Modelling the continuance intention towards the use of mobile hospital appointment system

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Abstract. Effective management of patient flow in the outpatient unit of a hospital is the key to achieving operational excellence. Hospital X, as one of the major hospitals in Indonesia, launched a mobile hospital appointment system (X-Go) to increase the effectiveness of patient flow management. Although the application has a good rating, only less than 28% of the patients are still using it. Aim of this study is to observe the factors affecting the continuance intention towards X-Go, using the Technology Acceptance Model. A questionnaire consisted of 15 questions, using 7 point Likert Scale was used to develop the model. Ninety eight respondents were involved voluntarily in this study by filling out the questionnaire. Results showed that relationship quality has the most significant direct influence on the continuance intention to use the system. Meanwhile, perceived ease of use has the most significant indirect influence on the continuance intention to use the system.

1. Introduction

Effective management of patient flow in the outpatient unit of a hospital is the key to achieving operational excellence [1, 2]. In real conditions, most hospitals in Indonesia have been administering patient registration procedure that is quite time-consuming. Such procedure requires patients to be present at the hospital, taking a queue number and wait to be called to the registration desk. Often times, patients have to wait several hours, even before the opening hours, just to pick a queue number. This condition is often worse in outpatients units (i.e., defined as the medical services provided for patients which are not in the form of hospitalization [3]) in major hospitals in Indonesia, due to very large volume of patients visit with mixed cases of disease [2]. One of the major hospitals that experience this problem is Hospital X, a national referral hospital in Bandung city.

To overcome this problem and improve patient registration, Hospital X has launched a mobile application for outpatient appointment called X-Go. This app utilized internet, accessible from Android smartphones. In addition to being able to speed up service and reduce patient waiting time, this app can help hospital staffs to reduce file preparation time. The app only involves one hospital—Hospital X. The app has been downloaded more than 11,000 times and received a high rating by the users. Although the app has the potential to improve the quality of existing health services, it has not
been widely used by outpatient patients. Only less than 28% of the total outpatient patients use the app daily. Most importantly, the app has a very low number of repeat uses, showing the fact that most app users have been reluctant to use the app for the second time. In other words, the continuance intention to use the app has been low.

Many factors influence the adoption of technology, including mobile application, by a society [4, 5, 6, 7, 8]. One reliable approach that can be used to observe factors influencing the continuance intention to use such application is technology acceptance model (TAM). TAM was first developed by Davis in 1989 as an information system theory that modeled how users understood, tried, used, and accepted technology [9, 10]. This theory was first developed from the theory of reasoned action (TRA) and was used as a basis for determining the relationships that occur between six key beliefs, namely the external factors, perspective ease of use (PEOU), perceived usefulness (PU), attitude towards application, behavioral intention to use, and actual system use [11]. Considering the importance of outpatient registration application to improve hospital X service performance, this research aimed to evaluate the level of continuance intention to use such application. The discussion utilized the TAM developed by Chen, et.al. [5], as can be seen in Table 1.

2. Method
A questionnaire was developed to observe factors that influence the continuance intention to use the X-Go app., consisted of 15 items with 7 Likert scales of which value 1 states “highly disagree” and value 7 states “highly agree”. Back-translation procedure was used to translate the questionnaire to Bahasa Indonesia. A pilot testing was done before carrying out the main data [12]. The TAM framework of this research can be seen in Figure 1. The definition of each construct can be seen in Table 1.

![Figure 1. TAM framework by Chen et al. [5].](image)

| Construct                  | Definition                                                                 |
|----------------------------|---------------------------------------------------------------------------|
| Perceived Usefulness (PU)  | A belief that the hospital e-appointment system useful in improving life performance |
| Perceived Ease Of Use (PEOU)| A believe that the hospital e-appointment system is easy to use.          |
| Relationship Quality       | The final outcome from interactions between two parties, and consists of two aspects, that are satisfaction and trust |
| Continuance Intention (CI) | An intention to continue to use the hospital’s e-appointment system       |

Based on the research framework, this research proposed several hypotheses:
• H1 = Relationship quality (consist of satisfaction and trust) has a positive influence on continuance intention of X-Go users.
• H2 = PU influence continuance intention of X-Go users positively
• H3 = PU influence relationship quality of X-Go users positively
• H4 = PEOU influence relationship quality of X-Go users positively
• H5 = PEOU influence PU of X-Go users positively

To analyze the result of TAM, this study used Structural Equation Modelling (SEM), a multivariate method to incorporate unobservable variables through indicator variables [13, 14, 15, 16, 17]. Two types of SEM include covariance-based SEM (CB-SEM, that is used to determine how well a proposed theoretical model can estimate the covariance matrix for a sample data set [13]) and PLS-SEM (i.e., used to develop theories in exploratory research [13]). The goal of the latter is predicting key target constructs or identifying key “driver” constructs [13]. Because this study aims to evaluate the level of continuance intention based on the influencing factors, this study used the PLS-SEM method.

