes how constructs converge in their items, we use the average variance extracted (AVE) (Sarstedt et al., 2014). As Sarstedt et al. (2014) and Henseler et al. (2009) advocate, the AVE value should be equal or higher than 0.5, thus explaining more than half of the variance of the indicator. To evaluate discriminant validity, which concerns the degree to which a construct is distinct from others in the model, we use three approaches: (i) the assessment of cross-loadings, by comparing the loadings versus cross-loadings and evaluating whether the loading value is higher than the cross-loadings; (ii) the Fornell-Larcker criterion, by evaluating whether the squared root of AVE is greater than the correlation of the constructs; and (iii) the Heterotrait-Monotrait (HTMT) criterion, by evaluating whether the HTMT ratio values are under 0.9 (Fornell & Larcker, 1981; J. F. Hair et al., 2011; Henseler et al., 2015; Tam et al., 2019).

Tables 2, 3 and appendix B show the results obtained. We excluded the item ATT1 from the PLS model estimation using the criterion of loadings higher than their cross-loadings (Götz et al., 2010). As we can see, every construct has CR and CA (Cronbach's Alpha) values above 0.7, which as aforementioned indicates that the model is reliable. The AVE values are also above 0.5, indicating satisfactory values of convergent validity for each construct. By comparing the

loadings (values in bold) with their cross-loadings, we confirm that the loadings are greater than their cross-loadings. By comparison, we can also confirm that the squared root of AVE is greater than the correlation between constructs. As for the HTMT criterion, we can observe that all values are under 0.9. Therefore, our model evinces discriminant validity (Henseler et al., 2015). Hence, we can affirm that the measurement model achieves its objective, its constructs are adequate, and can be used to measure the research model.

Table 2 - Correlations, and reliability and validity measures (CR, CA, and AVE) of latent variables.

Constructs	Mean	SD	CA	CR	SubN	Atti	PBC	BI	UseB	ServQ	Satisf
SN	5.075	1.287	.951	.960	**.896**						
ATT	6.005	.914	.901	.926	.646	**.846**					
PBC	6.076	.828	.829	.886	.445	.635	**.813**				
BI	5.919	1.183	.848	.904	.527	.671	.607	**.871**			
USE	6.096	1.088	.894	.927	.545	.657	.655	.657	**.873**		
SERQ	4.324	1.161	.915	.940	.346	.237	.216	.202	.242	**.893**	
US	5.586	1.061	.951	.965	.498	.605	.541	.466	.664	.455	**.934**

Legend: SN: Subjective Norm; BI: Behaviour Intention; ATT: Attitude; PBC: Perceived Behaviour Control; USE: Use/Behaviour; SERQ: Service Quality; US: User Satisfaction

Table 3 - Heterotrait-Monotrait Ratio of correlations (HTMT).

Constructs	SubN	Atti	PBC	BI	UseB	ServQ	Satisf
Subjective Norm							
Attitude	.698						
Perceived Behaviour Control	.499	.732					
Behaviour Intention	.551	.722	.694				
Use/Behaviour	.590	.731	.761	.713			
Service Quality	.370	.257	.249	.223	.266		
User Satisfaction	.523	.649	.608	.486	.719	.486	

5.2. Structural model

To assess the structural model, we ran a bootstrapping procedure based on 5000 resamples that enabled us to test the estimate path coefficients in PLS-SEM for their significance, and the validity of the hypothesized model (J. F. Hair et al., 2011; Tam et al., 2019). To study possible multicollinearity problems, we used variance inflation factor (VIF) calculations, which with values lower than 5 signal an absence of multicollinearity issues (Franque et al., 2021).

