Evaluating Usability and User Experience Amid COVID-19:
The Case of Innovative Digital Retailers

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ABSTRACT

This research evaluates e-commerce platforms (ECP) amid the COVID-19 pandemic and investigates the relationship between usability and user experience (UX) and e-commerce platforms performance (ECPP) by testing online customer's interactions with online retailers. Exploratory and confirmatory factor analyses assessed the research constructs' dimensions, dimensionality, validity, and composite reliability, while structural path analysis tested the hypothesized model relationships. The empirical results indicate that six usability dimensional attributes are strategically significant antecedents to UX and ECPP: navigation, information architecture, value of content, satisfaction, aesthetics, and consistency and functionality. An integrated framework of usability and UX is recommended for retailers running their businesses on digital platforms. This research investigates usability, UX, and ECPP through understanding digital marketing frameworks in e-commerce stores in the COVID-19 context, shedding light on the strategic role of usability attributes and how they affect UX digital performance.

KEYWORDS

COVID-19, E-Commerce Platforms, E-Commerce Platforms Performance, Online Retailers, Usability, User Experience

INTRODUCTION

Varying degrees of Covid-19 lockdowns at different times in most countries worldwide during 2020-2021 affected diverse aspects of everyday life, communication, and global commerce, with profound and lasting impacts on customer behavior—particularly a significant rise in the volume

and scope of e-commerce (Sahin, 2021). The closure of offline sales venues compelled retailers and customers to solely use e-commerce (where possible) (Vázquez-Martínez et al., 2021). This led to an intensification of e-commerce in developed countries with strong latent e-commerce infrastructure, and a rapid development of e-commerce capabilities in countries with hitherto negligible development, with a net dramatic increase in e-commerce and digital channels worldwide, and commensurate growth in the local and international online marketplaces (Rawash, 2021). This was accompanied by general awareness of the advanced communication abilities now available via social media and video conferencing, which were used for educational and professional communication in previously unimagined (or merely experimental) ways. Social media and e-commerce solutions—including Facebook and Instagram etc., and Amazon and eBay—showed their ability to transcend traditional physical and geographical barriers to communication (Berni & Borgianni, 2021), enabling communicative and commercial activities (including work) to continue when it would otherwise be impossible (Manuel et al., 2021).

Retailers of all sizes could benefit from this shift toward e-commerce, as they are already well-positioned to meet the growing demand for goods and services via online channels (Bozzi et al., 2021; Sahin, 2021). However, there are many challenges. If online channels cannot offer a competitive user experience there is a good chance they will fail to satisfy, attract, or retain customers (Rita et al., 2019). User experience (UX) refers to the quality of experience a person has when interacting with a specific design (Hassenzahl & Tractinsky, 2006). Online retailers must provide the best UX possible in order to satisfy and engage customers (Agustina, 2020; Berni & Borgianni, 2021). First, they need to be searchable when their customers want to make a purchase, and once customers are on the retailer's point of entry, the used e-commerce framework needs to be responsive, meeting or exceeding customer expectations (KPMG, 2017). Online surfing is a type of interactional behavior, so usability can be seen as equal in importance across all e-commerce platforms (ECPs). Users' tasks should be supported on efficient e-commerce frameworks where usability evaluation techniques are in place to evaluate whether a platform is usable or not (Babatunde et al., 2019).

The ways in which a good UX can be maintained in the context of Covid-19 remain underexplored, but actual and potential customers (i.e., users who do not purchase) are at the core of e-commerce studies and strategy (Agustina, 2020; Berni & Borgianni, 2021; Bozzi et al., 2021; Sahin, 2021). A successful e-commerce retailer needs a UX design that considers buyers, and which is perceived by users to improve the experience, and which increases adoption (i.e., leads to sales) (Allabarton, 2021). Good UX also helps e-commerce retailers establish a trustful relationship with customers, as positive UX confirms customers' expectations (Al Sokkar & Law, 2013). The acceleration of certain digital trends, particularly online shopping, during the Covid-19 crisis has galvanized a rapid transition to online retail, allowing many businesses to continue their activities while considering the safety and health of their customers. However, this idyllic image hides another reality: This massive transition to online shopping has completely changed the behavior and perception of customers worldwide in both developing and developed countries in potentially unforeseen ways.

This phenomenon was so sudden and dramatic that no one knows precisely how the pandemic will affect e-commerce UX over the long term, especially in e-commerce emerging countries. There are still many outstanding issues on this topic that trigger the need for evaluating e-commerce usability and UX in the context of Covid-19 in Jordan. This pandemic continues to have emerging impacts on market trends (e.g., supply chain disruptions caused by international lockdowns and staggered production schedules), including customers' purchasing behavior. Innovative retailers have increasingly started replacing traditional shopping channels, moving from physical stores to e-commerce channels, in whole or in part (Briedis et al., 2020). Customer experience has become a key matter amid this shifting landscape of purchasing behavior. Recent research has explored how usability might contribute to improved UX of ECPs, but only a few have partially evaluated this relation's impact on e-commerce platforms performance (ECPP) in the context of the Covid-19 pandemic for online retailers (Berni & Borgianni, 2021; Bozzi et al., 2021; Sahin, 2021). Hence, this research aims to evaluate the

usability, ECPP, and UX of ECPs amid the Covid-19 pandemic with regard to Jordanian customers. Accordingly, this study contributes to providing an overview of UX in relation to ECP usability and ECPP, in addition to developing and testing a reflective measurement for usability, UX, and ECPP.

The particular significance of this study lies in providing new knowledge to fill gaps in the literature on the effects of usability on UX and ECPP. This study moves forward the understanding of a correlation between usability, UX, and ECPP during the Covid-19 pandemic where a bigger percentage of Jordan's population were motivated to use e-commerce mobile platforms. This study moves this research field forward because it takes into consideration the new market dynamics that have emerged during the Covid-19 pandemic. Our findings deepen the current understanding about the effects of usability on UX and ECPP by analyzing six new usability attributes: navigation, information architecture, value of content, satisfaction, aesthetics and consistency, and functionality.

LITERATURE REVIEW

Usability Evaluation

Usability is defined as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context" (International Organization for Standardization, 2010b). Usability is one of the most important characteristics of any user interface, and it is a measure of how easy the interface is to use (Nielsen & Tahir, 2002). The user is an individual interacting with the system (International Organization for Standardization, 2011); they can judge the quality of the offered services. Several elements characterize users, including needs, desires, emotions, goals, motivations, and certain behaviors. In addition, users have their own activities and certain uses specific to time and place. All of these elements are attached to the users and need to be considered when designing an ECP (Berni & Borgianni, 2021; Bozzi et al., 2021; Sahin, 2021). Researchers have stressed the importance of making ECPs usable and have stated that good usability is not a luxury, but an essential prerequisite characteristic if a platform is to survive (Nielsen et al., 2001).

