Incorporating Functional Quality into Usability Model of E-Commerce Application

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Abstract **– E-commerce application usability refers to the design and functional aspects that facilitate user interaction and goal achievement. Well-designed usability of e-commerce applications will lead to usage continuance by users. Therefore, this study tries to identify usability factors and measure the effect of usability on usage continuance. Based on previous studies, the variables hypothesized to be the factors that define usability are learnability, efficiency, memorability, accuracy, emotion, and utility. Utility is a variable that represents the functional aspects of usability. It is described in more detail into information search, interface display, and transaction. Furthermore, this study also examined the relationship between usability, usage continuance, satisfaction, and usefulness. This study's hypotheses were evaluated using 242 survey responses from e-commerce application users. Structural equation modeling, or SEM, was applied to process the empirical data. Memorability, accuracy, efficiency, and utility were found to be able to describe the usability of e-commerce applications well. This proved that functional quality is also an essential part of usability. Usability was found to influence usage continuance.**

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1. Introduction

E-commerce is a business activity conducted online using digital technologies [1]. With the advancement of the Internet networks and technology, e-commerce has expanded swiftly and altered business trends in recent years [2], [3]. Since the emergence of the Internet, e-commerce has transformed how people shop [4]. It is common for customers to buy products online through e-commerce [5]. The emergence and rapid success of e-commerce raise important issues, including customer satisfaction with e-commerce applications (apps) [6].

Usability is a crucial aspect of e-commerce apps [7], [8]. E-commerce application usability is the quality of the application related to user interaction with the application itself [9]. Customer experience with e-commerce software influences its success or failure [10]. By measuring the usability of e-commerce apps, service providers can identify the elements that drive customers to continue using these apps. This knowledge can then be utilized to enhance the platform and give a better experience for users.

Usability is a broad notion that can be applicable to various entities, including services, goods, and systems [11]. Usability is an interesting topic to be studied because study on usability can lead to an understanding of how a technology or information system should be designed. According to Nielsen [12], usability is users' ability to use information systems or technology functions. Good usability in an information system or technology can increase user satisfaction and the use of information systems or technologies [9].

Previous studies have discussed usability in a focused and in-depth manner. The study attempted to describe the first-order factors that form usability and put usability as a second-order variable [9], [13], [14], [15].

For example, Lacka and Chong [13] conducted a study that discussed usability as a second-order factor consisting of learnability, memorability, efficiency, error, and satisfaction. Usability as a second-order factor consisting of ease of use, content, emotion, promotion use, and made for the medium is also discussed by Agarwal and Venkatesh [9].

Usability can describe functional aspects as well as non-functional aspects of information systems. Many prior studies paid little consideration to the functional aspects of the usability concept. Content is the most essential factor influencing usability [9]. In the usability concept, content relates to the functional aspects of information systems. In Lacka and Chong [13], there is a construct that has a similar meaning to content, i.e., perceived utility, which is a function of the system that should be able to do things that are needed by the user. However, this construct is not a construct that forms usability. As well as in Kim *et al*. [16], there is a content quality construct that does not form usability. Content quality in Kim *et al*. [16] encompasses three aspects of Akter *et al*. [17], i.e., utilitarian benefits (the extent to which information is produced following their actual goals), confidence (the extent to which service platforms are deemed safe), and hedonic benefits (the extent to which information services can generate good feelings). This aspect of content or utility is interesting to be studied more deeply because there were few previous researchers who studied non-functional and functional aspects simultaneously in measuring usability. In this study, content or utility will be formed by the main functional attributes of the object being studied, i.e., e-commerce apps. Li and Li [10] described that the functional aspects of e-commerce consist of information search, display interfaces, and transactions. Therefore, in this study, the concept of usability will be studied more comprehensively, including functional and non-functional aspects.

Most studies that put usability as a second-order construct pay less attention to the relationship between usability and other constructs. Good usability can increase the use of an information system, not merely in the moment but also in the years to come (usage continuance). Usage continuance is advantageous for an organization because the investment spent becomes beneficial. Many studies have widely adopted usage continuance as a critical use outcome [18]. Daghan and Akkoyunlu [19] discussed web-based information systems usage continuance. In their study, there are constructs consisting of usage continuance, satisfaction, and usability.

It is known that satisfaction and usability directly affect usage continuance. Additionally, Kim *et al*. [16] and Wang *et al*. [20] showed that satisfaction positively influences usage continuance. Moreover, Chiu *et al*. [21] and Liao *et al*. [22] have discovered evidence that usability directly affects usage continuance via satisfaction. Other studies that discussed the influence of usability on usage continuance include Hoehle and Venkatesh [14] and Hoehle *et al*. [15]. They stated that usability attributes can influence use outcomes. Information systems or technology will continue to be used and sought by users because of the benefits provided. If the user finds that a technology is not useful, then it is likely that the technology will be abandoned [23]. There are many other studies regarding the relationship between usability and usefulness in the scope of information systems in general [19], [23]. Therefore, this study will also examine the relationship between usability, usage continuance, satisfaction, and usefulness.

2. Theoretical Foundation

This section describes the basic concepts, models, and theories that serve as a guide for this study.

2.1. Usage Continuance

The notion of information systems usage is quite wide, so measuring its use can be done from various perspectives [24]. To measure the willingness to use an information system or technology (before use), the term intention to use is usually used [13], [25]. Intention to use is defined by Lien *et al*. [26] as the possibility that individuals will employ a specific service or product.

Retaining existing customers is crucial for business management due to the significantly higher costs associated with gaining new customers [20]. A study that focuses on after-use could be divided into short and long-term use. Some studies are more interested in discussing long-term use (usage continuance) than short-term use [27]. Usage continuance is a key factor in information systems' success and long-term sustainability [20]. According to Meena and Sarabhai [28], usage continuance is crucial in this era, given that most customers have already moved beyond the initial phase of technology adoption.

In the context of usage continuance, continuance usage intention is usually used as a measurement variable [19], [29], [30].