In Figure 2 we can see the structural model results. The model indicates 51.7% of the variation in behaviour intention, 54.1% in use/behaviour, and 53.3% in user satisfaction. Behaviour intention is explained by attitude ($\beta = 0.391$, $p < 0.001$), perceived behaviour control ($\beta = 0.295$, $p < 0.001$), and subjective norm ($\beta = 0.144$, $p < 0.05$). Thus, confirming hypotheses H2, H3, and H1, respectively. As for use/behaviour, behaviour intention ($\beta = 0.402$, $p < 0.001$) and perceived behaviour control ($\beta = 0.396$, $p < 0.001$) are statistically significant and support hypotheses H4 and H5. However, service quality ($\beta = 0.075$) is not statistically significant in explaining use/behaviour. Therefore, H6 is not supported. Lastly, use/behaviour ($\beta = 0.588$, $p < 0.001$) and service quality ($\beta = 0.313$, $p < 0.001$) are statistically significant and explain user satisfaction. Ergo, hypotheses H7 and H8 are supported. In conclusion, 7 of a total of 8 hypotheses were supported by the model and the collected data.
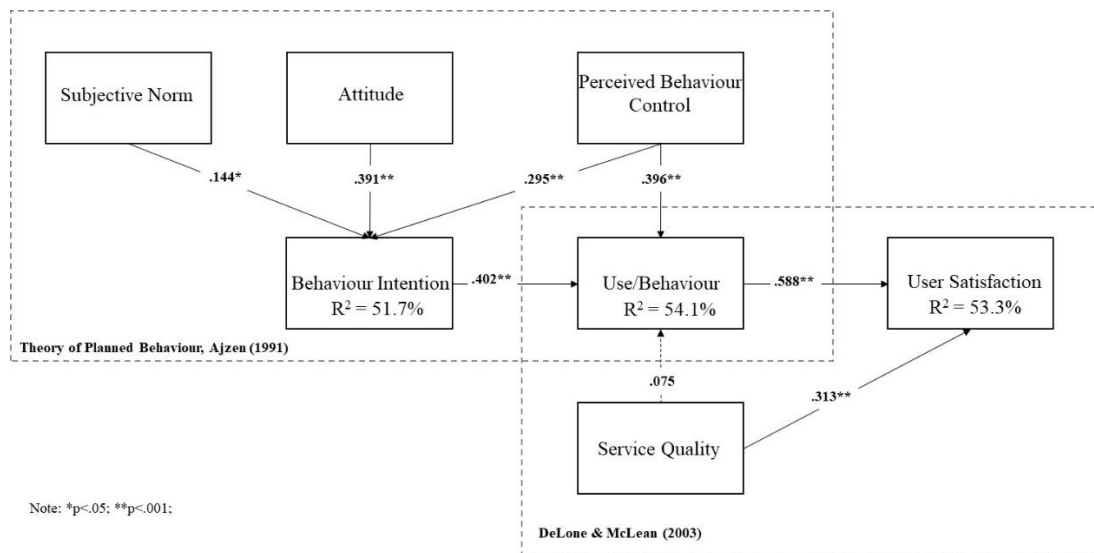

Figure 2 – Structural model results

Table 4 - Hypotheses results summary.

Hypotheses	Dependent variable (R^2)	Findings	Result
H1: SN → BI		Positive and statistically significant ($\beta = 0.144$, $p < 0.05$)	Supported
H2: ATT → BI	**Behaviour Intention** (51.7%)	Positive and statistically significant ($\beta = 0.391$, $p < 0.001$)	Supported
H3: PBC → BI		Positive and statistically significant ($\beta = 0.295$, $p < 0.001$)	Supported
H4: BI → USE		Positive and statistically significant ($\beta = 0.402$, $p < 0.001$)	Supported
H5: PBC → USE	**Use/Behaviour** (54.1%)	Positive and statistically significant ($\beta = 0.396$, $p < 0.001$)	Supported
H6: SERQ → USE		No significant effect ($\beta = 0.075$)	Not supported
H7: USE → US	**User Satisfaction** (53.3%)	Positive and statistically significant ($\beta = 0.588$, $p < 0.001$)	Supported
H8: SERQ → US		Positive and statistically significant ($\beta = 0.313$, $p < 0.001$)	Supported

Legend: SN: Subjective Norm; BI: Behaviour Intention; ATT: Attitude; PBC: Perceived Behaviour Control; USE: Use/Behaviour; SERQ: Service Quality; US: User Satisfaction

6. Discussion

To study user satisfaction with e-commerce SC logistics in the context of a COVID-19-affected country, we proposed a combination of two IS theories: TPB (Ajzen, 1991), and the D&M model (Delone & McLean, 2003). Table 4 shows the summary of the findings and results for each hypothesis. With an acceptance rate of 87.5%, only one of the hypotheses was not supported.