Usability evaluation methods can be categorized by how usability problems are identified, such as by users, evaluators, or tools (Agustina, 2020; Berni & Borgianni, 2021; Bozzi et al., 2021; Sahin, 2021). Different methods are used to evaluate the usability of ecommerce. Nielsen (1994) developed and refined heuristics for usability evaluations, while others rely on expert reviews. More recent approaches utilize IT technology and machine learning techniques. At the current juncture, usability can be evaluated in eight different ways (Usability.gov, 2022). The combination of different techniques might result in more robust and reliable usability assessment. However, the setting, scope, and context of the study define the most appropriate technique (Khajouei & Farahani, 2020).

User Experience (UX)

The concept of UX dates back to the 1990s (Berni & Borgianni, 2021). It refers to the feelings of users before, during, and after using a product or system, including emotions, beliefs, and preferences, etc. (Law et al., 2009). It is a "person's perceptions and responses that result from the use or anticipated use of a product, system or service" (International Organization for Standardization, 2019). The factors that affect UX are the driving factors that trigger user satisfaction and dissatisfaction with a product or brand (Zahidi et al., 2014). In the case of this research paper, to simplify the concept, UX refers to the relationship between the user and the online marketplace. It is necessary to distinguish between UX and usability; usability has a significant role in ECPs, as they enable users to achieve their goals efficiently, effectively, and satisfactorily (Díaz et al., 2017).

Although prior researchers did not fully study UX directly, they examined some of its related dimensions, such as service quality and platform design. Nabot et al. (2016) evaluated Jordanian customer attitudes toward online shopping and found that ease of ECPs use and the ease of purchasing

process (spanning item selection, ordering, paying, receiving the order, delivery, or services) enhanced the online shopping experience, leading to an enhanced customer experience. ECP interfaces should be well-designed and easy to use, especially for less experienced users, saving time and allowing easy comparison and browsing among products (Nabot et al., 2016).

The United Nations carried out a questionnaire in 2020 to examine the effect of the Covid-19 pandemic on online purchasing behavior of customers in Brazil, China, Germany, Italy, Russia, South Africa, South Korea, Switzerland, and Turkey. They reported that customers from emerging economies expected that they would use online marketplaces more often after the Covid-19 pandemic era. In parallel to that, respondents across all surveyed countries stated that they have lowered their average expenditures per online transaction for most of the categories (i.e., food and beverage, books and media, and tools); only gardening and DIY spending categories showed an increase (UNCTAD, 2021). However, this study's findings were related to perceptions of online shopping and did not explore the UX of online stores' customers. Furthermore, it did not include any country from the Middle East and North Africa (such as Jordan).

E-Commerce Platform Performance (ECPP)

ECPP is a key indicator of UX in ECPs. When designing and developing a user interface, many components need to be considered in relation to its UX, including layout, hierarchy, intuitiveness, and ease of use (Berni & Borgianni, 2021; Díaz et al., 2017; Dickinger & Stangl, 2013). The user interface experience determines how much the users trust the brand, return to the ECP, and share it with others (Berni & Borgianni, 2021). Page load time and the perceived speed of ECP are a large part of UX and should be weighed equally with the aesthetics of platform (Hogan, 2014). Concerning the type of ECPs, this research is interested in online stores ECP.

Marketplaces such as Amazon, eBay, Etsy, and Cdiscount provide sales spaces for thousands of sellers and allow them to benefit from their features and the hundreds of thousands of visitors they attract each month. Some marketplaces also offer support for the integrated inventory and shipping of products, to provide an excellent UX for both the seller and the buyer (Berni & Borgianni, 2021). Consequently, investigation on this type of ECP and their performance is of great academic interest (Berni & Borgianni, 2021; Díaz et al., 2017; Dickinger & Stangl, 2013). Researchers should aim to provide new knowledge to fill gaps in the literature on this topic, and propose relevant models to adapt e-commerce usability, UX, and ECPP in relation to the changes in market factors to meet the needs of businesses and the general public (Hogan, 2014), including the new dynamics associated with the Covid-19 pandemic (Berni & Borgianni, 2021). Specifically, this study's objectives are to examine the effects of usability attributes (navigation, information architecture, value of content, satisfaction, aesthetics and consistency, and functionality) on UX and ECPP when mediated by UX.

Circular Economy and UX

Circular economy has emerged as a way to achieve sustainability (Galvão et al., 2018). Understanding the correlation between UX and circular economy can explain the correlation between usability and ECPP. Circular economy looks for sustainable designs of UX, which is achievable directly through the fulfillment of clients—by learning about their needs while moving away from product ownership—or indirectly by approaching sustainable service designs, which, in turn, is achievable by involving clients from various teams in the development of processes (e.g., product development and e-commerce teams) (Uxplanet.org, 2020).

Service design helps with defining the starting points for improving a service. For example, using a customer journey, it is possible to make an informed decision of which opportunity is most interesting to start with. The transition to a circular economy starts by putting user needs at the core. By using a continuous, iterative process, all stakeholders can take steps in the right direction from their own starting point. Moving towards circular economy in iterations has been tested in the industry and can be achieved by updating service ecosystems and customer journeys over the years.

Monitoring new insights based on a previous customer journey can greatly improve the next iteration. Continuous evolution is a route of success in circular economy.

UX design mechanism in circular economy should be modified to enable follow-up experiments and modification to facilitate understanding of changing user preferences without re-planning experience (Lin, 2018). However, best responding to the objectives of the platform and the user's expected needs of the user interface and UX of the platform was determined a key success factor for creating platforms in sustainable practices of circular economy (Gesawahong et al., 2021).

METHOD

Research Framework

This research proposes relationships among the factors of usability, UX, and ECPP. One of the significant changes in customer behavior amid the Covid-19 pandemic is the increasing use of e-commerce. Figure 1 presents the constructs and the hypothesized relationships for a framework to evaluate usability and UX and ECPP for ECPs.

Hypotheses Development

Usability evaluation assesses the level to which users are achieving their goals effectively and efficiently while maintaining their satisfaction during their interactions with a specific product (International Organization for Standardization, 2010a). UX is about the perception a user has after interacting with an ECP, whether it will be positive or negative. Online customers require excellent ECP that is engaging and well-designed, and which provides accurate information and easy navigation. Empirical research has found a relationship between usability and UX, and how usability can contribute to UX and ECPP, particularly in terms of conversion rate (the proportion of platform visitors who execute a desired action, usually purchasing) (Deaton, 2011).

