An Exploratory Study on the Intention to Adopt a New Mobile Commerce Application in Nanjing, China

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Abstract: The objective of this research is to present an exploratory study on the intention to adopt a new mobile commerce application in Nanjing, China. The application studied in this research is already being used by some customers around China. A formative structural equation model (SEM) is developed to assess the intention to adopt this new m-commerce application by sellers. A set of 9 indicators are used to build the final construct intention to adopt this new m-commerce application. It is found that perceived benefits, innovativeness and perceived enjoyment are significant factors influencing the adoption of a new mobile commerce application for the sample studied in Nanjing, China. Further research is needed to extend the results presented in this study to larger samples.

Key words: Formative model, mobile commerce, structural equation model (SEM), technology adoption.

1. Introduction

Mobile commerce involves more than using mobile phones for buying and selling goods, services and entertainment [1], [2]. It also involves the creation of a sharing platform where users interact at various levels.   M-commerce offers new markets and new possibilities that could produce significant social and economic benefits. According to data from the National Bureau of Statistics of China [3] mobile internet subscribers per 10,000 for year 2014 were 87,522 and for year 2015 were 96,447. This represents a growth of 10 percent over just a year. Whereas, flow accessed using mobile internet per 10,000 G was 206,194 for year 2014 and 418,753 for year 2015. This represents a growth of almost 200 percent. This last aspect is especially important since it opens the possibility of accessing new markets in China through mobile commerce [4]-[6]. Then it is important to identify relevant factors that could promote the adoption of mobile commerce applications [1]. The identification of such factors could guide marketing strategies and the design of the m-commerce application to attract more buyers and sellers. Identification of successful factors for the adoption of m-commerce applications are likely to vary depending on the products and the target market [1]. Then, different separate studies are needed to identify significant factors for the adoption of m-commerce in each market sector. Therefore, the objective of the present research is to propose a model to identify significant factors affecting the intention to adopt a new mobile commerce application in Nanjing, China. Identifying factors affecting mobile commerce adoption is also relevant in several other different countries such as Bangladesh [7], India [8], Iran [9], Malaysia [4], Spain [10] and the U.S. [5], [6], [11]. The research presented here differs from some of the available studies about m-commerce [4]-[8, [10] since it researches the intention to adopt a new existing m-commerce application by sellers [12] in a new market in

Nanjing, China. M-commerce application studied here is developed by JiuYao Pintuan. It is used in other cities in China but it is still a new entrant in the Chinese m-commerce sector dominated by well-known companies as Taobao and Pinduoduo. The m-commerce application developed by JiuYao Pintuan is based on a novel concept of group buying in which unrelated buyers put together orders for the same product benefiting then on the economies of scale that produce buying a larger quantity of the same product. As indicated by [13] mobile commerce applications that promote group buying present issues of trust and security. Organizers of group buying may not be known by all members of the group. Group members only share the common interest of buying the same product at a cheaper price. Reference [13] proposes a method to increase security of group buying transactions based on logic of mutual authentication. The mobile commerce application studied in this paper adds additional features that increase the security of the group buying transactions by not releasing the financial incentive to the group organizer until all participants in the group have received their complete orders. Although the adoption of a new mobile commerce application involves sellers and buyers, this study focuses only on sellers since there are more studies available that focused on the buyers [4]-[8], [10]. The present paper extends the research presented in [14] by considering the intention to adopt the same m-commerce application but by sellers. In [14] the analysis focuses in the intention to adopt the m-commerce application by buyers. As indicated in [2] a limitation of some of the research studies about m-commerce is that they have a tendency to focus on promoting the positive side of the technology to increase the number of users while ignoring the negative side of the technology. In the analysis presented here to overcome this limitation potential m-commerce adopters are introduced the new features of the application. This allows potential adopters to compare the positive and negative features of this new app against the features of leading m-commerce apps in the Chinese market. This information is used in a model to determine significant factors influencing the decision to adopt the m-commerce app developed by JiuYao Pintuan.

The Structural Equation Model (SEM) variance based Partial Least Squares (PLS) technique [15]-[18] is used to develop a formative model to assess the intention to adopt a new m-commerce application in Nanjing, China. The contribution of the present research it to propose a SEM-PLS model based on a set of 9 indicators to identify significant factors influencing the decision to adopt the m-commerce app developed by JiuYao Pintuan. These indicators are: perceived benefits, innovativeness, perceived security, perceived ease of use, perceived cost, perceived enjoyment, perceived compatibility, perceived lack of critical mass or perceived subjective norm and perceived intention to adopt mobile commerce [1], [4], [8]. Formative models build the final construct from a set of indicators representing different dimensions of the final construct. They differ from reflective models in that the indicators in a reflective model are made up of a set of highly correlated items representing the same dimension of the construct. Therefore, constructs in a formative model cannot be dropped from the model without affecting the meaning of the final construct [16]. Indicators in a formative model are likely to be unrelated to each other [16]. Therefore, traditional reliability indicators such as Cronbach Alpha [16], [19], [20] may not be appropriate to use, despite its use in similar studies [4], [5], [8] in which there are multiple items measuring the same indicator. Highly correlated items in a formative model are likely to be indicators of the same aspect. In the study presented here to facilitate the application of the survey, there are no duplicate items measuring the same indicator, therefore it is expected correlation among indicators not to be high. Formative SEM models remain controversial as oppose to reflective models specially in terms of defining standard reliability criterion [16], [18], [21]-[23].