Steelman and Soror [30] stated that usage continuance is a long-term use of individuals. Usage in the case of e-commerce means an overall measurement of application usage, starting from navigation of the interface, receipt of information, and execution of transactions [31]. Therefore, usage continuance of e-commerce apps means the intensity of utilizing e-commerce application features to continuously carry out some tasks to achieve a goal.

Some examples of studies on usage continuance are as follows. Meena and Sarabhai [28] explored intrinsic and extrinsic factors that motivate individuals to keep using mobile apps. Kim *et al*. [16] and Wang *et al*. [20] discussed continued use of mobile apps and considered usage continuance as an essential measure of mobile apps' success and long-term viability. Weng *et al*. [29] discussed the usage continuance of taxi booking app services. The continuation of the business will depend on the usage continuance of its services [29]. Rezvani *et al*. [23] carried out a study regarding the usage continuance of strategic information system (SIS) or Enterprise System (ES), usage continuance will help the company to gain benefits from the investment that has been made. Daghan and Akkoyunlu [19] conducted a study focusing on the usage continuance in using online learning.

2.2. Usability

Usability refers to the level to which a service or product may be utilized with success, efficiency, and effectiveness [32]. In general, usability encompasses the system's characteristics related to user-friendliness and the simplicity of user interfaces [33]. The measurements of usability and how to understand the relationships between various usability measures are interesting things to be discussed [34]. Usability in human-computer interaction (HCI) shows how people perceive a technological product as being effortless to learn, practical to use, and satisfactory [35]. According to ISO 9241-11 [36], usability is the measure of how well a product allows individuals to efficiently and effectively accomplish their goals within a particular setting of use, while also ensuring their satisfaction.

Over time, usability has been widely discussed in the information system area, including e-commerce apps. In e-commerce apps, usability is defined as application design and certain functional characteristics that enhance the apps' user-friendliness [37].

Usability is critical in determining the apps' success because it can affect the perceptions and decisions of users regarding purchases [38]. A good application design will improve user experience and satisfaction.

Some studies have discussed the concept of usability. For example, Agarwal and Venkatesh [9] developed usability measurement instruments on apps using guidelines owned by Microsoft. Oztekin *et al*. [34] carried out an investigation combining the quality and usability dimensions of information systems based on the web. According to Oztekin *et al*. [34], quality and usability dimensions have overlapping items on the concept. Therefore, combining these concepts can produce a new methodology to measure usability.

3. Research Model

This study attempted to reconceptualize the concept of usability by compiling the first-order factors that form usability more comprehensively. Lacka and Chong [13] discussed the usability concept with usability attributes consisting of learnability, memorability, efficiency, errors, and satisfaction. This study makes some adjustments to the usability attribute used in Lacka and Chong [13], which are as follows.

a) Error attributes are primarily used in usability studies with experimental design methods, for example, in Kim *et al*. [39] and Kaikkonen *et al*. [40]. Within the experimental design investigations, errors are often regarded as user actions that are not as expected. In this study, error is considered as a discrepancy that was expected by the user. For example, for e-commerce apps, errors are related to the incompatibility of information presented by the seller [41], so errors will be more suitable if associated with accuracy.
b) In this study, satisfaction will be used as a mediator variable related to usage continuance. The name of satisfaction attribute in Lacka and Chong [13] will be adjusted in this study to avoid name redundancy. Satisfaction has the same meaning with emotion [9], so satisfaction will be changed to emotion.

Beside study by Lacka and Chong [13], study by Agarwal and Venkatesh [9] is also used as the basis of this study. The usability attributes in Agarwal and Venkatesh [9], which are used as a basis for this study, are content, emotion, and ease of use. Some adjustments to the usability attributes of Agarwal and Venkatesh [9] are as follows.

a) Content is defined as the the level at which an application provides transactional and informational capability [9]. There is an attribute in Lacka and Chong [13] which have the same meaning as content, i.e., perceived utility. Lacka and Chong [13] mentioned that utility is the function of a system that should be able to do what the user needs. Utility is also an attribute related to user interaction with a technology. Therefore, perceived utility is a part of the concept of usability. Furthermore, because content and utility have the same meaning, utility is then chosen to represent the two attributes.

b) There is a merging of attributes, ease of use from Agarwal and Venkatesh [9] with efficiency from Lacka and Chong [13], because the two attributes have similar meanings. Efficiency is related to efficient technology to be used so that users are willing to use it [12], [13]. Perceived ease of use pertains to an individual's belief that employing a certain system will necessitate a low level of exertion [9]. Merging is done to avoid redundancy.

Besides reconceptualizing the concept of usability, this study attempted to examine the connection between the general usability concept and other concepts (i.e., usage continuance, satisfaction, and usefulness). This study's conceptual model is displayed in Fig. 1.

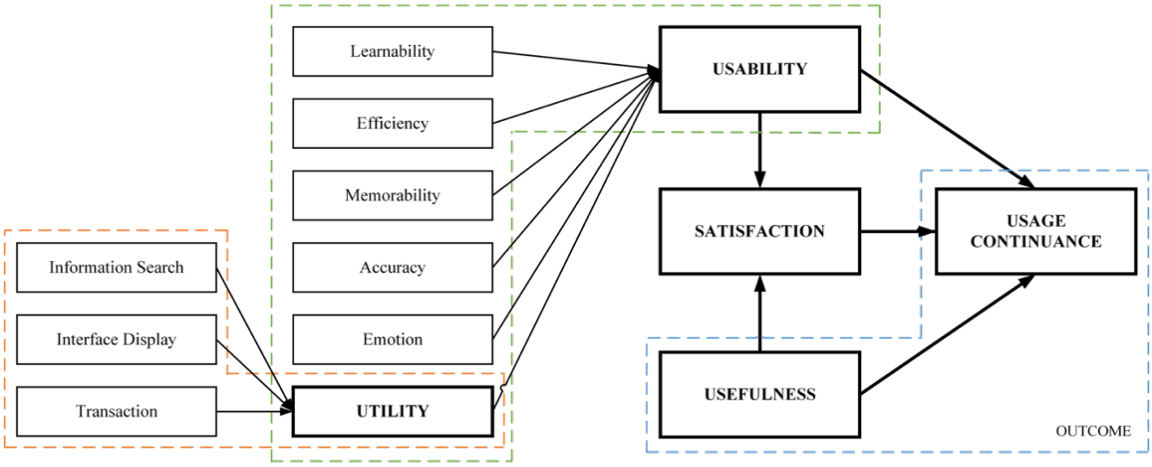

Figure 1. Research model

3.1. Usability and Its First Order Factors

The hypotheses of the usability attribute are as follows.