Figure 1. Research proposed framework
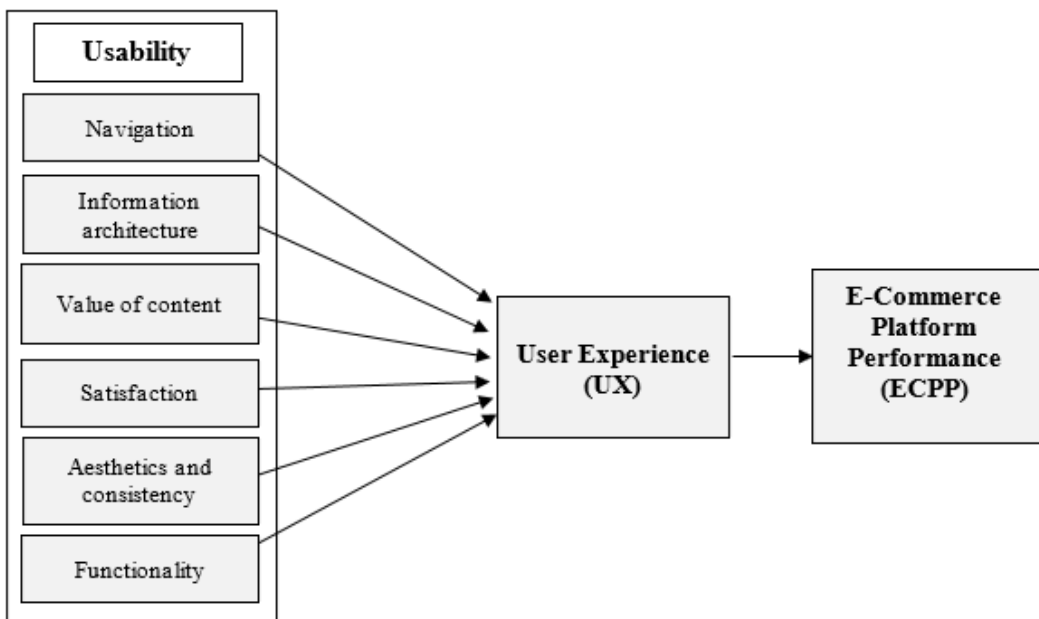
Assessing the high bounce rate and decrement in the conversion rate on a leading online store (a joint venture with eBay), Agustina (2020) explored the impacts of usability aspects on UX and found that learnability, memorability, efficiency, and satisfaction have a positive impact, while the error aspect has a negative impact. Although this study revealed the importance of usability on UX and enhancing the conversion rate, it was not able to highlight other aspects of usability such as aesthetics and consistency. Usability is linked to UX; the easier a product learns, the better the UX will be. However, it is important to understand that a product's experience covers more than merely its usability, including experiential aspects, such as aesthetics and user enjoyment (Torenvliet, 2008). According to Allabarton (2021), a good experience is likely to result in users returning to use the service and recommending it, which increases platform traffic and conversion rate, whereby a site user becomes a customer (Allabarton, 2021). Consequently, a good UX can be defined by the fact that users often return to the ECP, and the latter has a high conversion rate. Based on this understanding, it is hypothesized that:

H$_1$: Usability in e-commerce has a positive effect on UX.

Customers' adaptations to online shopping accelerated by the Covid-19 pandemic are not likely to end or reduce after the pandemic passes (Kim, 2020), as online shopping tends to be substantially more convenient, economical, and offers greater flexibility in terms of time, location, and product variety. Rita et al. (2019) conducted an exploratory study to identify which e-service quality attributes were available in Indonesian online stores using the four dimensions of the e-service quality model, and to measure the impact of e-service quality (i.e., e-commerce impacts on customer satisfaction and customer trust) on repurchase intention, word of mouth, and site revisit. The study found that security/ privacy, fulfillment, and user interface design are cornerstone elements in building superior service quality and overall performance of an ECP. On the other hand, it found that customer service was not an important dimension of e-service quality in the Indonesian context. Thus, it can be hypothesized that:

H$_2$: UX in e-commerce has a positive effect on ECPP.

In the broadest sense, an e-marketplace is an inter-organizational information system in which buyers and sellers in a market communicate information on prices and products and can complete transactions via electronic communication channels (Bakos, 1991). The e-marketplace is simply a platform on which independent sellers, professionals, or individuals can sell their products or services online (Berni & Borgianni, 2021; Díaz et al., 2017; Dickinger & Stangl, 2013). The marketplace has many benefits for both parties. On the buyers' side, it allows benefiting from an important choice of products (Berni & Borgianni, 2021; Díaz et al., 2017). It offers access to millions of potential customers and payment guarantees for professionals. E-Marketplaces have been the buzz of the customer industry in recent years, but many brands and retailers are still struggling to understand how to partner with them successfully. Moreover, the owners of these platforms struggle to maintain a high level of UX with many parties (sellers and customers) but understanding the needs of those users and being able to capture their feelings and opinions towards the ECPP are essential for market success (Berni & Borgianni, 2021). Thus, it can be hypothesized that:

H$_3$: The relationship between usability and ECPP is mediated by UX.

Research Design

This research is designed to develop and test a conceptual framework for evaluating usability and UX effect of e-commerce amid the Covid-19 pandemic based on a quantitative methodology. Various underlying factors of usability, UX, and ECPP are analyzed to clarify the relationships between these

constructs. The present research reflects relevant views from the perspectives of online customers who have experienced e-commerce during the pandemic by purchasing online from retailers in various industries. This research uses primary and secondary data to deductively evaluate the usability of ECPs among online customers related to their UX with regard to ECPP, providing knowledge of this specific context. Secondary data is analyzed following an extensive review of books and peer-reviewed journals. Primary data—especially data about usability and UX amid the Covid-19 pandemic—was limited; therefore, a survey method was suitable to provide rich data pertaining to the explanation of complex emergent constructs (Schoonenboom & Johnson, 2017). Consistent with previous empirical research in the field of innovative digital retailers, the unit of analysis was "the online customer" in Jordan who was purchasing online from different ECPs available from retailers.

Measurement Items

In the present research, the items measuring the research constructs were adapted from previous research in the field of e-commerce and online retailers. Based on the discussed literature, the usability scale and its six attributes (navigation, information architecture, value of content, satisfaction, aesthetics and consistency, and functionality) were specified, as previous empirical studies have examined its psychometric properties (Moczarny et al., 2012).

Usability is measured based on a version of the 30-item usability questionnaire, as shown in Table 1. The usability scale was employed to measure retailer usability from online customers' perspectives. While usability can be measured using subjective and objective techniques, in this study only the subjective technique was adopted as it allows for a high number of participants to complete and submit the survey to provide more generalizable findings, whereas objective controlled usability testing requires 8-12 respondents and demands a relatively long time and a controlled environment for data collection (Hwang & Salvendy, 2010).