3. Data Analysis and Results

3.1. Descriptive Statistics Analysis

This study collected 98 copies of questionnaires in total. This number exceeds the minimum total sample needed to conduct a PLS-SEM analysis [18, 19]. The following is the respondent’s demographic data. In terms of gender, 40 (40.82%) were male and 58 (59.18%) were female. In terms of age, 9.18% of the respondents were aged <=20, 38.78% were aged 21-30, 37.76% were aged 31-40, and 13.27% were aged 41-50. In terms of education, 2.04% have master’s degree, 15.31% have bachelor’s degree, 6.12% have diploma degree, 50% were high school graduates, 23.47% were junior high school graduates, and 3.06% were elementary school graduates. Housewives accounted for 36.73% of respondents, students accounted for 6.12% of respondents, 51.02% were employed, and 6.12% were unemployed. In regard to the level of experience of the app users, 31.63% have used the app 2-5 times, 10.20% have used 6-10 times, and 58.16% have used more than 10 times.

3.2. Measurement Model Analysis

The first criterion to be evaluated was the internal consistency reliability (IRC), which can be measured by the Cronbach’s alpha value and the composite reliability value [13]. All of the survey questions were acceptable because all the values were larger than 0.708 and below 0.900 (Table 2). This implies that each indicator variable per construct, has a strong relationship with one another and has values that are consistent with each other so that it can be used to measure the same latent variable.

The second criterion was convergent validity, which can be measured by the average variance extracted (AVE) and/or outer loading value. The outer loading value above 0.708 and AVE value of 0.5 or higher indicates that on average the construct explains more than half of the variance of its indicators [13]. Based on results in Table 2, all the requirements have been met. Therefore, the measurement model is acceptable in terms of convergent validity. The result of these two methods imply that each indicator variable has a high correlation with other indicator variables, in the same construct.

| Construct | Composite Reliability | Cronbach’s α | AVE | Items | Outer Loading |
|-----------|-----------------------|--------------|-----|-------|---------------|
| CI        | 0.890                 | 0.886        | 0.736 | PU1   | 0.854         |
|           |                       |              |      |       | 0.499         |
|           |                       |              |      |       | 0.435         |
|           |                       |              |      |       | 0.668         |
|           |                       |              |      | PU2   | 0.908         |
|           |                       |              |      |       | 0.550         |
|           |                       |              |      |       | 0.557         |
|           |                       |              |      |       | 0.571         |
|           |                       |              |      | PU3   | 0.807         |
|           |                       |              |      |       | 0.521         |
|           |                       |              |      |       | 0.428         |
|           |                       |              |      |       | 0.521         |

| Table 2. Internal consistency reliability and convergent validity analysis (a). |

| Construct | Composite | Cronbach’s α | AVE | Items | Outer Loading |
|-----------|-----------|--------------|-----|-------|---------------|
| CI        | 0.890     | 0.886        | 0.736 | PU1   | 0.854         |
|           |           |              |      |       | 0.499         |
|           |           |              |      |       | 0.435         |
|           |           |              |      |       | 0.668         |
|           |           |              |      | PU2   | 0.908         |
|           |           |              |      |       | 0.550         |
|           |           |              |      |       | 0.557         |
|           |           |              |      |       | 0.571         |
|           |           |              |      | PU3   | 0.807         |
|           |           |              |      |       | 0.521         |
|           |           |              |      |       | 0.428         |
|           |           |              |      |       | 0.521         |

| Table 3. Internal consistency reliability and convergent validity analysis (b). |
There are three methods to assess discriminant validity. The first one is by examining the cross loading of the indicators [13]. All the indicator’s outer loading on the associated construct were greater than all of its loadings on the other constructs, thus exhibit discriminant validity (Table 2). The second method is using the Fornell-Larcker criterion in which it compares the square root of the AVE values with the latent variable correlations [13]. Based on the result, the square root AVE of each construct exceeded its highest correlation with other construct, thus it supported discriminant validity (Table 4). The third method is Heterotrait-Monotrait (HTMT) correlation ratio. An HTMT ratio close to 1 indicates the model doesn’t have a sufficient discriminant validity. A model is considered to have a sufficient discriminant validity if each of the relationships between the latent variables has a HTMT ratio with a value equal to or less than 0.85 and has a confidence interval that does not exceed 1. Based on results in Table 4, all the requirements have been met. Therefore, the measurement model is acceptable in terms of convergent validity.

### Table 4. Fornell-Larcker and HTMT ratio analysis.

|       | CI       | PEOU | PU   | RQ   | CI       | PEOU | PU   |
|-------|----------|------|------|------|----------|------|------|
| CI    | 0.609    | 0.552| 0.689| 0.413| 0.691    | 0.601| 0.636|
| PEOU  | 0.800    | 0.796| 0.800| 0.636| 0.801    | 0.772| 0.528|
| PU    | 0.704    | 0.498| 0.772| 0.923| 0.413    | 0.682| 0.833|
| RQ    | 0.393    | 0.484| 0.485| 0.779| 0.239    | 0.733| 0.380|