In this *new era* post-COVID-19 where consumers adopted new shopping habits with e-commerce and accepted social distancing and limited physical interaction whenever possible (Ikram et al., 2021), our model's results show that behaviour intention (with 51.7% of variation) is explained by attitude, perceived behaviour control, and subjective norm. As originally supposed, subjective norm does not significantly affect behaviour intention, having the lowest significant value (β=0.144, p < 0.05). These findings are similar to findings from other studies using TPB (Franque et al., 2021; George, 2004; Tam et al., 2019). However, upon looking at the model's results regarding use/behaviour we observe that only H4 and H5 were supported, suggesting that for the universe of inquiries we studied service quality was not a defining factor. H4 and H5 results are aligned with other studies (Danila & Abdullah, 2014; Shih & Fang, 2004). Finally, the research model's results indicate that, as initially thought, user satisfaction is positively affected by use/behaviour and service quality. Such findings are akin to others from previous studies (Tam et al., 2019; Tam & Oliveira, 2016).

6.1. Theoretical implications

Our results suggest that, as originally hypothesized, the consumers' intention to use e-commerce platforms is positively influenced by their perception of ease in engaging in such behaviour, their perception of whether it is easy/intuitive to use e-commerce platforms, and the opinions of those close to them. We theorized that use/behaviour would be positively affected by one's intention to use e-commerce platforms, the perceived behavioural control related to such an activity, and the quality of the service of the used platforms. However, quality of service did not have the anticipated significance. We justify service quality not being a defining factor for why an individual uses e-commerce platforms in two ways: (i) because one assumes *a priori* that the e-commerce platforms service already has good quality, regardless of previous contact with customer support; and (ii) despite previous contact with customer support, like subjective norm, it is not a decisive factor in one's actions. Lastly, hypotheses 7 and 8 were supported. Meaning that the users' satisfaction is shaped by their experience while engaging in the behaviour and the quality of the service being provided.

In summary, using TPB we were able to learn how, for instance, one's perception of the ease to perform a behaviour (such as the use of e-commerce platforms) and the positive outcomes that result from such behaviour influence the intention to perform such behaviour as proposed by Ajzen in 1991. In the context of this study, we found that both ATT and PBC affect positively BI. Meaning that the more positive values of attitude and perceived behaviour control, the more likely the behaviour intention. We also found that perceived behavioural control and behaviour intention affect positively use/behaviour. Although subjective norm was found to have less influence on behaviour intention, it should not be disregarded. Regarding service quality, its relevance is mainly attached to one's satisfaction levels rather than the engagement in a behaviour such as the use of e-commerce platforms.

From a theoretical perspective, our proposed research model poses a valuable base for other IS studies, as it can be applied to several other contexts and research topics. Moreover, by using TPB as means to explore use/behaviour and how it relates to user satisfaction, future researchers may also apply human social behaviour components to further explore users' experiences and satisfaction with other technologies, products, and services.

6.2. Practical implications

We believe this research brings insights for decision-makers on the paths they may take to enhance users' satisfaction. Given the variables of the study, our results point to paying more attention to the role of perceived behavioural control and attitude when exploring behaviour intention, and the role of use/behaviour and service quality for user satisfaction.

Albeit service quality was not found to be a good predictor of use/behaviour, managers should not overlook its importance since it influences user satisfaction along with use/behaviour. The experience with service quality can be easily perceived as negative due to simple details such as delays in response time and lack of information (Tam et al., 2019). Great and effective customer service enhances the customer experience and ultimately their satisfaction, so it must convey a high level of reliability, technical competence, and responsiveness (Tam et al., 2019).

Overall, managers should regard ways to enhance positive opinions and experiences, by using marketing strategies to positively affect attitude, perceived behavioural control, and subjective norm; getting their teams to work on user experience, and promoting the contact between customer and supplier, to affect positively use/behaviour and service quality. Thence, managers and their teams should design a customer journey tailored to the needs of their growing audience to improve their customers' experience and, consequently, their satisfaction.