The surveyed online customers were Jordanian users who purchase products from online retailers. Consistent with the reviewed UX literature, UX was measured using a 12-item scale (Moczarny et al., 2012), and platform efficiency was measured using an 8-item scale (Dickinger & Stangl, 2013) (Table 1). All the research constructs were measured with five-point Likert-type scales, with responses ranging from 5 ("Strongly Agree") to 1 ("Strongly Disagree"). A small section was also included in the questionnaire to study the respondents' demographic characteristics (Table 2).

Data Collection

The target population of this research is online purchasing customers in Jordan, as recently and specifically after the Covid-19 pandemic people have chosen online stores for their various needs. An online survey was developed and administered to customers who purchased their products offered through online retailers via their ECPs since the Covid-19 pandemic started in 2020 in Jordan. A number of processes were considered to validate the survey. The questionnaire was designed by an iterative process adapted from previous empirical research to generate its measurements and items. The questionnaire was constructed in English and Arabic, offering respondents a choice of which instrument to use via online terminals. It was then reviewed by two independent researchers for face and content validity. The survey instrument was then piloted using a judgmental sample of 15 digital customers to test its appropriateness for the research purposes—the 15 original pilot responses were not included in the main data analysis. These processes have helped the researchers to amend the first draft of the questionnaire. Confidentiality was assured to the respondents at the beginning of the questionnaire.

The survey consisted of four sections: the invitation letter, the demographic profile, the usability to measure the ECP that offer products to digital customers, the UX to measure the perceptions of digital customers toward retailers' ECP, and the ECPP to measure the platform's overall appeal from a customer's point of view. The questionnaires were sent randomly via social media to digital customers. Two-hundred and fifty responses were received through Google Forms—a tool used to

Table 1. Constructs measurements and items

Constructs and Items		Sources
Usability		
Navigation		Moczarny et al. (2012)
1	I can maneuver easily between related pages, and between different sections to find the content I need.	
2	I can find quickly what I am seeking.	
3	The terminology of the headings is understandable.	
4	The links color within the content area are obvious to the user.	
Information Architecture		
1	I find the information where I expect it to be.	
2	The ECP structure and layout hinder usage and lead to errors.	
3	The intra-page navigation is effective and logical.	
4	The structure of the content facilitated the achievement of my goals.	
Value of Content		
1	The ECP content addresses my goals and objectives as a user.	
2	The ECP content is of value to me as a user.	
3	The informational content is concise and comprehensive.	
4	The ECP supports the flexible use.	
Satisfaction		
1	I enjoyed using the ECP.	
2	I am satisfied with what is available on the ECP.	
3	I found the ECP easy to learn and effective to use.	
Aesthetics and Consistency		
1	The ECP tone, use of graphics and colors and the graphical intensity is appropriate.	
2	The ECP standardized aesthetic norms (e.g., balance, visual load) are appropriate.	
3	The screen content displays only the information I need at a given time.	
Functionality		
1	I was able to locate the available functionality (e.g., search functionality) easily.	
2	I was able to use the available functionality.	
3	The available functionality meets the needs of both novice and expert users.	
User Experience (UX)		
1	The content of product offerings on the ECP is simple and understandable.	Moczarny et al. (2012)
2	I enjoyed the innovative look-and-feel of the ECP, and the tone used made the ECP's content easy to read.	
3	The ECP uses friendly terminology which is easy to understand.	
4	The ECP is engaging and includes innovative sections (e.g., new product info and reviews).	
5	The colors used in the ECP are appealing.	
6	The pictures and illustrations used helped me in my online purchasing decision.	
7	The ECP content is clear and easy to read.	
8	The text size used in the ECP content is appropriate and easy to read.	
9	The ECP content is simple and appropriate where the content is not too little or too much.	
10	The product naming in navigation menus is intuitive and help me access suitable products.	
11	The homepage identified the proposed value of purchasing a product.	
12	The ECP design is simple and intuitive and I can understand the product offerings easily.	

Table 1. Continued

Constructs and Items		Sources
E-Commerce Platforms Performance (ECPP)		Dickinger & Stangl (2013)
1	I find the ECP useful for my search task.	
2	I find it easy to get the ECP to do what I want it to do.	
3	I find the ECP entertaining.	
4	I like the look and feel of the ECP.	
5	I think the ECP is trustworthy.	
6	The ECP communicates relevant information.	
7	It is easy to understand the overall navigation structure of the ECP.	
8	The pages of the ECP do not stop loading when I search.	

Table 2. Demographic characteristics

Measure	Items	Frequency	Percentage
Gender	Male	102	49.0%
	Female	106	51.0%
Age (years)	< 30	47	22.6%
	30 – 49	107	51.4%
	≥ 50	54	26.0%
Marital status	Single	52	25.0%
	Married	156	75.0%
Educational level	Secondary certification	18	8.7%
	Diploma	30	15.8%
	Bachelor	66	27.7%
	Postgraduate	94	45.4%
Monthly income (JOD)	200 – 499JOD	78	37.5%
	500 – 699JOD	32	15.4%
	700 – 999JOD	32	15.4%
	≥ 1000JOD	66	31.7%
Family size	2 - 4	110	52.9%
	5 – 7	62	29.8%
	> 7	36	17.3%
ECP of retailers (you/your family mostly use)	Amazon	40	19.2%
	eBay	23	11.1%
	OpenSooq	25	12.0%
	Etsy	19	9.1%
	Cdiscount	31	14.9%
	Modanisa	24	11.5%
	Shein	33	15.9%
	Others	13	6.3%

Table 2. Continued

Measure	Items	Frequency	Percentage
How many times do you (or your family) use one or more from the above selected ECPs?	1 - 3 times/year	88	42.3%
	4 - 6 times/year	60	28.8%
	7 - 9 times/year	32	15.4%
	> 10 times/year	28	13.5%
How many products do you (or your family) buy each time you use these platforms?	1 - 3	93	44.7%
	4 - 6	63	30.3%
	> 7	52	25%
How did you find about the ECPs of these retailers?	Social media apps	82	39.4%
	Search engines	71	34.1%
	Online advertisement	33	15.9%
	Referral from other platforms	15	7.2%
	others	7	3.4%

facilitate collecting participants' responses. A total of 208 questionnaires were found to be suitable for data analysis (after excluding incomplete responses or those with homogenous, repetitive answers), yielding a response rate of 83.2%.

RESULTS AND DISCUSSION

Validity and Reliability

Research instrument validity was assessed through face, content, construct, convergent, and discriminant validity. The face validity was assessed through the pilot work of the research instrument with 15 digital customers as well as two academic experts from reputable universities who checked the relevance and appropriateness of the questionnaire. Content validity was evidenced by explaining the methodology used to develop the research questionnaire, which included: (a) examining previous empirical and theoretical work of usability, UX, and ECPP; and (b) conducting a pilot study before starting the fieldwork. Regarding construct validity, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used to assess construct validity. EFA was performed to test the unidimensionality of the research constructs to examine the degree to which the items are tapping into the same concept. CFA, which is derived from structural equation modelling (SEM), is a more rigorous test of unidimensionality that was used in order to refine the unidimensionality of measurements that resulted from EFA.