3.1.1. Learnability

Learnability refers to how easily users can execute a task when using an application for their initial use, as well as how quickly users can enhance their performance [42]. The usability of e-commerce apps is often assessed in relation to how straightforward it is for users to learn [43]. Learnability is part of the first-order usability concept and plays a significant role in order to determine usability [12], [13], [44]. Technology must be easy to be learned and understood in order to be used [12]. From a brief explanation of learnability above, we presented the subsequent hypothesis.

H1 Learnability has a positive effect on usability.

3.1.2. Efficiency

Nielsen [12] stated that if a user has learned to use a technology, the technology must be able to increase user's productivity. In the context of study by Lacka and Chong [13], social media is needed to achieve company productivity. In this study, e-commerce should be able to increase users' productivity. Users do not need to go to the store to find product information, users only need to find information on their smartphone or PC.

Efficiency related to technology means that technology must be efficient to be used so that users want to use it [12], [13]. Efficiency is sometimes used in other terms, namely ease of use [9], [35], [45], [46]. According to Nielsen [12], technological efficiency can affect usability. Thus, we presented the subsequent hypothesis.

H2 Efficiency has a positive effect on usability.

3.1.3. Memorability

The term memorability pertains to the extent to which individuals can retrieve the necessary steps to operate an application even after not using it for a certain period of time [42]. Memorability is a crucial aspect in determining usability [12], [13], [44]. Technology users should be able to easily remember how technology can be used for a particular purpose and re-use it after some time without learning how to use it again [12], [13]. Hence, memorability becomes the main attribute of the usability of technology, including e-commerce apps. Thus, we presented the subsequent hypothesis.

H3 Memorability has a positive effect on usability.

3.1.4. Accuracy

Nielsen [12] stated that users should rarely make mistakes when using technology, but if a user makes a mistake, it should be easily corrected. In other studies, accuracy is often referred to as errors [13], both have the same definition. Error or accuracy is part of usability [12], [13], [47]. It is known that accuracy is also called effectiveness [42], with the definition of completeness and accuracy used by users to achieve certain goals. Accuracy, sometimes known as reliability [16], refers to the capacity to fulfil the promised services precisely and consistently. Thus, we presented the subsequent hypothesis.

H4 Accuracy has a positive effect on usability.

3.1.5. Emotion

Emotion can be seen as a feeling that makes users feel comfortable when operating a technology. Nielsen [12] stated that technology's usability is determined by the user's subjective assessment of satisfaction or pleasure in using the technology. The concept of satisfaction in Lacka and Chong [13] is similar to emotion in Agarwal and Venkatesh [9], so both concepts were combined into emotion in this study. Enjoyment is also often used to describe emotion [48]. Davis *et al*. [48] described that enjoyment is the extent to which a person experiences happiness when performing a task without needing external assistance. Thus, we presented the subsequent hypothesis.

H5 Emotion has a positive effect on usability.

3.2. Utility

Utility is defined as the functions of a system that should be able to do what the user needs [13].

Utility also deals with the interaction between users and the system, so this study includes utility in the usability concept. Content, as the most important result that influences usability according to Agarwal and Venkatesh [8], is interesting to study in more depth, because this characteristic refers to the functional features of technology or information systems. Content in Agarwal and Venkatesh [9], or utility in Lacka and Chong [13], will be represented by the main functional attributes of the object being studied in this study, namely e-commerce apps. Thus, we presented the subsequent hypothesis.

H6 Utility has a positive effect on usability.

Each technology's utility varies according to its nature, function, and intended use [13]. Li and Li [10] described that the functional aspects of e-commerce consist of information search, interface displays, and transactions. Therefore, the functional aspects that make up the utility of an e-commerce apps in this study consist of information search, interface display, and transaction.

3.2.1. Information Search

Online buying offers the advantage of effective product search [49]. Users can rely on e-commerce to search for products [49], [50]. Search is part of the concept of usability. Search is defined as the degree to which the user considers that mobile apps adequately facilitate the process of finding information [14]. For e-commerce, product information is important, it is known that 65% of e-commerce use is to search for product information [51]. Product information displayed on e-commerce apps should be thorough enough to help customers make informed purchasing decisions [52]. Thus, we presented the subsequent hypothesis.

H7 Information search has a positive effect on utility.

3.2.2. Interface Display

The user interface is a constituent of a computing system that enables users to engage with the system and acts as a visual representation of the product [53]. Hoehle and Venkatesh [14] mentioned that interface is part of usability. Interface is divided into three, namely interface input, structure, and output. Interface refers to the point at which individuals perceive that the e-commerce application's display (or in this study, product display) is displayed effectively. Every facet of user interface design is vital and exerts a significant influence, especially on the overall performance of an information system [54].

Products need to be effectively displayed on the e-commerce apps [54]. Thus, we presented the subsequent hypothesis.

H8 Interface display has a positive effect on utility.

3.2.3. Transaction

E-commerce refers to the utilization of technology in digital business to support online transactions [55]. E-commerce apps are internet-based platforms that facilitate the exchange of goods ownership, monetary transactions, as well as the transfer of information [55]. E-commerce apps ought to offer secure transactions [50]. Transaction is the final process of using e-commerce technology. If the transaction is successfully carried out, then e-commerce can be said to be successfully used [10]. Thus, we presented the subsequent hypothesis.

