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User experience modeling on consumer-to-consumer (c2c) e-commerce website

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Abstract. Rapid technology and communication developments have brought us to the digital age, where its media, such as the internet become one famous media that is widely used for various purposes around the world. Many organizations view this situation as a space or new media to do business expansion as an innovative way of doing activities that meet the communities' expectations of economy-related aspects of convenience, known by the term of e-commerce as one alternative options for the organizations as a medium of information to facilitate the presence of interaction between sellers and buyers without limited time and space, where their progress was supported by the use of the website. How the user experience in interacting with the website become an important key in the advancement of the e-commerce. This research provides user experience modeling on e-commerce website in order to be able to increase the success of e-commerce business performance through the use of the website. This research focuses on e-commerce type of C2C in Indonesia with the aim to model the relationships of each user experience factors using structural equation modeling.

1. Introduction

Rapid development of technology and communications has brought us to the era of digitalization. Digitalization is the process of converting information into digital format, in which the information is organized into bits. Main media contributing in this era is the internet, as the network that connects all the computers in the world. This allows the computer in an area to communicate with computers in other areas. Today, the need for the internet is increasing as a means of exchange and dissemination of information. Many organizations, both social and commercial, began to realize the need for the internet as an alternative medium of information exchange. The advantages and conveniences offered by the internet cause people around the world are able to easily adapt, including in Indonesia.

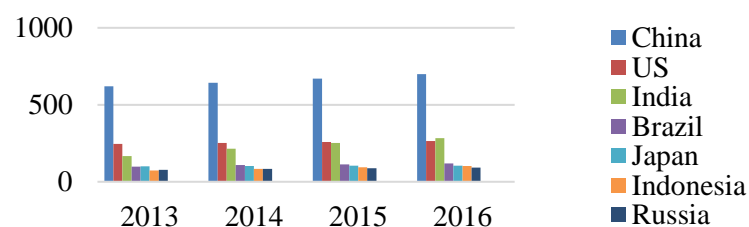


Figure 1. Biggest number of internet users in the world in 2013-2016 (in million people)

Figure 1 shows that of the seven most internet users in the world, where internet users in Indonesia are always rising, even ranked sixth in the world, reaching 102.4 million by 2016. This figure also shows that Indonesia ranked first of the largest number of internet users in more relevant scope, Southeast Asia.



The variety of advantages gained from the internet are the main factors in the increasing number of users using the internet. It gives the possibility for almost everything to be done online, ranging from education, entertainment, and even businesses. Many companies benefit this situation to create new space or medium to expand business in an innovative way of conducting economic activities that meet people's expectations, especially in the aspects of ease. It is known as e-commerce, where these days, it is an alternative way for companies to facilitate the interaction between sellers and buyers without being limited by space and time [5]. For the seller, e-commerce will help to expand the marketing area of the product to be sold, while on the side of the buyer, e-commerce will facilitate the revenue and comparison of information about the product to be purchased. Supported by the increasingly sophisticated information technology development, e-commerce is growing more in many companies, especially in Indonesia. ICD Research Institute in 2017 revealed that the development of e-commerce in Indonesia is the highest in Southeast Asia, with a growth of 57% from 2014-2017. Data from Social Research & Monitoring also shows that in 2016, 70% of Internet users in Indonesia have reached 102.8 million people, using internet services to search for product information and do online shopping. Besides, the number of active online shopper in Indonesia has reached 8.7 million people with transaction value of about 4.49 billion US dollars. This value has increased from the previous few years as shown in Figure 2 which occupies Indonesia ranked first of e-commerce sales in Southeast Asia.

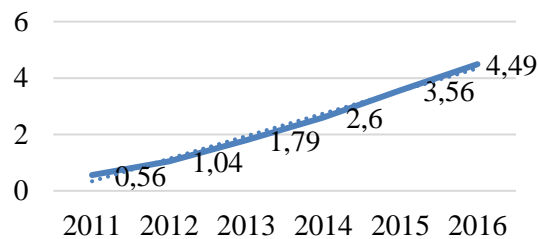


Figure 2. Number of online sales transactions in Indonesia in 2011-2016 (in million dollars)

It can be said that implementation of e-commerce is one success breakthrough. One of the determinants of this success is the use of website [6]. The interaction between users and website is related to user experience (UX), which means a sensation of experience of using website which will ultimately affect the quality of using website. Website with better UX can possibly affect the users to always return to visit the website regularly and continuously, to make e-commerce consumers remain loyal [18] and encourage intention to buy of the users [1]. Therefore, website with good UX will become an advantage and good value of business, so the selling value of a product or service will increase by avoiding the possibility of loss level of sales and providing significant benefits to all actors in e-commerce [17].