The results from this research indicate that perceived benefits, perceived enjoyment and innovativeness are significant factors influencing the intention by the sellers to adopt a new mobile commerce application. Previous results published in 2012 [4] for a similar study in China indicated that trust, social influence, and

cost have a significant relationship with the decision to adopt mobile commerce. Earlier results published in 2009 [5] identified perceived usefulness, perceived ease of use, perceived cost and subjective norm as significant factors influencing the decision to adopt mobile commerce. Results from [14] indicate that Education and Perceived Lack of Critical Mass or Perceived Subjective Norm are the only two significant indicators for buyers to decide to adopt the m-commerce app developed by JiuYao Pintuan. The difference in these results with the results of the study presented here may be due to increase user's awareness of mobile commerce applications in China at the moment of this research. Therefore, any new mobile commerce application to be successful has to provide much more than the applications currently in the market. This is in accordance with the significant factors identified in the research presented in this article.

2. Materials and Methods.

2.1. SEM-PLS Model

The formative Structural Equation Model Partial Least Squares (SEM-PLS) [15]-[17], [22] model is presented in Fig. 1. This model is used to assess the intention to adopt a new m-commerce application in Nanjing, China. Similarly, with most of the studies on mobile commerce adoption, the study presented is this research is based on the Technology Acceptance Model (TAM) [24]. The survey used in this research consists of 9 items described below [1], [4], [5], [8], [12], [24].

Perceived Benefits (Q1): Sellers are likely to use the new mobile commerce application if they perceive it would be beneficial to them by exposing their items to a bigger market giving them the possibility to increase their sales.

Innovativeness (Q2): In the Chinese mobile commerce there are already some big players, then sellers would only switch to a new mobile commerce application if they perceive this application offers a great deal of innovation in the way to reach customers in different markets.

Perceived security (Q3): Electronic commerce transactions as well as mobile commerce transactions need to be secure preserving the privacy of the consumers. Buyers and sellers need guarantees that transactions are secured and their privacy is protected at all times.

Perceived Ease of Use (Q4): Mobile commerce applications need to allow buyers and sellers to perform transactions in a fast an easy way. Sellers would be reluctant to adopt a mobile commerce application that is too complex to use since potential buyers will not use it. Spending too much time searching for products or completing the sale carries additional costs to consumers (i.e. consumers are using more megabytes of their data plan to complete transactions).

Perceived Cost (Q5): Transaction costs, maintenance costs and any other costs associated to use an m-commerce platform have to be kept to a minimum. Potential sellers are willing to assume theses costs if in the long run the benefits are more. Sellers would be more likely to switch to a new platform that offers no costs for them and their clients.

Perceived Enjoyment (Q6): Mobile commerce has to offer consumers a pleasant buying experience. Sellers would be more likely to adopt a new mobile application if they perceived customers would use the application not for mere shopping but as an enjoyable activity providing more or similar gratification to the experience of shopping at the store.

Perceived Compatibility (Q7): Mobile commerce applications to stay in the market need to keep up with constant technological changes. Sellers need to be reassured that any new m-commerce application will have the technical support and infrastructure to keep up or even stay ahead of such changes and trends.

Perceived Lack of Critical Mass or Perceived Subjective Norm (Q8): Sellers understand that m-commerce is an activity that involves more than buying and selling products. In an era characterized by social networks, sellers do not want to be stuck with a mobile platform that is not a trend setting platform and
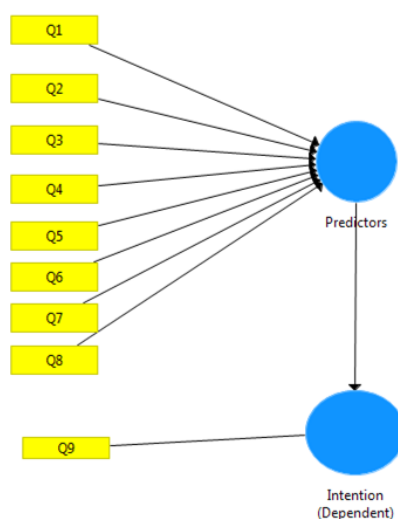
that it has become obsolete.