H9 Transaction has a positive effect on utility

3.3. Usage Continuance, Usability, Satisfaction, and Usefulness

Steelman and Soror [30] defined usage continuance as the long-term use by users, whereas Weng *et al*. [29] defined usage continuance as an expansion of initial acceptance; nevertheless, it is widely believed that both initial acceptance and prolonged use should involve some of the same external factors to forecast and elucidate a user's internal assessment process and judgment. Daghan and Akkoyunlu [19] conducted a study that examined the direct impact of perceived usability on usage continuance. Usability of a well-designed information system will lead to continued use of the information system by users [9]. Moreover, Liao *et al*. [22] found that satisfaction has a substantial part in mediating the impacts of usability on continuance intention. Thus, we presented the subsequent hypothesis.

H10.a Usability directly has a positive effect on usage continuance.

H10.b Usability indirectly has a positive effect on usage continuance through satisfaction.

As stated by Ifinedo *et al*. [35], perceived usefulness refers to the extent to which someone considers that utilizing a system will improve users' performance, while Page *et al*. [46] provided a definition for perceived usefulness as the extent to which someone feels that information system usage are beneficial. Perceived usefulness has a significant effect on usage [18], [56]. Weng *et al*. [29] stated that usefulness affects usage continuance in two ways, directly and indirectly (through satisfaction). Rezvani *et al*. [23] and Rezvani *et al*. [57] also supported this relationship. Information systems or technology will continue to be used and sought by users because of the benefits provided, if users find that a technology is not useful then it is likely to be abandoned. Thus, we presented the subsequent hypothesis.

H11.a Usefulness directly has a positive effect on usage continuance.

H11.b Usefulness indirectly has a positive effect on usage continuance through satisfaction.

Ifinedo *et al*. [35] defined satisfaction as a measure of pleasure and approval of the use of a system. According to Ozok *et al*. [26], satisfaction is determined by comparing expectations to the reality of information system performance or post-use experiences, i.e., the level to which user needs are fulfilled [58]. Customer satisfaction encompasses all potential customer reactions and the different stages of the purchasing process [59]. In the case of e-commerce apps, satisfaction is the subjective evaluation of a user's experience with e-commerce apps. Kim *et al*. [16], Daghan and Akkoyunlu [19], Cho [56], and Nie *et al*. [58] discovered that satisfaction has a substantial influence on usage continuation. Users who are happy with their experience with information systems are more inclined to utilize them again. Satisfaction is affected by usefulness [23], [29], [30], [60]. In addition, a good apps design or a good information system will also affect the satisfaction of e-commerce apps' users [21], [61], [62]. Thus, we presented the subsequent hypothesis.

H12.a Usability has a positive effect on satisfaction.

H12.b Usefulness has a positive effect on satisfaction.

H12.c Satisfaction has a positive effect on usage continuance.

4. Methodology

This section discusses the methodology employed to analyze the research model presented in Section 3. Development of instruments, data collection, and data analysis methods are explained respectively in following sections.

4.1. Development of Instruments

In this study, there were 58 measurement items from a total of 13 constructs in the model. The measurement items were derived from prior studies and modified to suit this study's context.

The measurement items collected from prior studies were written in English. Subsequently, they were translated into Indonesian to accommodate the survey respondents, who were Indonesians utilizing e-commerce apps.

The measurement items applied in this study and their references can be seen in https://bit.ly/appendix-measurement-items. The learnability construct was measured using two indicators, namely easy to learn and easy to understand [13]. The efficiency construct was measured using five indicators, namely efficient to use, enhance productivity, easy to use, fast information, and interaction [13], [35], [63]. The memorability construct was measured using four indicators, namely easy to remember, able to return and use, can use in the future, and repeat shopping [13]. Accuracy construct was measured using five indicators, namely product accuracy, information accuracy, apps error rates, error in use, and can recover errors [10], [13], [42]. Emotion construct was measured using four indicators, namely plot, fun interacting, fun service, and enjoy to use [45], [64], [65], [66], [67].

Utility construct was measured using five indicators, namely relevance, media use, feature objective support, useful functions, and very functional [9], [13], [14], [45]. The information search construct was measured using four indicators, namely easy to search information, useful information, save time to search, and up-to-date information [14], [34], [46]. Information display construct was measured using four indicators, namely realistic picture for product understanding, picture to illustrate product, frequently needed information at main interface, and frequently used function at the main interface [14]. Transaction construct was measured using five indicators, namely fast to acquire product, efficient purchasing, type of payment, convenient pay system, and delivery information [10], [46].

Usability construct was measured using three indicators, namely saved time, easy to find information, and easy to use [13], [37], [62], [63], [68]. The usefulness construct was measured using six indicators, namely help understand product, product help shop, more convenience, easy communication, improve life productivity, and overall usefulness [69], [70], [71], [72], [73]. The usage continuance construct was measured using six indicators, namely frequency of use, duration of use, use for support of particular activities, free time, future use, and other alternatives [25], [29], [74], [75]. Satisfaction construct was measured using five indicators, namely satisfied, pleased, same as expectation, liked, and overall satisfied [13], [29], [35], [62].

4.2. Empirical Collection of Data

The data for this study were gathered by distributing online questionnaires that were made using Google Forms. The questionnaire was intended for e-commerce apps users who have been selected as research objects. To ensure that the respondent was the intended e-commerce user, there was a validation question about the apps that the respondent had used.

The survey in this study consisted of two sections. The first section was the questions about personal data or demographic data of respondents. The second part was the question about respondents' preference for the statements given (measurement items that had been predetermined). Respondents then gave their preferences using a Likert-like scale, which ranges from (1) strongly-disagree to (6) strongly-agree.

The survey instrument was tested using data from 32 respondents with experience using e-commerce apps. Validity and reliability tests were conducted using SPSS Statistics 20. The Pearson correlation coefficient was employed to test the convergent validity of measurement items, and Cronbach's alpha was utilized to evaluate the internal consistency and reliability of measurement items. All constructs had Cronbach's alpha coefficients that exceeded the required threshold of 0.7. The measurement items employed in this study were both valid and reliable.