6.3. Limitations and recommendations for future work

We identified three main limitations of this study. Firstly, this research was conducted in the context of a single geography: Portugal. Therefore, the results may differ from other countries for cultural reasons. Secondly and regarding our respondents, most of the participants were under the age of 35 (with a global age average of 33), and only 17 respondents (9%) had an education degree lower than bachelor's degree. Consequently, the study did not consider a sample with a full spectrum of Portuguese consumers' profiles and may not reflect the typical consumer. Thirdly, this study only considers the perspective of the consumer. The data was solely collected by surveying the consumer and did not include surveys or interviews from organizations. Thus, it does not contemplate the full picture from both the consumer's and the organizations' point of view.

For future studies, we recommend: (i) testing this research model across other geographies (e.g., other countries); (ii) expanding the universe of inquiries to gather a more complete sample of descriptive groups, through a larger dataset, and diversifying the divulgation methods of the questionnaire; (iii) gathering companies' insights through interviews, focus groups or questionnaire; (iv) finally, in future works, other constructs, such as system quality, individual performance, and repurchase intention, may be included to enrich the findings.

7. Conclusions

Since the beginning of COVID-19 pandemic, the adoption of e-commerce as a more common way of shopping in Portugal has come to evidence the SC logistics involved, thus the need to understand the main disruptions caused by COVID-19 and the need to study the users' satisfaction arose. We reckoned, based on the literature, that the three central and interrelated causes of disruptions across SC were (i) the government's response, (ii) changes in supply, and (iii) volatility of demand. Our study bases its research model on TPB and the D&M model. We argue that besides service quality and ultimately use, the variables behind use are of great importance. These are perceived behaviour control, attitude, subjective norm, and behaviour intention. Based on the responses of 203 Portuguese individuals, we tested empirically our model and confirmed 87.5% of our hypotheses. The model explained 53.3% of the variance of user satisfaction. Since e-commerce and user satisfaction are relevant topics in academia as in industry, this study has theoretical and practical implications. This research does not come without its limitations, they were identified and recommendations for future work were indicated.

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Appendix

Appendix A - Items

| Constructs		Items	Adapted from
Subjective Norm	SN1	People important to me would think that using e-commerce platforms would be a wise idea	Shih & Fang (2004)
	SN2	People important to me would think that using e-commerce platforms is a good idea	
	SN3	Most people important to me would think I should use e-commerce platforms	
	SN4	My family would think that using e-commerce platforms would be a wise idea	
	SN5	My family would think that using e-commerce platforms is a good idea	
	SN6	My family would think I should use e-commerce platforms	
Attitude	ATT1	Using e-commerce platforms is necessary.	Tam et al. (2022)
	ATT2	Using e-commerce platforms is beneficial.	
	ATT3	E-commerce platforms are useful.	
	ATT4	I have a positive view about using e-commerce platforms.	
	AAT5	My attitude towards the use of e-commerce platforms is favourable.	
	ATT6	I believe that the use of e-commerce platforms is something valuable to me.	
Perceived Behaviour Control	PBC1	I believe that using e-commerce platforms isn't hard.	Tam et al. (2022)
	PBC2	I believe that my experiences help me use e-commerce platforms.	
	PBC3	Using e-commerce plaftorms is easy to me.	
	PBC4	Using e-commerce platforms is an achievable practice.	
Behaviour Intention	BI1	I intend to use e-commerce platforms.	Tam et al. (2022)
	BI2	I predict to start using e-commerce platforms.	
	BI3	I plan to start using e-commerce platforms.	
Use/Behaviour	USE1	I use e-commerce platforms	Tam & Oliveira (2016)
	USE2	I use e-commerce platforms to compare products and prices	
	USE3	I use e-commerce platforms to make purchases	
	USE4	I make repeated purchases at e-commerce platforms	
Service Quality	SERQ1	The responsible service personnel is always highly willing to help whenever I need support with the e-commerce platform	Tam & Oliveira (2016)
	SERQ2	The responsible service personnel provides personal attention when I experience problems with the e-commerce platform	
	SERQ3	The responsible service personnel provides services related to the e-commerce platform at the promised time	
	SERQ4	The responsible service personnel has sufficient knowledge to answer my questions with respect to the e-commerce platform	
Use Satisfaction	US1	I am satisfied that e-commerce meets my needs	Tam & Oliveira (2016)
	US2	I am satisfied with e-commerce efficiency	
	US3	I am satisfied with e-commerce effectiveness	
	US4	Overall, I am satisfied with e-commerce	

Appendix B - PLS loadings and cross-loadings.