To assess the EFA, five commonly used assumptions were followed (Hair et al., 2012), as shown in Tables 3 and 4. IBM SPSS version 20 was used to conduct EFA. To assess CFA, guidelines and goodness of measurement model fit using SEM were followed (Sarmento & Costa, 2019), as shown in Tables 5 and 6. Convergent validity was examined using the Bentler-Bonett normed fit index (NFI) (Bentler, 1990). All the constructs had NFI values above 0.90. Furthermore, as shown in Tables 5 and 6, indication of the measures' convergent validity is provided by the fact that all factor loadings are significant and that the scales exhibit high levels of internal consistency. Moreover, and as shown in Tables 5 and 6, the values of Composite Reliability (CR) and Average Variance Extracted (AVE) for each construct are all above the threshold suggested by Bagozzi (1981) (0.70 and 0.50, respectively).

Moreover, the discriminant validity is established by the absence of significant cross-loadings that are not represented by the measurement model (i.e., congeneric measures). The absence of significant

cross-loading also evidences constructs' unidimensionality (Gerbing & Anderson, 1988). Second, to establish evidence for the discriminant validity among the constructs, the AVE for each variable was calculated and then compared with the shared variances among the variables. The discriminant validity is established between two constructs if the AVE of each construct is higher than the shared variance. A comparison of the shared variance and AVE values is shown in Table 7 (where the diagonal values are the AVEs). The outcomes support the discriminant validity among the latent model variables.

Demographic Profile

Analysis of the respondents' profiles showed that over half of those who purchase from ECP were females (51%) and were aged 30-49 years (51.4%). Three-quarters of respondents were married (75%), while the remainder were single. The majority of the respondents were literate and 45.4% of them have completed postgraduate education. Regarding the monthly incomes of respondents (in JOD), the following proportions reported the associated remuneration: 37.5% have 200-499JOD as monthly income, 15.4% have 500-699JOD as monthly income, 15.4% have 700-999 JOD as monthly income, and 31.7% have $\geq$ 1000 JOD as monthly income. More than half of respondents (52.9%) had a small family size (ranging from 2-4 family members), 29.8% had 5-7 members, and 17.3% had more than 7 members.

Regarding the most used ECPs, 19.2% of the respondents cited Amazon, 15.9% Shein, 14.9% Cdiscount, 12% OpenSooq, 11.1% eBay, and 11.5% Modanisa. The largest group of respondents (42.3%) purchased from ECPs 1-3 times per annum, while 28.8% reported 4-7 times, and 15.4% purchased online 7-9 times a year. Regarding the number of products bought each time from ECPs, 44.7% usually buy 1-3 items, while 30.3% buy 4-7 items, and 25% buy more than 7 items each time. The majority of respondents found out about the used ECP from social media or from search engines (39.4% and 34.1%, respectively), while 15.9% found out about the used ECP from online advertisements, and 7.2% were referred from other platforms.

Structural Framework and Hypotheses Testing

To test the model and the hypothesized relationships, the two-step procedure suggested by Gerbing and Anderson (1988) was followed: conducting a CFA to develop a measurement model with an acceptable fit to the data and constructing a structural model to test the hypothesized relationships. This research used the maximum likelihood method in the R program to examine the measurement and structural models. SEM was used to test the research model and examine its hypotheses (as shown in Figure 2 and Table 8). The first step was to test the proposed model by creating direct paths from each of the usability variable attributes (navigation, information architecture, value of content, satisfaction, aesthetics and consistency, and functionality) to UX. A direct path was created from UX to ECPP. Table 8 shows the SEM model goodness-of-fit measures and the resulting paths. The goodness-of-fit measures indicate that the model has an excellent fit to the data except for the path between value of content and UX.

The structural findings support all of the research hypotheses except H1e. Navigation attribute of usability (β= 0.144, t=2.735, p < 0.05) positively and significantly affected UX, providing support for H1a. Information architecture attribute of usability (β= 0.110, t= 2.105, p < 0.05) positively and significantly affected UX, providing support for H1b. Value of content attribute of usability (β= 0.066, t= 1.102, p > 0.05) had a positive but non-significant effect on UX, providing no evidence to support H1c. Satisfaction attribute of usability (β= 0.278, t= 4.745, p < 0.05) positively and significantly affected UX, providing support for H1d. Aesthetics and consistency attribute of usability (β= 0.221, t= 4.652, p < 0.05) positively and significantly affected UX, providing support for H1e. Functionality attribute of usability (β= 0.257, t= 4.779, p < 0.05) positively and significantly affected UX, providing support for H1f. Lastly, UX (β= 0.741, t= 15.833, p < 0.05) positively and significantly affected ECPP, providing support for H2.

Table 3. EFA indicators-usability dimensions

EFA Analysis Indicators		EFA Indicators: Cut-Off Points	EFA Analysis Results
Testing for multicollinearity or singularity: Determinant of R-matrix		Determinant > 0.00001	Determinant= 0.006
Measure of sampling adequacy: Kaiser-Meyer-Olkin:		KMO > 0.50	KMO= 0.864
Measure of sampling adequacy: Bartlett's test of sphericity		$\chi2$: p ≤ 0.05	$\chi2$: 1013, p= 0.000
Factor extracting (retention) method: Principal component factor analysis		Eigenvalues > 1	7 factors extracted
Factor analysis rotation: Independent factors		Orthogonal – Varimax: it simplifies the interpretation of factors	7 factors extracted
EFA factor loadings		Loading > 0.40	0.487 – 0.868

Extraction of Sum Square Loadings									
Constructs	**Items**	**EFA factor Loadings**							
		1	2	3	4	5	6	7	
Navigation	Nav.1_I can maneuver easily between related pages, and between different sections to find the content I need.					0.734			
	Nav.2_I can find quickly what I am seeking.	0.591							
	Nav.3_The terminology of the headings is understandable.	0.619							
	Nav.4_The links color within the content area are obvious to the user	0.489					-0.405		
Information architecture	Info.1_I find the information where I expect it to be.	0.597							
	Info.2_The site structure and layout hinder usage and lead to errors.			0.703					
	Info.3_The intra-page navigation is effective and logical.	0.528							
	Info.4_The structure of the content facilitated the achievement of my goals.	0.526							
Value of content	Val.1_The ECP content addresses my goals and objectives as a user.	0.618							
	Val.2_The ECP content is of value to me as a user.	0.544	-0.473						
	Val.3_The informational content is concise and comprehensive.	0.413					0.525	-0.480	
	Val.4_The ECP supports the flexible use.	0.614							
Satisfaction	Sat.1_I enjoyed using the ECP.	0.650							
	Sat.3_I found the ECP easy to learn and effective to use.	0.602							
	Sat.2_I am satisfied with what is available on the ECP.	0.551							
Aesthetics and consistency	Aesth.1_The ECP tone, use of graphics and colors and the graphical intensity is appropriate.	0.438		0.433					
	Aesth.3_The screen content displays only the information I need at a given time.		0.535						
	Aesth.2_The ECP standardized aesthetic norms (e.g., balance, visual load) are appropriate.	0.452			0.558				
Functionality	Fun.3_The available functionality meets the needs of both novice and expert users.	0.627							
	Fun.2_I was able to use the available functionality.	0.538						0.440	
	Fun.1_I was able to locate the available functionality (e.g., search functionality) easily.	0.520							
Total variance explained by a (7)-factor model									
Eigen-values		27.06	6.037	5.637	5.571	5.075	4.993	4.785	