After the measurement items used in this study were known to be reliable and valid, the questionnaires were redistributed. Missing data and outliers would be identified before the data processing was carried out. Outlier testing was done using a residual value (Z). The value of Z was obtained with the help of SPSS software. In this study, the missing and outlier data were discarded, so there were only 242 data left for further data processing. Respondent demographic data is provided in Table 1. Demographic data consists of gender, age, occupation, highest level of education, monthly expenses, and respondent's domicile.

Determining the proper sample size for SEM is challenging for researchers and reviewers [76]. However, there have been suggestions for using certain guidelines, such as a minimum sample size of 100 or 200 [77]. So, based on the statement, the data collected were sufficient.

Table 1. Respondent demographic data (n = 242)

Characteristic		Number	Percentage	Characteristic		Number	Percentage
Gender	Male	117	48,35%	Domicile	Sumatera	11	4,55%
	Female	125	51,65%		Kalimantan	5	2,07%
Age range	>= 23	130	53,72%		Sulawesi	3	1,24%
	< 23	112	46,28%		Papua	1	0,41%
Work	Student	110	45,45%		West Java	86	35,54%
	Private Employees	80	33,06%		Central Java	26	10,74%
	Civil servant	27	11,16%		East Java	18	7,44%
	Entrepreneur	13	5,37%		DIY	15	6,20%
	Etc.	11	4,55%		DKI Jakarta	59	24,38%
Last Education	Middle School or equivalent	1	0,41%		Banten	18	7,44%
	High School or equivalent	61	25,21%	Searching & Price Comparison Activities	1-2 times	116	47,93%
	Bachelor	157	64,88%		3 - 5 times	73	30,17%
	Master	22	9,09%		6 – 7 times	20	8,26%
	PhD	1	0,41%		more than 7 times	33	13,64%
Expenses in a month	less than IDR 1.250.000	56	23,14%	Online Shopping Activities	1-2 times	158	65,29%
	IDR 1.250.000 – 2.000.000	76	31,40%		3 - 5 times	69	28,51%
	IDR 5.000.000 – 7.500.000	10	4,13%		6 – 7 times	9	3,72%
	more than IDR 7.500.000	11	4,55%		more than 7 times	6	2,48%

4.3. Data Analysis Method

The data collected in this study were analysed by employing the structural equation modelling (SEM) approach. SEM is a statistical model that examines the relationship among several factors by testing the structure of the linkage expressed in a set of equations [78]. The data was processed in two phases using the Mplus program. The measurement model was validated in the first stage. If the measurement model's goodness of fit was judged to be satisfactory, data processing would proceed to the second stage, which includes structural model evaluation that involves examining the relationships between constructs and hypothesis testing.

5. Results

This section consists of measurement model evaluation (Section 5.1), structural model evaluation and hypothesis testing (Section 5.2).

5.1. Measurement Model

Factor loadings were initially investigated to ensure the validity of measurement items. To be deemed valid, measurement items must have factor loadings that surpass the minimal threshold of 0.50, and preferably 0.70 [13]. As indicated in Table 2, the factor loadings exceeded 0.5, indicating that over half of the variation in a measurement item can be attributed to its related construct [16]. In addition to factor loadings, the assessment of measurement item validity was conducted using composite reliability (CR) and average variance extracted (AVE). All CR values were above the acceptable limit of 0.6 [13], [20]. However, some constructs were found to have AVE values below the suggested threshold of 0.5. Fornell and Larcker [79] asserted that when the AVE value is below 0.5 but the CR is above 0.7, the construct still demonstrates sufficient convergent validity. Table 2 displays the outcomes of the validity test.

Table 2. Convergent validity for the measurement model

CONSTRUCT	INDICATOR	ESTIMATOR	AVE	CR
LA	LA1	0.848	0.532	0.694
	LA2	0.936		
EFF	EFF1	0.696	0.491	0.872
	EFF2	0.586		
	EFF3	0.711		
	EFF4	0.760		
	EFF5	0.736		
MA	MA1	0.798	0.662	0.886
	MA2	0.753		
	MA3	0.884		
	MA4	0.814		
ACC	ACC1	0.719	0.434	0.791
	ACC2	0.778		
	ACC3	0.592		
	ACC4	0.610		
	ACC5	0.571		
EM	EM1	0.760	0.715	0.909
	EM2	0.849		
	EM3	0.889		
	EM4	0.877		
IS	IS1	0.792	0.612	0.863
	IS2	0.847		
	IS3	0.757		
	IS4	0.729		
ID	ID1	0.846	0.695	0.901
	ID2	0.876		
	ID3	0.821		
	ID4	0.790		
TR	TR1	0.723	0.681	0.914
	TR2	0.807		
	TR3	0.900		
	TR4	0.875		
	TR5	0.808		
UA	UA1	0.695	0.672	0.859
	UA2	0.874		
	UA3	0.877		
US	US1	0.748	0.566	0.886
	US2	0.802		
	US3	0.809		
	US4	0.643		
	US5	0.690		
	US6	0.805		
UT	UT1	0.840	0.653	0.903
	UT2	0.882		
	UT3	0.782		
	UT4	0.825		
	UT5	0.699		
UC	UC1	0.791	0.557	0.881
	UC2	0.620		
	UC3	0.861		
	UC4	0.588		
	UC5	0.856		
	UC6	0.715		
SA	SA1	0.854	0,676	0.912
	SA2	0.866		
	SA3	0.799		
	SA4	0.716		
	SA5	0.865		

After evaluating the validity of the measurement model, the fitness of the measurement model was assessed based on the following indicators: degrees of freedom (df), Chi-squared ($\chi 2$), the root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), Chi-squared/degrees of freedom ($\chi 2$/df), and Tucker Lewis index (TLI). If $\chi 2$/df is < 3, the model and data match well [12]. RMSEA values are often interpreted as follows: 0 indicates perfect fit, <0.05 indicates close fit, 0.05-0.08 indicates fair fit, 0.08-0.10 indicates mediocre fit, and >0.10 indicates poor fit [80], [81]. The recommended threshold for CLI and TLI is 0.90. An SRMR score below 0.08 is deemed a good fit [82]. The results of the measurement model fitness can be seen in Table 3.