2. Literature review

The relationship between UX elements in e-commerce websites can be modeled using Structural Equation Modeling (SEM) which is a statistical modeling tools to explain the relationship between latent constructs and indicators, latent constructs with one another and can also see the error measurement of the model. SEM can perform analysis between dependent and independent variables directly [8].

2.1. Pragmatic quality and perceived user experience

Pragmatic quality is the practical and functional quality of a product. It includes efficiency, simplicity, informativeness, learnability, flexibility, directness, and user support [11]. It addresses the underlying human need for security and control. The more pragmatic quality a product has, the easier it is to reach task-related goals with effectiveness and efficiency. Pragmatic quality focuses on goal-related functions or design issues [9]. It is believed as key factors for appealing products, which gives judgement of user value and its consequences. When users make product goodness judgments by looking the pragmatic aspects of the user experience, it seems to be dominant for the initial experiences with the product [13].

2.2. Hedonic quality and perceived user experience

Hedonic quality is a quality that affects psychological needs and emotional experiences of a product. It includes luxuriousness, color, simplicity, attractiveness, delicacy, and texture [11]. This is addressing human needs for novelty and status induced [9]. Hedonic aspects are believed as key factors for appealing products, which gives judgement of user value and its consequences. It creates delight, which has been found to increase customer loyalty more than satisfaction alone does [3]. It can also be seen as aspects of broader concept of user experience [9]. Hedonic aspects are believed so important in increasing the user experience over time [3]. As the user-product relationship evolves over time, the hedonic quality seem to gain more weight [16], although it is believed to influence pragmatic quality.

2.3. User value and perceived user experience

User value is the user's subjective value of a product. It includes self-satisfaction, pleasure, customer need, sociability, and attachment [11]. Users will have many perceptions based on their judgement of the product's appealingness. The users' current internal state, which includes mood, motivation, needs, predispositions, and expectations, may have an impact on the UX because user's mood might change the UX [12]. Users may weight and combine the pragmatic quality and hedonic quality of a product in to a single judgement [9]. The relative weights of the pragmatic and the hedonic quality in forming an overall evaluation of a product are dependent on the users' motivational orientations and the context of evaluation itself [10].

3. Hypothesis and conceptual model

Based on the literature studies, there are six hypothesis made, which are hedonic quality affects pragmatic quality (H1), pragmatic quality affects user value (H2), hedonic quality affects user value (H3), pragmatic quality affects perceived UX (H4), hedonic quality affects perceived UX (H5), and user value affects perceived UX (H6).

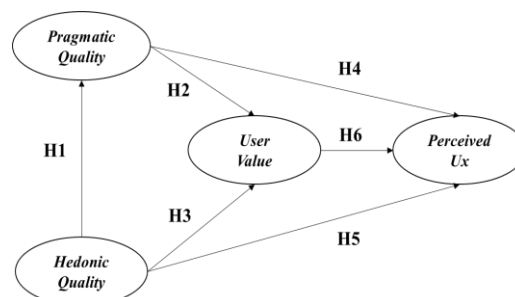


Figure 3. Conceptual model of user experience

4. Methodology

4.1. Instrument development

To gather data for the modeling, questionnaire were made using UX metrics concept, such as System Usability Scale [2], After Scenario Questionnaire [14], and Usefulness, Satisfaction and Ease of Use Questionnaire [15]. These three UX metrics were combined in order to get 26-points of measured variables with 5-likert scale states strongly disagree to strongly agree. Before gathering final data, pilot testing were done to see the validity and reliability of this instrument. The validity test was performed using the Kaiser-Meyer-Olkin test which should be > 0.50 and Bartlett's significance test should be ≤ 0.05 on each latent variables [7]. Meanwhile, the reliability test uses the Cronbach's Alpha test which should be > 0.60 [4]. The results shown that questionnaire is valid and reliable.