Table 4. EFA indicators-UX and ECPP constructs

EFA Analysis Indicators		EFA Indicators: Cut-Off Points	EFA Analysis Results
Testing for multicollinearity or singularity: Determinant of R-matrix		Determinant > 0.00001	Determinant= 0.009
Measure of sampling adequacy: Kaiser-Meyer-Olkin:		KMO > 0.50	KMO= 0.856
Measure of sampling adequacy: Bartlett's test of sphericity		χ^2: p ≤ 0.05	χ^2: 939, p= 0.000
Factor extracting (retention) method: Principal component factor analysis		Eigenvalues > 1	6 factors extracted
Factor analysis rotation: independent factors		Orthogonal – Varimax: it simplifies the interpretation of factors	6 factors extracted
EFA factor loadings		Loading > 0.40	0.402 – 0.634

Extraction of Sum Square Loadings							
Construct	**Items**	**EFA Factor Loadings**					
		1	**2**	**3**	**4**	**5**	**6**
UX	UX1.The content of product offerings on the ECP is simple and understandable.	0.538					
	UX2. I enjoyed the innovative look-and-feel of the ECP, and the tone used made the ECP's content easy to read.	0.539			-0.49		
	UX3.The ECP uses friendly terminology which is easy to understand.	0.418	0.492				
	UX4.The ECP is engaging and includes innovative sections (e.g., new product info and reviews).	0.545					
	UX5.The colors used in the ECP are appealing.	0.536					
	UX6.The pictures and illustrations used helped me in my online purchasing decision.	0.634					
	UX7.The ECP content is clear and easy to read.	0.506					
	UX8.The text size used in the ECP content is appropriate and easy to read.	0.542	0.402				
	UX9.The ECP content is simple and appropriate where the content is not too little or too much.	0.529					
	UX10.The product naming in navigation menus is intuitive and help me access suitable products.	0.567					
	UX11.The homepage identified the proposed value of purchasing a product.	0.52					
	UX12.The ECP design is simple and intuitive and I can understand the product offerings easily.	0.566					
E-Commerce Platform Performance (ECPP)	Web1.I find the ECP useful for my search task.	0.49					
	Web2.I find it easy to get the ECP to do what I want it to do.	0.442				0.418	
	Web3.I find the ECP entertaining.						0.623
	Web4.I like the look and feel of the ECP.	0.529					
	Web5.I think the ECP is trustworthy.	0.582					
	Web6.The ECP communicates relevant information.	0.484		0.44			
	Web7.It is easy to understand the overall navigation structure of the online store.	0.577					
	Web8.The pages of the ECP do not stop loading when I search.			0.566		0.489	
	Extraction method: PCA						
Total variance explained by a (6)-factor model							
Eigen-values		26.945	7.226	5.943	5.615	5.276	5.108

Table 5. CFA fit indices, factor loadings, CRs, and AVEs-usability dimensions

Constructs	Items	CFA Factor Loadings	CR	AVE
Navigation	Nav.1_I can maneuver easily between related pages, and between different sections to find the content I need.	0.99	0.868	0.628
	Nav.2_I can find quickly what I am seeking.	0.687		
	Nav.3_The terminology of the headings is understandable.	0.652		
	Nav.4_The links color within the content area are obvious to the user.	0.799		
Information architecture	Info.1_I find the information where I expect it to be.	0.688	0.882	0.656
	Info.2_The site structure and layout hinder usage and lead to errors.	0.994		
	Info.3_The intra-page navigation is effective and logical.	0.763		
	Info.4_The structure of the content facilitated the achievement of my goals.	0.763		
Value of content	Val.1_The ECP content addresses my goals and objectives as a user.	0.659	0.822	0.540
	Val.2_The ECP content is of value to me as a user.	0.739		
	Val.3_The informational content is concise and comprehensive.	0.861		
	Val.4_The ECP supports the flexible use.	0.662		
Satisfaction	Sat.1_I enjoyed using the ECP.	0.615	0.720	0.500
	Sat.2_I am satisfied with what is available on the ECP.	0.739		
	Sat.3_I found the ECP easy to learn and effective to use.	0.684		
Aesthetics and consistency	Aesth.1_The ECP tone, use of graphics and colors and the graphical intensity is appropriate.	0.844	0. 897	0. 745
	Aesth.2_The ECP standardized aesthetic norms (e.g., balance, visual load) are appropriate.	0.832		
	Aesth.3_The screen content displays only the information I need at a given time.	0.911		
Functionality	Fun.1_I was able to locate the available functionality (e.g., search functionality) easily.	0.769	0.762	0.519
	Fun.2_I was able to use the available functionality.	0.746		
	Fun.3_The available functionality meets the needs of both novice and expert users.	0.64		

CFA Model Goodness of Fit Indices			
Model Goodness of Fit Indices	**Model Desired Level**	**Model Indices Results**	**CFA Analysis Results**
Chi-Square	χ^2, P ≥ 0.05	χ^2= 243, p= 0.000	Confirmed the CFA cut-off points
Normed fit index	NFI ≥ 0.90	0.908	
Non-normed fit index	NNFI ≥ 0.90	0.911	
Comparative fit index	CFI ≥ 0.90	0.918	
Goodness-of-fit index	GFI ≥ 0.90	0.907	
Adjusted goodness-of-fit index	AGFI ≥ 0.80	0.823	
Standardized root mean-square residual	SRMR ≤ 0.08	0.050	
Root mean square error of approximation	RMSEA < 0.10	0.044	
CFA factor loadings range	Loadings > 0.60	0.615 - 0.994	