3.3. Structural Model Analysis

The first step for structural model analysis was to measure the collinearity of the constructs. The research result showed that each construct’s tolerance, variance inflation factors (VIF) value were all lower than 5 (Table 5) therefore the structural model does not have any collinearity issues. The path coefficient supported all hypothesize relationship except H2 (Table 5). In addition to direct impacts caused by the structural relations in the model, an analysis of mediation variables was also carried out by looking at the total effects and indirect effects (Table 6) found in the model. Evaluation on the coefficient of determination (R²), predictive relevance (Q²), f² effect size, and q² effect size of the model was also conducted. The R² was used to determine the predictive power of the model. On the other hand, Q² is an indicator of out-of-sample predictive power or predictive relevance (Table 7). The Q² test was carried out using a blindfolding procedure. The f² effect size is a measure used to evaluate
whether an exogenous construct has a substantial impact on its endogenous construct, while the $q^2$ effect size was used to measure the relative strength or impact of $Q^2$ (Table 7). A value of 0.02, 0.15, and 0.35 for the effect sizes each represents a low, moderate, and high value [13].

| Relation | VIF | Path coeff. | t-val | p-val | 2.5% | 97.5% | Hypothesis Result |
|----------|-----|-------------|-------|-------|------|-------|-------------------|
| H5 PEOU $\rightarrow$ PU | 1.00 | 0.413 | 3.928 | 0.000 | 0.176 | 0.595 | Accepted |
| H4 PEOU $\rightarrow$ RQ | 1.206 | 0.408 | 4.876 | 0.000 | 0.252 | 0.588 | Accepted |
| H2 PU $\rightarrow$ CI | 1.678 | 0.192 | 1.911 | 0.056 | -0.008 | 0.382 | Not accepted |
| H3 PU $\rightarrow$ RQ | 1.206 | 0.467 | 4.752 | 0.000 | 0.234 | 0.628 | Accepted |
| H1 RQ $\rightarrow$ CI | 1.678 | 0.567 | 6.632 | 0.000 | 0.386 | 0.718 | Accepted |

4. Conclusion
Factors of “perceived usefulness” and “perceived ease of use” determined the “continuance intention” of the X-Go app through relationship quality. It is interesting that “perceived usefulness” was not significantly related directly to “continuance intention”. This indicates that the X-Go’s ability to improve patient’s medical services cannot increase the patient’s intention to continue to use the app to make appointments in the future, if the patients do not have a satisfactory experience of using the app, trust the quality and reliability of the app, nor trust the hospital that provided the app. This could be the reason why the percentage of daily users were relatively low compared to the number of daily outpatient patients, even though the app had received a high rating and number of downloads. Based on the interview, there were also a number of current patients who stopped using the app after several times of usage because of trust and satisfactory issues. Based on Kettinger et al. (1994) and Woo et al.
(1999) in Chen et al. (2013), a stable internet connection will increase user satisfaction and trust. Therefore, Chen et al. (2013) proposed a relationship between PU latent variables and PEOU so that the model can focus more on the quality of the relationship felt by customers. On the other hand, X-Go application users will use the application to book a schedule for 2 days to 5 months ahead. Hence, X-Go users still have plenty of time available that can be used to re-use the application if the internet connection is not satisfactory. Therefore, the assessment of respondents on satisfaction and trust for latent RQ variables is no longer influenced by these stable internet connection factors. In addition, the object used in the research of Chen et al. (2013) is an application that involves more than one hospital. This causes if the application user was dissatisfied and did not trust a hospital, there is still an opportunity for the user to book a schedule with other hospitals available in the application. Hence, there are still opportunities where users still have the intention to continue using the application. This is different from the X-Go application which only involves one hospital, namely Hospital X. If the users doesn’t feel satisfied or trust in X Bandung then the user has no other hospital choice.

With the exception of the result above, the result of this research basically showed similar findings with the prior study by Chen et al. [5]. “Perceived ease of use” have a positive impact on “Perceived usefulness”. The findings indicated that the patient who felt that the app was easy to use might have better understanding that the app can improve their medical service quality. In contrast, the patient who felt that the app was difficult to use would not have the chance to acquire the usefulness of the app. Thus, it is an important indicator that the app must be easy to use. This finding can also be explained by the education demographic data. Since 76.53% of the respondents were high school graduates or lower education levels, the learning difficulty may exist among the respondents. The second finding was that “perceived usefulness” and “perceived ease of use” were positively related to “relationship quality”. This indicated that the more the patient felt the app was easy and worth it to use, the more satisfied and trusting they were with the app. The last finding was that “relationship quality” positively impacted on “continuance intention”. This indicated that in order to use the app, patients must first had a good relationship with the app and the hospital. These findings imply that X-Go needs to provide a user interfaces that are easier to understand and use. A number of patients mentioned they need a bigger font size and notification for error handlings. X-Go also needs to provide useful contents and functions for patients. In addition the main function as an appointment application, hospital X can add various features that can support this main function such as completing the outpatient service schedule to the operating hours of each outpatient polyclinic. Finally, this study may have some insufficient aspects that it lacks a high value of coefficient of determination and the use of PLS-SEM, instead of CB-SEM for confirmatory study. Thus, highly recommended that future studies could overcome these limitations.

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