4.2. Data collection

After the questionnaire was stated as valid and reliable, the questionnaire were distributed to randomly qualified respondents who used the C2C e-commerce website tested, Tokopedia and Bukalapak. The

data has been collected amounted to 605 respondents. According to gender, the majority of the study respondents were female, 4% superior to men. Some of them are mostly young and productive, aged 16-25 and others older, while 69% are still learning and others have worked.

The data will be tested first to see if the initial structural model is valid and reliable using 182 first respondents. Evaluation is performed on reflective and formative latent variables. For testing the reflective latent variable, a convergent validity test is performed by looking at the Average Variance Extracted (AVE) value with the test results as shown in Figure 4, where the AVE value of both objects has exceeded the predetermined cut-off value > 0.7 and signifies the suitability of the data on the model.

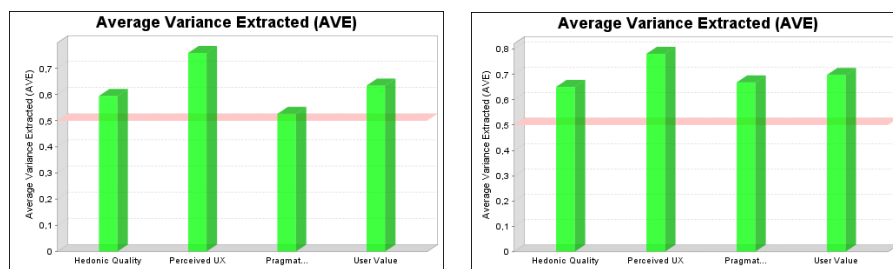


Figure 4. (a) AVE test results for Tokopedia (b) AVE test results for Bukalapak (n = 182)

In addition, cross loadings are also seen by comparing the loading values in the intended constructs should be greater than the loading values with other constructs. The results show that there is one variable that does not meet the cross crossings on both objects. Composite Reliability (CR) and Cronbach's Alpha (CA) tests were also performed with results in cut-off value > 0.7 on almost all objects, except for CA values in the perceived UX of Tokopedia as shown in Figure 5 and Figure 6.

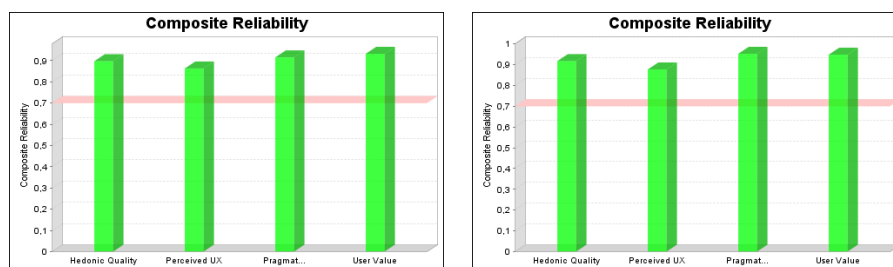


Figure 5. (a) CR test results for Tokopedia (b) CR test results for Bukalapak (n = 182)

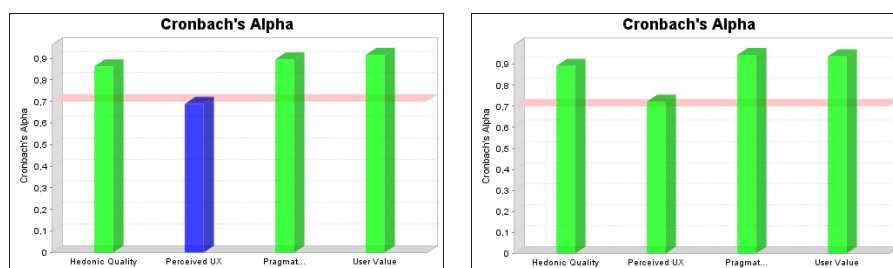


Figure 6. (a) CA test results for Tokopedia (b) CA test results for Bukalapak (n = 182)