**Table 6. CFA fit indices, factor loadings, CRs, and AVEs—UX and ECPP**

Construct	Items	CFA Factor Loadings	CR	AVE
UX	UX1.The content of product offerings on the ECP is simple and understandable.	0.752	0.805	0.568
	UX2. I enjoyed the innovative look-and-feel of the ECP, and the tone used made the ECP's content easy to read.	0.853		
	UX3.The ECP uses friendly terminology which is easy to understand.	0.736		
	UX4.The ECP is engaging and includes innovative sections (e.g., new product info and reviews).	0.753		
	UX5.The colors used in the ECP are appealing.	0.638		
	UX6.The pictures and illustrations used helped me in my online purchasing decision.	0.784		
	UX7.The ECP content is clear and easy to read.	0.749		
	UX8.The text size used in the ECP content is appropriate and easy to read	0.76		
	UX9.The ECP content is simple and appropriate where the content is not too little or too much.	0.717		
	UX10.The product naming in navigation menus is intuitive and help me access suitable products.	0.771		
	UX11.The homepage identified the proposed value of purchasing a product.	0.714		
	UX12.The ECP design is simple and intuitive and I can understand the product offerings easily.	0.798		
E-Commerce Platform Performance (ECPP)	Web1.I find the ECP useful for my search task.	0.838	0.680	0.641
	Web2.I find it easy to get the ECP to do what I want it to do.	0.876		
	Web3.I find the ECP entertaining.	0.763		
	Web4.I like the look and feel of the online store.	0.704		
	Web5.I think the ECP is trustworthy.	0.804		
	Web6.The ECP communicates relevant information.	0.709		
	Web7.It is easy to understand the overall navigation structure of the online store.	0.891		
	Web8.The pages of the ECP do not stop loading when I search.	0.838		

CFA Model Goodness of Fit Indices			
Model Goodness of Fit Indices	**Model Desired Level**	**Model Indices Results**	**CFA Analysis Results**
Chi-Square	χ^2, P $\geq$ 0.05	χ^2= 279, p= 0.000	Confirmed the CFA cut-off points
Normed fit index	NFI $\geq$ 0.90	0.914	
Non-normed fit index	NNFI $\geq$ 0.90	0.942	
Comparative fit index	CFI $\geq$ 0.90	0.906	
Goodness-of-fit index	GFI $\geq$ 0.90	0.928	
Adjusted goodness-of-fit index	AGFI $\geq$ 0.80	0.854	
Standardized root mean-square residual	SRMR $\leq$ 0.08	0.059	
Root mean square error of approximation	RMSEA < 0.10	0.056	
CFA factor loadings range	Loadings > 0.60	0.638 - 0.891	

Table 7. Shared variance among all research constructs

Research Constructs	Navigation	Information	Value	Satisfaction	Aesthetics	Functionality	UX	ECPP
NavigationM=2.281, SD=0.689	0.628							
Information architectureM=2.354, SD=0.636	0.202	0.656						
Value of contentM=2.311, SD=0.702	0.327	0.276	0.540					
SatisfactionM=2.174, SD=0.766	0.242	0.253	0.401	0.500				
Aesthetics and consistency M=2.256, SD=0.696	0.091	0.187	0.158	0.188	0. 745			
FunctionalityM=2.293, SD=0.752	0.239	0.211	0.294	0.326	0.120	0.519		
UXM=2.246, SD=0.564	0.315	0.317	0.372	0.475	0.301	0.421	0.568	
ECPP M=2.263, SD=0.570	0.271	0.256	0.367	0.450	0.194	0.370	0.549	0.461

Note: AVEs are on the diagonal and below, which are constructs shared variance.

Figure 2. Empirical framework
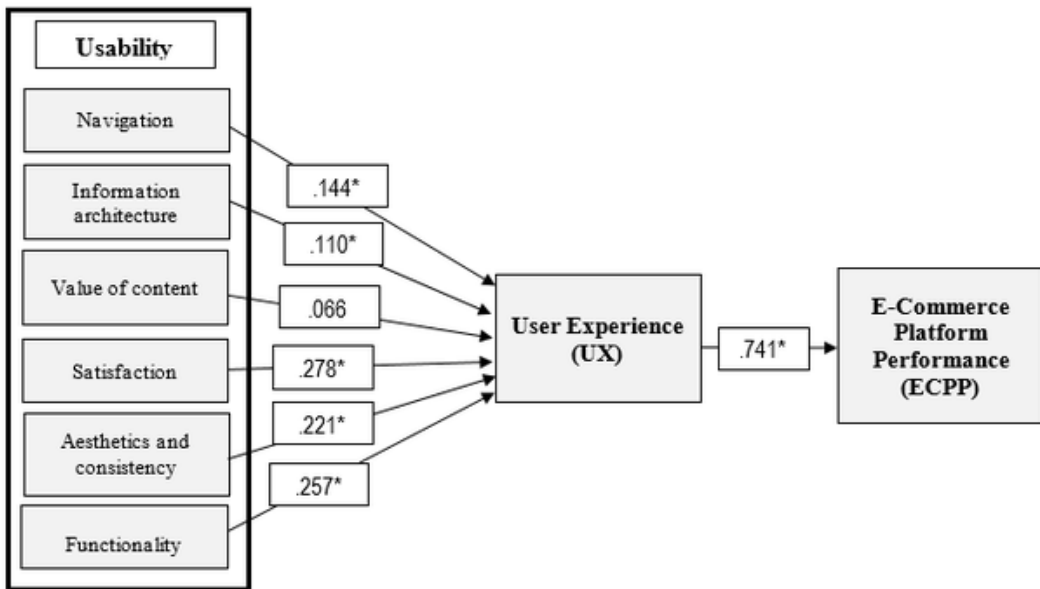
Note: *Standardized beta coefficient is sig. 0.05.

The Sobel test was utilized to examine if UX mediated the relationship between usability and ECPP—the Sobel test provides a statistical method for determining the influence of a mediator on an intervention or outcome. First, the results of multiple linear regression (Table 9) showed that the navigation attribute of usability was a statistically significant predictor of ECPP (b= 0.090, β= 0.109, t= 1.851, P < 0.05). When the mediator (UX) was entered in the regression analysis (Table 10), the usability attribute was no longer a significant predictor of ECPP (b= 0.045, β= 0.054, t= 0.953, P> 0.05). On the other hand, the mediator (UX) emerged a significant predictor of ECPP (b=

Table 8. Summary of structural framework path

Hypothesis	Variables in Path Model (Framework)	β	t	P value
H1	Navigation → UX	.144	2.735	.007
	Information architecture → UX	.110	2.105	.037
	Value of content → UX	.066	1.102	.272
	Satisfaction → UX	.278	4.745	.000
	Aesthetics and consistency → UX	.221	4.652	.000
	Functionality → UX	.257	4.779	.000
H2	UX → ECPP	.741	15.833	.000

Table 9. Multiple linear regression of the usability variable attributes with ECPP as a dependent variable