Table 3. Measurement model fitness

Fit Indices	Values
Chi-squared ($\chi 2$)	3,232.294
Degrees of freedom (df)	1,517
Chi-squared/degrees of freedom ($\chi 2$/df)	2.131
RMSEA	0.068
SRMR	0.058
CFI	0.851
TLI	0.838

Table 3 shows that, except for CFI and TLI, the values of RMSEA, Chi-squared/degrees of freedom ($\chi 2$/df), and SRMR all met the required thresholds. Nevertheless, both CFI and TLI remained within a narrow range close to the suggested value of 0.90. Thus, it can be inferred that the measurement model had a satisfactory level of goodness of fit.

5.2. Structural Model and Hypotheses Testing

The structural model describes the links between latent constructs. Given an acceptable measurement model, the fitness of the structural model was then investigated. Table 4 shows the fitness results for structural models. Aside from CFI and TLI, RMSEA, Chi-squared/degrees of freedom ($\chi 2$/df), and SRMR were within suggested ranges. However, both CFI and TLI remained within a narrow range close to the suggested value of 0.90. Thus, it can be inferred that the structural model had a satisfactory level of goodness of fit.

Table 4. Structural model fitness

Fit Indices	Values
Chi-squared (χ2)	3,394.385
Degrees of freedom (df)	1,545
Chi-squared/degrees of freedom (χ2/df)	2.197
RMSEA	0.070
SRMR	0.064
CFI	0.840
TLI	0.829

Table 5 presents the findings of the hypothesis tests. Of the 16 correlations between constructs proposed in this study, 13 hypotheses were accepted, and 3 hypotheses were rejected. Efficiency, memorability, accuracy, and utility showed a statistically significant beneficial impact on usability. Emotion was not shown to have a statistically substantial impact on usability. Furthermore, learnability was discovered to have a statistically significant influence on usability, but because it is in the opposite direction as expected, the hypothesis is rejected. Information search, interface presentation, and transaction were all shown to have a statistically significant beneficial impact on utility. The findings also indicate that usability directly impacts usage continuance and indirectly influences usage continuance through satisfaction. Usefulness did not directly influence usage continuance, but usefulness exerted significant indirect effects on usage continuance through satisfaction. A statistically significant relationship was shown between usability and satisfaction. Similarly, there was a substantial significant connection between usefulness and satisfaction. The relationship between satisfaction and usage continuance was also statistically significant.

Table 5. Hypothesis testing

Hypothesis		Estimate	P-value	Support[a]
H1	LA → UA	-0.144	0.017	-
H2	EFF → UA	0.251	0.002	***
H3	MA → UA	0.214	0.000	***
H4	ACC → UA	0.174	0.002	***
H5	EM → UA	0.039	0.554	-
H6	UT → UA	0.608	0.000	***
H7	IS → UT	0.288	0.001	***
H8	ID → UT	0.150	0.030	**
H9	TR → UT	0.526	0.000	***
H10.a	Direct UA → UC	0.437	0.004	***
H10.b	Indirect UA → UC	0.268	0.022	**
H11.a	Direct US → UC	0.052	0.700	-
H11.b	Indirect US → UC	0.125	0.081	*
H12.a	UA → SA	0.629	0.000	***
H12.b	US → SA	0.302	0.006	***
H12.c	SA → UC	0.332	0.013	**

Figure 2 depicts the proposed research model and the significance of the path coefficients. Bold black arrows indicate that the relevant path coefficients were statistically significant with p-values < 0.01, while thin black arrows suggest that they were statistically significant with p-values < 0.05. The red arrows indicate that the hypotheses are rejected.