Furthermore, for the test of latent variable formative, tested by seeing the value of outer loadings and outer weights with the test results there are variables that are not fulfilled the terms of outer loadings, five variables in Tokopedia, and one variable in Bukalapak. Meanwhile, the value of outer weights is not so reference as measured variables whose only weight is not significant can still be maintained because it still has significant interest (loadings) to the latent variable so that the value of the most

attention is the value of its loadings. The variance inflation factor (VIF) test is also performed with a cut-off value of > 5 , where the test results are found not necessarily to have the variables eliminated. Finally, the evaluation of the structural model by looking at the value of R^2 , where if the value of R^2 is between 0.67-1.00, it means having a strong relationship, the value of R^2 is between 0.33-0.66, it means having a medium relationship, and the value of R^2 is between 0.00-0.32, it means to have a weak relationship and Q^2 as the total determinant coefficient. The test results as in Figure 7.

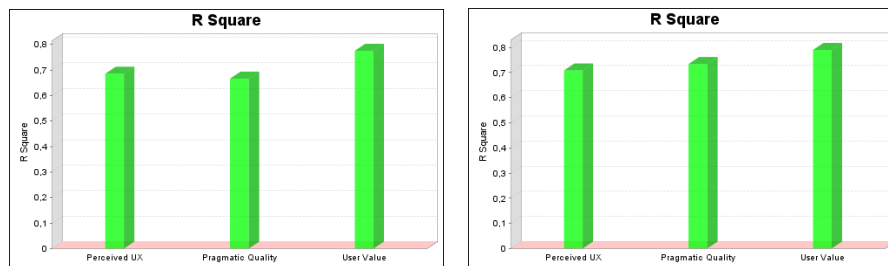


Figure 7. (a) R^2 test results for Tokopedia (b) R^2 test results for Bukalapak (n = 182)

It can be seen that the R^2 value of latent variable shows the pragmatic quality variable has medium relation and other variables are strongly related to Tokopedia, and the three variables are strongly related to the Bukalapak. In addition to the R^2 test, the Q^2 test used for model evaluation of predictive relevance. Q^2 values should be in the range of 0 and 1 and better if near 1. The value of Q^2 can be from the formula:

$$Q^2 = 1 - (1 - R_1^2)(1 - R_2^2) \dots (1 - R_p^2) \quad (1)$$

where:

$R_1^2, R_2^2, \dots, R_p^2$ is R square value for exogenous variable in the model.

$$Q^2 \text{ Tokopedia} = 1 - (1 - 0,470)(1 - 0,442)(1 - 0,600) = 0,882$$

$$Q^2 \text{ Bukalapak} = 1 - (1 - 0,501)(1 - 0,539)(1 - 0,624) = 0,914$$

After evaluating the measurement and structural model, a model has been obtained through the initial evaluation test so that it can be continued to the next stage, as shown in Figure 8.

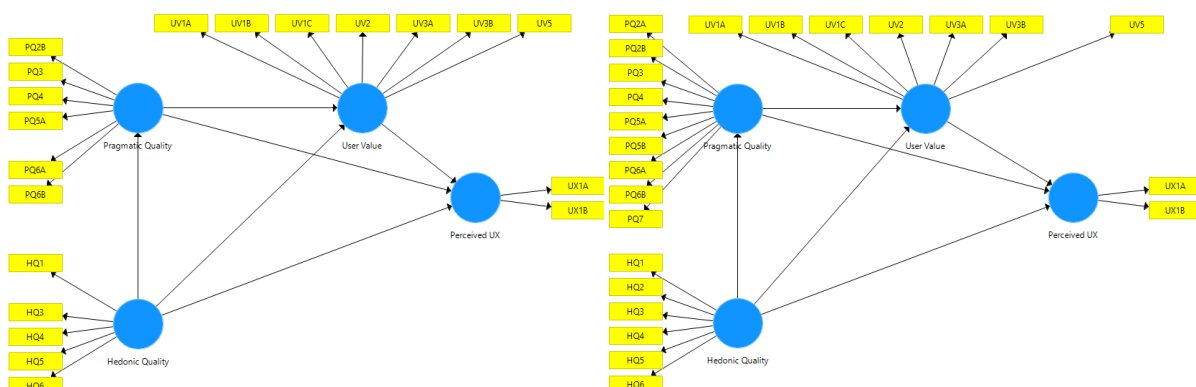


Figure 8. (a) Final testing model for Tokopedia (b) Final testing model for Bukalapak (n = 182)