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Navigation	.090	.049	.109	1.851	.046
Information architecture	.067	.053	.075	1.279	.202
Value of content	.113	.055	.139	2.063	.040
Satisfaction	.236	.049	.317	4.813	.000
Aesthetics and consistency	.085	.044	.104	1.955	.052
Functionality	.173	.046	.228	3.783	.000

Table 10. Multiple linear regression of the usability variable attributes and UX with ECPP as a dependent variable

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Navigation	.045	.047	.054	.953	.342
Information architecture	.029	.050	.033	.586	.558
Value of content	.092	.052	.113	1.785	.076
Satisfaction	.156	.049	.210	3.210	.002
Aesthetics and consistency	.016	.043	.019	.365	.715
Functionality	.098	.045	.129	2.160	.032
Navigation	.388	.075	.384	5.152	.000

0.338, β= 0.384, t= 5.152, P > 0.05). To further investigate the mediator, the Sobel test was utilized to examine if UX significantly mediated the relationship between navigation and ECPP (Table 11). The results confirmed that UX significantly mediates the relationship between navigation attribute of usability and ECPP (Z= 2.34, p < 0.05). The results shown in Table 11 also confirmed that UX significantly mediates the relationship between the information architecture, satisfaction, aesthetics and consistency, and functionality attributes of the usability variable and the ECPP variable (P < 0.05), while for the value of content attribute of usability, the UX showed no significant mediation in the relationship with ECPP (P > 0.05).

Table 11. Summary of Sobel test results for Hypothesis 3

Variables in Path Model Mediated by UX	Z Score	P Value
a. Navigation → ECPP	2.344	.02
b. Information architecture → ECPP	1.926	.05
c. Value of content → ECPP	1.072	.28
d. Satisfaction → ECPP	3.275	.001
e. Aesthetics and consistency → ECPP	3.215	.001
f. Functionality → ECPP	3.293	.001

Summary

This study evaluates UX in the context of the Covid-19 pandemic in Jordan, to explore ECP usability and how it affects ECPP. It develops and tests a reflective measurement for usability, UX, and ECPP. The data were obtained from Jordanian customers who use ECPs to test a model of the effects of six usability attributes on UX and ECPP. The findings revealed that there are significant positive relationships between these constructs, which supported the proposed model.

The findings show that the usability attributes of navigation, information architecture, satisfaction, functionality, and aesthetics and consistency of ECPs positively affect UX. These outcomes are consistent with the findings reported in the literature by Moczarny et al. (2012) and Agustina (2020), affirming the intuitive assumption that flexible, easy-to-learn, and effective-to-use platforms that provide the needed information with appropriate aesthetics can support users' confidence and enhance their engagement and conversion. This consequently increases their return visits and retains them as users (and ultimately as customers). The outcomes of this study are also consistent with the findings reported in the literature by Turkyilmaz et al. (2015) in affirming the effect of aesthetics on UX and its role in increasing customer satisfaction and sales through providing ease of use and enjoyment for users, and by Hasan et al. (2013) where the aesthetics of UX were found to influence the perception of trust.

However, in terms of usability, the value of content attribute was found to be statistically insignificant in its effect on UX—a research finding that seems to be novel. In literature, Hartmann et al. (2008) identified content/functionality as one of the quality attributes that affect user experience on ECP, and Alshaheen and Tang (2022) found that the trustworthiness of the content and the perceived credibility of the content can affect customer satisfaction. Both studies suggested that the value of content attribute can have an impact on UX, but none has determined the statistical significance of this relationship.

In light of the above findings, for a satisfactory UX, ECPs designers should consider usability attributes in developing ECPs, with particular concern for ECPP, which is highly correlated (a satisfactory UX yields satisfactory ECPP)—a research finding that is consistent with Agustina (2020) who found that the usability of e-commerce platforms affects user satisfaction and conversion rates. All in all, ECPP was found to be positively affected by usability attributes when mediated with UX. Accordingly, we can argue that the chain of usability → UX → ECPP shapes an effective dimensional model to understand e-commerce business in relation to the needs of users and online retailers.

CONCLUSION

Main Outcomes

This study evaluated the impacts of selected usability attributes (navigation, information architecture, value of content, satisfaction, aesthetics and consistency, and functionality) on UX in the context of ECPs during the Covid-19 pandemic. It examined the effect of UX on their ECPP and finally it evaluated the effect of usability attributes on ECPP when mediated by UX. The analysis showed

that navigation, information architecture, satisfaction, functionality and aesthetics, and consistency attributes of usability positively affect UX in ECPs; of these, satisfaction, functionality, and aesthetics and consistency contributed the most statistically significant impacts. On the other hand, the value of content attribute showed no significant effect on UX. Moreover, the usability attributes of navigation, information architecture, satisfaction, functionality, and aesthetics and consistency significantly affect ECPP when mediated by UX. The analysis also showed that UX exerts a strong positive effect on ECPP.

Theoretical Contributions

Many reviewed studies supported the theory of positive correlation between usability and UX. The originality of this research paper is that it generates empirical evidence to establish the theoretical implications of these findings. However, few researchers studied the relationship between UX and ECPP. Eventually, the findings of this research will help in establishing and supporting theoretical literature positing a positive relationship between UX and ECPP.

Managerial Implications

This research highlights the strategic importance of usability on UX and ECPP during the Covid-19 pandemic in Jordan. A set of usability attributes act as preceding factors to UX and ECPP. Furthermore, an integrated framework of usability and UX is required by retailers running digital platforms, which will return benefits to online stores who had struggled during the pandemic at enhancing their businesses and at promoting their growth. On the other hand, online customers and purchasers will find their demands available through these ECPs with greater ease of use, enjoyment, and affordability.

Limitations

Although the results of this research demonstrate a significant positive correlation between usability and ECPP, the findings cannot be generalized due to many factors, including the time when the study was conducted: during the Covid-19 pandemic. The exceptional nature of the pandemic scenario entail that the explored factors and model have not been evaluated in non-exceptional situations such as normative pre-Covid-19 e-commerce, or the post-Covid-19 "the new normal." Additionally, it would be worthwhile to validate the statistical significance of the demographic characteristics in relation to the results; due to time constraints, we were not able to conduct any advanced statistical tests such as analysis of variance (ANOVA) or t-tests to evaluate the statistical significance of these independent demographic features with other variables in this research. To tackle some of these limitations in future research, it is recommended to repeat this research after the subsidence of the Covid-19 pandemic, while considering other developing countries that are new to e-commerce business, in addition to Jordan. Additionally, this research can be enriched if other evolving online retailers were involved in the survey.

COMPETING INTEREST STATEMENT

FUNDING AGENCY STATEMENT

DATA SETS

Data collected and metadata are available in the Mendeley Data repository at doi: 10.17632/xdbtxtdrwp.1.

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