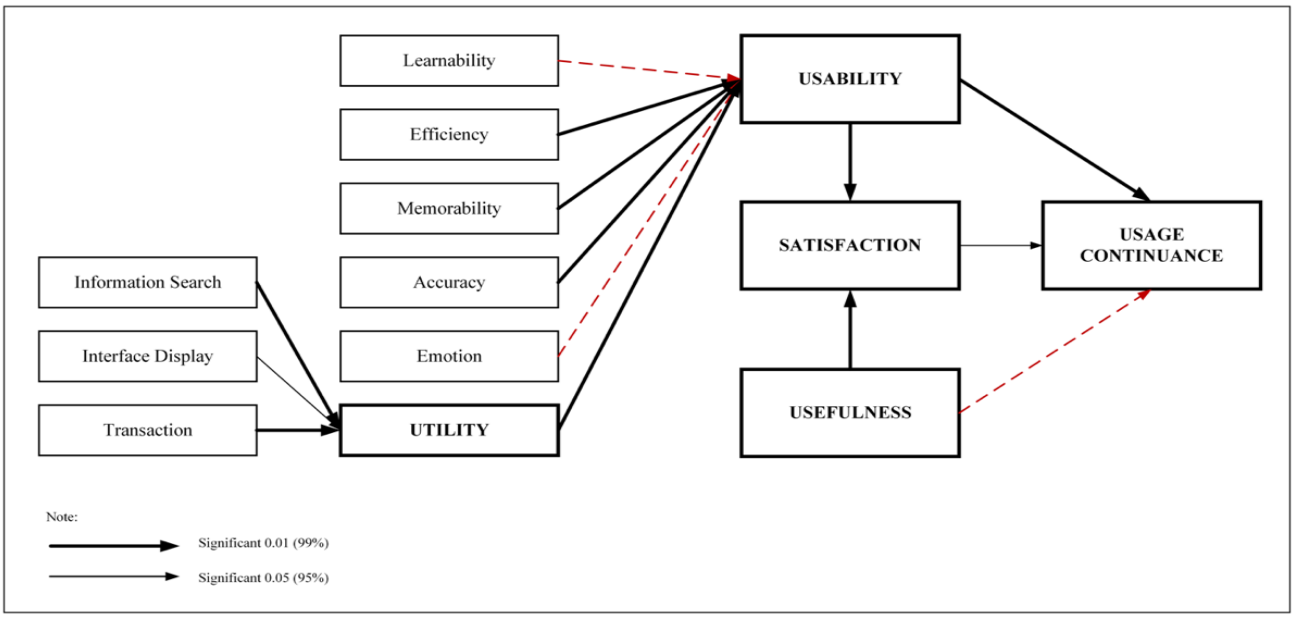

Figure 2. Result of structural model analysis

6. Discussion

This study tried to reconceptualize the concept of usability by compiling six first-order factors that form usability consisting of non-functional and functional aspects, i.e., learnability, efficiency, memorability, accuracy, emotion, and utility. These six factors have also been examined in several different studies. This study proved that four factors significantly form usability with $p < 0.01$, i.e., efficiency, memorability, accuracy, and utility. Emotion was found not to form usability. In addition, one factor is proven to form usability with $p < 0.5$, i.e., learnability. However, because it is in a contradictory direction than that expected, the hypothesis is rejected.

The results obtained in this study are different from Lacka and Chong [13]. Lacka and Chong [13] conceptualized learnability, efficiency, memorability, errors, and satisfaction as forming factors for usability, but the factors that were proven to describe usability were only learnability and memorability. Compared to Lacka and Chong [13], learnability in this study was proven to negatively affect usability, resulting in the hypothesis being rejected. The difference between this study and Lacka and Chong [13] lies in the context of the study. They studied the social networking platforms' usability when used for B2B promotional purposes, so training is needed regarding their use, and it is known that marketing via social media in B2B is still something new. Meanwhile, the object being studied in this study is e-commerce apps. E-commerce in Indonesia has been widely developed. Every e-commerce application almost has the same functions or features, making it easier for users to understand what they are doing. Adding features to increase learnability (such as tutorials or pop-up help) may add complexity to the e-commerce apps, reducing overall usability.

This study also found that in e-commerce apps, usability is not significantly influenced by emotion. Respondents in this study who shop through e-commerce apps pay little attention to their emotions when using the apps. Users may focus more on the basic functions of e-commerce apps rather than the emotional aspects. If these basic functions can be performed smoothly, emotions may not have a substantial impact on perceived usability. Respondents only noticed the apps' efficiency, memorability, accuracy, and utility. If e-commerce provider improves these factors on their apps well, then the apps' usability will also be improved.

Moreover, this work proved that content or utility has a significant positive impact on usability. Among other factors that influence usability considered in this study, utility was found to have the most influence on usability.

This can be seen from the coefficient value in Table 5. Agarwal and Venkatesh [9] stated that content or utility is the factor that most supports the concept of usability. Therefore, the functions available on the e-commerce apps that can support what the user needs will most determine the usability of the apps. This study successfully demonstrated that functional quality, instead of just non-functional quality, is also an essential part of usability. There are three attributes used to characterize the utility or functional features of e-commerce apps: information search, interface display, and transactions. The data processing results show a considerable association between the three attributes and utility. There is a substantial link between information search and utility, since search is one of the first-order constructs that make up the second-order application utility [14]. The relationship between interface display and utility is also significant. This is consistent with Hoehle and Venkatesh's [14] finding that content relevance (also known as product display) is part of the second-order application utility. Transaction is a utility attribute taken from Li and Li [10] and Lacka and Chong [13].

This study supported the notion that usability has a considerable beneficial impact on satisfaction. This outcome is consistent with the finding of Lee *et al*. [61], who concluded that usability affects satisfaction with a confidence level of 99.9%. Furthermore, satisfaction has a positive effect on usage continuance. This is consistent with research undertaken by Kim *et al*. [15], Daghan and Akkoyunlu [19], Wang *et al*. [20], and Nie *et al*. [58], which discovered that satisfaction had a considerable beneficial influence on usage continuance. Kim *et al*. [16], Wang *et al*. [20], and Nie *et al*. [58] explored the usage continuance of mobile apps, stating that users who experience satisfaction with a particular technology are likely to engage in its repeated usage.

Based on previous studies, it is known that usability can affect usage continuance in two ways, i.e., directly and indirectly. According to the data processing results from this study, usability positively impacted usage continuance in a direct manner. This aligns with the discoveries made by Hoehle and Venkatesh [14] and Hoehle *et al*. [15], who discovered that usability, as a second-order construct, has a direct impact on usage continuance as a use outcome. This study also discovered that usability indirectly influenced usage continuance through satisfaction. This aligns with the outcomes of an investigation carried out by Liao *et al*. [22], who discovered that satisfaction serves as a major mediator in the link between usability and continuous usage of e-banking services.

However, the direct influence of usability on usage continuance is greater than the indirect influence through satisfaction. This may be because if users find it easy to use an e-commerce application without encountering obstacles, they tend to continue using it without considering other factors. Additionally, usability may be considered a basic expectation by users. So, although satisfaction may be a driver for continued use of a product or service, users may prioritize usability higher in their considerations.

The results of this study indicated that usefulness did not have a direct impact on usage continuance but exerted a significant indirect impact on usage continuance through satisfaction. According to Weng *et al*. [29], usefulness has a direct effect on usage continuance, as well as an indirect effect through satisfaction. Although the direct effect cannot be proven in this study, it is established that usefulness indirectly influences usage continuance via satisfaction. The difference between this study and Weng *et al*. [29] lies in the object being studied. Weng *et al*. [29] investigated mobile apps for taxis. The usefulness of a taxi mobile apps is determined by its simplicity of use and the quality of the transportation services provided, so if both are met, the user will continue to use the application [29]. Transportation is a basic need, so if the application can provide transportation well, users will use it again [29]. Usefulness is also proven to significantly affect intention to use [13]. Furthermore, the difference between this study and Lacka and Chong [13] is that Lacka and Chong [13] focused on before-use, so if users feel that social media will be beneficial, they will use it. This study focused on after-use. If users feel that e-commerce apps are useful and satisfied with the services provided, they will continue to use them. This is an interesting discovery because it differs from earlier studies. In this study, usefulness has no direct effect on usage continuance. Satisfaction is influenced by usefulness [23], [29], [30], [59] and satisfaction has been proven to have a large beneficial impact on usage continuance. As a result, customer satisfaction must be established first, and satisfaction can lead to usage continuance. It can be claimed that if customers find the e-commerce apps useful and satisfactory, they will continue to use them. However, if customers find the e-commerce apps beneficial but are dissatisfied with the services offered, they will not use them again.