After obtaining the model as in Figure 8, the final model is evaluated by including the overall 605 final respondent data obtained and the same previous model evaluation test was done. By looking at the value of cross loadings, it is concluded that all measurable variables describe latent variables well. Other tests

such AVE test, CR test, and CA test have met the test standards. Furthermore, for the latent formative variable test, one variable in Tokopedia still has not met the test standard so that the variable will be removed permanently in the analysis phase. VIF values were also tested and found no variables needed to be eliminated. Lastly, in the R^2 test, all the variables qualify for a strong and moderate relationship, as shown in Figure 9, with Q^2 test results also as follow.

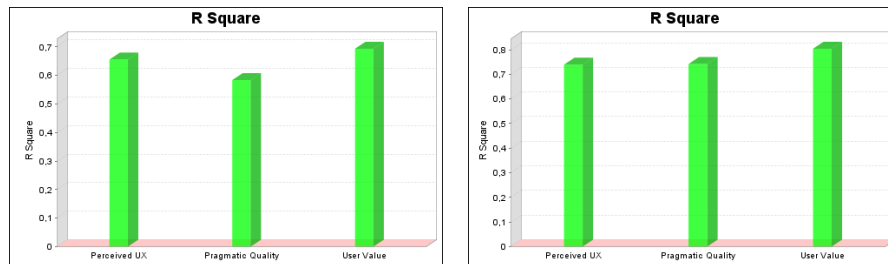


Figure 9. (a) R^2 test results for Tokopedia (b) R^2 test results for Bukalapak (n = 605)

$$Q^2 \text{ Tokopedia} = 1 - (1 - 0,430)(1 - 0,341)(1 - 0,482) = 0,805$$

$$Q^2 \text{ Bukalapak} = 1 - (1 - 0,546)(1 - 0,552)(1 - 0,647) = 0,928$$

Thus, this research model can be declared valid and reliable to be continued to the analysis phase.

5. Results and discussion

5.1. Causal relationship of user experience model

To see the relationship between variables in the UX model, the regression load values are entered into the UX model. The model for Tokopedia and Bukalapak is shown in Figure 10. The significance of the relationships among variables in the UX model can be seen by performing a bootstrapping with subsample of 5000. The T-Statistics value of end model is shown in Table 1 and Table 2 below.

Table 1. T-Statistics of path coefficient model for Tokopedia

Variables	Original Sample	Sample Mean	Standard Deviation	T Statistics	P-Value	Sig.
HQ → UX	-0,020	-0,017	0,052	0,379	0,705	No
HQ → PQ	0,764	0,765	0,021	35,817	0,000	Yes
HQ → UV	0,470	0,471	0,040	11,625	0,000	Yes
PQ → UX	0,227	0,233	0,058	3,888	0,000	Yes
PQ → UV	0,416	0,416	0,051	8,154	0,000	Yes
UV → UX	0,638	0,630	0,070	9,075	0,000	Yes

Table 2. T-Statistics of path coefficient model for Bukalapak

Variables	Original Sample	Sample Mean	Standard Deviation	T Statistics	P-Value	Sig.
HQ → UX	-0,007	-0,007	0,078	0,078	0,931	No
HQ → PQ	0,864	0,864	0,013	66,631	0,000	Yes
HQ → UV	0,425	0,426	0,048	8,792	0,000	Yes
PQ → UX	0,370	0,370	0,068	5,418	0,000	Yes
PQ → UV	0,503	0,503	0,048	10,517	0,000	Yes
UV → UX	0,524	0,525	0,078	6,717	0,000	Yes