Constructs		SubN	Atti	PBC	BI	UseB	ServQ	Satisf
Subjective Norm	SN1	**.867**	.586	.316	.411	.424	.321	.443
	SN2	**.888**	.604	.391	.421	.476	.371	.457
	SN3	**.896**	.579	.390	.497	.525	.340	.469
	SN4	**.917**	.583	.420	.476	.499	.286	.458
	SN5	**.926**	.580	.427	.513	.523	.278	.475
	SN6	**.878**	.545	.434	.497	.471	.278	.376
Attitude	ATT2	.550	**.840**	.451	.597	.444	.175	.448
	ATT3	.528	**.809**	.509	.525	.566	.098	.421
	ATT4	.491	**.878**	.540	.550	.520	.193	.478
	AAT5	.548	**.864**	.637	.573	.637	.292	.548
	ATT6	.608	**.838**	.550	.587	.615	.236	.654
Perceived	PBC1	.368	.472	**.781**	.422	.492	.253	.473
Behaviour	PBC2	.391	.504	**.795**	.490	.524	.106	.393
Control	PBC3	.310	.489	**.860**	.482	.549	.128	.414
	PBC4	.380	.591	**.816**	.567	.562	.220	.480
Behaviour	BI1	.579	.742	.601	**.842**	.713	.195	.524
Intention	BI2	.365	.458	.461	**.887**	.472	.160	.305
	BI3	.362	.461	.477	**.882**	.447	.162	.321
Use/Behaviour	USE1	.483	.622	.589	.607	**.924**	.185	.578
	USE2	.429	.510	.660	.542	**.812**	.216	.495
	USE3	.506	.649	.566	.636	**.930**	.245	.623
	USE4	.482	.501	.473	.500	**.816**	.196	.620
Service Quality	SERQ1	.319	.182	.211	.171	.235	**.917**	.435
	SERQ2	.315	.175	.188	.160	.207	**.923**	.397
	SERQ3	.232	.194	.195	.181	.191	**.870**	.353
	SERQ4	.358	.291	.177	.210	.225	**.861**	.431
User Satisfaction	US1	.517	.609	.554	.490	.669	.352	**.920**
	US2	.401	.487	.445	.360	.567	.446	**.935**
	US3	.477	.562	.512	.428	.590	.468	**.950**
	US4	.461	.596	.507	.460	.650	.438	**.931**

Annexes

Annex 1 – Impact of COVID-19 pandemic on SC's
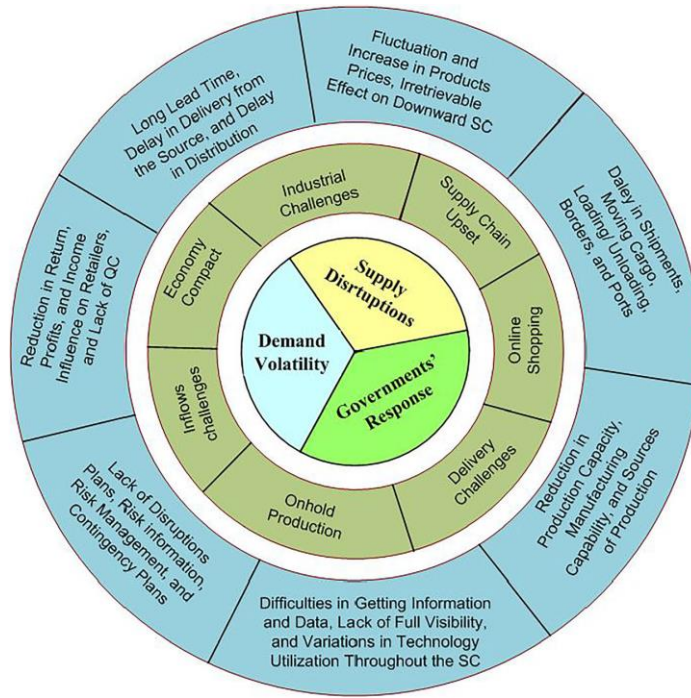
Source: Reprinted from "Supply Chains and the COVID-19 Pandemic: A Comprehensive Framework" by Magableh, G. M., 2021*, European Management Review*, p.4