To get loyal users, platform providers must ensure that their users are satisfied. According to the results of this study, it is possible to infer that in the context of e-commerce, the usefulness of a platform alone is insufficient to encourage people to use it regularly; instead, the platform provider must satisfy the customer in order for them to continue using it. Satisfaction is acknowledged to have a crucial role as a mediator between usefulness and usage continuance, as well as usability and usage continuance. Platform providers must be aware of factors that impact customer satisfaction. In this study, satisfaction has an R-squared value of 0.809. This revealed that only 80.9% of satisfaction is explained by the predictor variables. This also indicated that there are more variables that can explain 19.1% of satisfaction. Moreover, in this study, usage continuance has an R-squared value of 0.627. This showed that the predictor variables explained only 62.7% of usage continuance, so there are still other variables that can explain 37.3% of usage continuance.

6.1. Implications for Research

The first implication is that prior studies have mostly neglected the functional components of usability. This study tried to reconceptualize the concept of usability by compiling the first-order factors that form usability more comprehensively which consists of non-functional aspects and functional aspects and found that content or utility is a functional aspect of usability that can describe usability well. In addition to content or utility, this study discovered that the e-commerce apps' usability may be well described by efficiency, memorability, and accuracy. The second implication is that satisfaction significantly influences usage continuance. This study discovered that usability and usefulness indirectly influence usage continuance through satisfaction. In this study, satisfaction mediated the impacts of usability and usefulness on usage continuance. Given the importance of satisfaction, further study is needed to establish a thorough model that identifies the factors that lead to satisfaction.

6.2. Implications for Practice

This study is expected to provide benefits for e-commerce service providers so that they can develop strategies for designing their apps by considering the factors that form usability. In this study, it was found that usability is most influenced by utility (which is described by information search, interface display, and transaction). Because usability has a considerable impact on usage continuance, then utility, which is a part of the overall user experience, also has a substantial impact on whether users will continue to use the e-commerce apps. User interactions with functional aspects of e-commerce can influence how users perceive e-commerce.

Given that information search influences utility, e-commerce service providers should guarantee that information search on their platforms is intuitive, which means that product information should be easy to discover, complete, and relevant. Interface display also affects utility. Therefore, e-commerce service providers need to create an interface design that is attractive, responsive, and easy to navigate. Transactions can also impact utility. Users will find it simpler to complete purchases if the transaction procedure is simple, there are several payment choices, and the application is integrated with popular payment platforms.

Furthermore, this study found that usability is also formed by efficiency, memorability, and accuracy. Efficiency in completing tasks is one of the keys to ensuring good usability. Websites that are too slow or require many steps to complete certain tasks can disappoint users. E-commerce providers can pay attention to efficiency attributes by optimizing application speed and simplifying transaction flow. Memorability is a usability aspect related to the ease with which e-commerce is remembered by users. Therefore, service providers should make their apps simpler, without many features that confuse users, thereby facilitating users' ability to recall the usage of e-commerce apps. In this study, accuracy affects usability, which can be attributed to the fact that if customers do not receive information that matches the product they receive, it will affect their perception of the e-commerce they are using. Likewise, if users often encounter problems when using e-commerce, this will affect user interactions and perceptions of e-commerce. E-commerce providers can pay attention to the accuracy attribute by increasing the accuracy of information about the products sold by sellers. This can be realized by having guidelines for filling in product information, real images, a confirmation process from e-commerce providers regarding the accuracy of product information to sellers, and so on.

This study discovered that satisfaction acts as a mediator between usefulness and usage continuance, as well as between usability and usage continuance. Hence, it is critical for practitioners, particularly platform providers, to comprehend the factors that lead to satisfaction.

7. Conclusion

The study's contributions can be briefly summarized as follows. This work contributes to the reconceptualization of the concept of usability by compiling the first-order factors that form usability more comprehensively, which include non-functional aspects (i.e., efficiency, memorability, accuracy) and functional aspects (i.e., content or utility). This study specifically discusses the usability of e-commerce apps, so the content or utility proposed in this study is formed by three aspects consisting of information search, interface display, and transaction. This study also discusses the connection between the general usability concept and other concepts (i.e., usage continuance, satisfaction, and usefulness). This study shows that usability directly influences usage continuance and indirectly influences usage continuance through satisfaction. Meanwhile, usefulness was found not directly affect usage continuance, but indirectly affect usage continuance through satisfaction. Usability and usefulness can positively influence satisfaction, satisfaction can positively influence usage continuance. These findings, therefore, provide e-commerce service providers with valuable insight into developing e-commerce apps that will satisfy users, thereby increasing the likelihood of consumer retention.

This study has some limitations. Respondents were collected using the convenience sampling technique, which is included in non-probabilistic data collection techniques. It is best to collect respondents using probabilistic techniques so that the results obtained are more representative and can be generalized. Probabilistic data collection techniques include stratified random sampling, double sampling, systematic sampling, and cluster sampling. The value of several model fitness indices in this study, such as CFI and TLI, did not meet the recommended value. The value of this fitness model can still be improved by respecifying the model based on modification indices, but modifying a model should be based on a theory. Another constraint of this study is that data collection was conducted using a questionnaire, so respondents' responses or assessments of e-commerce apps were solely based on their memories of using them. Future studies can combine questionnaires with experimental designs. First, respondents will be asked to use some features or functions of the e-commerce apps, then respondents will be asked to answer questions in the questionnaire.

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