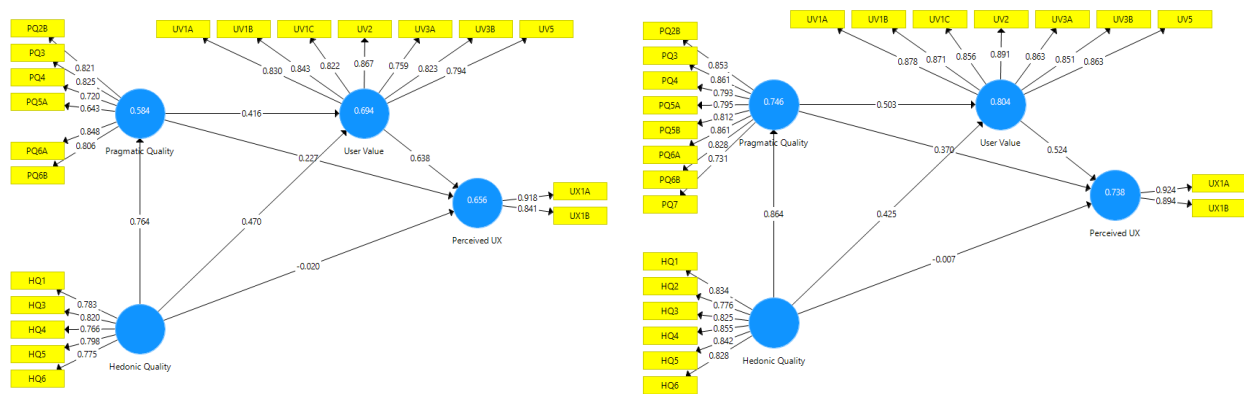


Figure 10. (a) UX model of Tokopedia (b) UX model of Bukalapak

Both tables show that there are 5 hypotheses that are fulfilled as follows:

- Hedonic quality has a positive and significant relationship on pragmatic quality
- Hedonic quality has a positive and significant relation on user value
- Pragmatic quality has a positive and significant relation on perceived UX
- Pragmatic quality has a positive and significant relation on user value
- User value has a positive and significant relation on perceived UX

5.2. Regression loads of measured variables

In Tokopedia model, pragmatic quality variable that has the highest weight is from directness side, which means the practicality of users using the website so users become more confident in operating the function of the website becomes an important factor. In addition, the simplicity and informativeness sides are important factors that affect perceived UX, where the user feels the website is easy to use and the information available also clearly encourages the maximum user experience of Tokopedia website users. In terms of hedonic quality variables, which is a second important factor to perceived UX, it is found that the highest weights are from the simplicity, which means the system of the website function is to-the-point, followed with delicacy, which means the website also needs to work accurately. Meanwhile, in terms of user value variables, high weight is owned by pleasure, which means the website in accordance with user expectations and provide satisfaction for users and self-satisfaction, which means customer satisfaction in terms of time and information is crucial.

In Bukalapak model, the highest weight in pragmatic quality variables is from directness, which means the practicality of the website and the convenience of the website makes the user more confident in using the website to be a crucial factor. In addition, the informativeness side, which means the clarity of information and simplicity, which means the ease of using the website is also an important factor affecting perceived UX. In terms of the hedonic quality variable, which is the second important factor to perceived UX, it is found that the highest weight is from the attractiveness, which means the attractive appearance becomes the main factor, followed by delicacy, which means the website also needs to work accurately. Meanwhile, in terms of user value variables, the highest weight is owned by pleasure, which means the website in accordance with user expectations and provide satisfaction for users and self-satisfaction, which means customer satisfaction in terms of time and information is crucial.

6. Conclusion

From the overall research, obtained some conclusions as follows.

- Based on the six hypothesis made in both objects, there are two user experience models gotten which show that the accepted hypothesis are H1, H2, H3, H4, and H6.
- User value factor is the most important factor based on the total effect on the user experience perceived by the users of the website on the two research objects.

- For both models, pragmatic quality variables that affect the UX most are directness (the practicality of using the website so that user becomes more confident in operating the website function), simplicity and informativeness. Meanwhile, the hedonic quality variables that most influence the user to have the best UX is from simplicity and delicacy. From the user value variable, the pleasure and self-satisfaction side are the biggest influence to have the best UX.
- Strategic recommendation of the author consists of three main things, namely focusing on the pragmatic or functional value of the website to allow users to be more confident in operating the function on the website, paying attention to the aesthetic factors of the website by providing an attractive website that has a website function system to-the-point, and paying close attention to the target characteristics of product sales on the website.

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Acknowledgments

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