Fig. 1. Research model.

Perceived Intention to adopt m-commerce due to overall advantages (Q9): Intention to adopt the new mobile platform is estimated as 5via this question in a similar fashion as in [5].

2.2. Survey Questionnaire

A survey questionnaire was designed, based on the items described in the previous section, to assess the intention to adopt this new mobile commerce application by potential sellers located in Xianlin, Nanjing, China. Students enrolled in the Corporate Challenge program at the School of Management, New York Institute of Technology, Nanjing, China, distributed the survey questionnaire. Students were instructed in the application of the survey and the features of the new mobile application. Students illustrate the use and features of the mobile application directly in front of the potential m-commerce adopter using their cellular phones. Students could also share the application using the WeChat application to potential users during the distribution of the survey. A total of 90 surveys were distributed with the intention of achieving the suggested sample size outlined in [16]. A larger sample size would have been preferred but study was limited in terms of number of participants, businesses near the School and time constraints for the completion of the Corporate Challenge program by students. Therefore, businesses were selected considering their proximity to campus and size of the business. Small to medium size businesses were preferred considering they could provide the advantage to interview the owner who is ultimately the person in charge of making the final decision to adopt the new m-commerce app [9]. However, access to business owner was very limited as it would be described further in the paper. At the end of the survey distribution day a total of 54 completed surveys were returned. The response rate is 60%. Although it was not achieved the desired sample size [12] the technique used to analyze the data has the advantage of being able to handle small sample sizes [16], [25].

2.3. Characteristics of the Sample

In terms of the age distribution of the respondents 33 respondents are younger than 30 years old and 19 are in the group between 31 and 50 years old. Sample is positively skewed towards younger respondents. These indicates not only a younger work force but perhaps that younger people are more likely to be interested in adopting new m-commerce application. There are more females in our sample (57%), however in terms of ownership only 19% of female respondents own their business and only 30% of all the

respondents are business owners. The incorporation of these additional indicators [1] constitutes part of the current research being carried out by the author to determine their significance in terms of adopting a new mobile commerce application.

3. Results

Results presented in this section are obtained using the program SmartPLS 3 [26]. The formative model presented in Fig. 1 is evaluated in this section to assess the potential influence of the indicators presented in section 2 to predict the intention to adopt a new mobile commerce application using data from 54 surveys. Variance-based SEM-PLS techniques offer advantages over other covariance-based SEM techniques [17], [22], [25], [27], [28] in the ability to handle small samples and requiring fewer assumptions about the distribution of the data [29]. Consistent Partial Least Squares (PLSc) [17], [28] is employed to evaluate the relationship between the indicators and the final construct "Intention" (Q9) which is used as proxy [5] to indicate the intention to adopt a new mobile commerce application. PLSc offers advantages over Partial Least Squares (PLS) [23], [28]-[30] since it produces asymptotically consistent estimators and it gives the possibility of derived goodness of fit estimators. This last aspect is still controversial particularly in formative models as the one used in this research [16], [21], [23].

According to the results presented in Fig 2. 37.8% of the target endogenous variable "Intention" variance is explained by the predictors used in the model. Reference [15] proposes cutoff values for the coefficient of determination R^2. Values for R^2 greater than 0.67 are considered substantial, values between 0.67 and 0.33 are considered moderate and values between 0.19 and 0.33 are considered week. According to these cutoff values the research presented here has moderate explanatory power. Reference [16] proposes higher cutoff values. Modeled developed in [5] for China presents a higher explanatory value since R^2 is 0.523. However [5], uses a larger sample size with multiple items for the same indicator.

Consistent PLSc Bootstrapping [26] is used to determine statistical significance of inner model path coefficients [23] and outer model weights. The idea of Bootstrapping is to draw a large number of random subsamples with replacement to estimate the parameters. Therefore, this technique could produce results with small variations each time the algorithm is run for the same problem [15]. Then when Consistent PLSc Bootstrapping technique is employed parameters are estimated using the PLSc procedure. Consistent PLSc Bootstrapping algorithm for the study presented here uses 500 random samples considering individual sign changes, basic bootstrapping and Bias-Corrected and Accelerated (BCa) Bootstrap to determine the confidence intervals. Significant factors for values presented in Fig. 3 are those whose t-statistic is larger than 1.96 considering a significant level of 5% in a two tailed test. Therefore, the inner model path coefficient linking the predictors with the intention to adopt m-commerce is significant. Perceived benefits (Q1) and Perceived Enjoyment (Q6) are also statistically significant. These results differ from earlier results presented in [4], [5] as stated in the introduction of this paper, indicating perhaps a more mature mobile commerce sector in China and more consumer awareness of mobile commerce.

In a reflective model since there is redundancy among the indicators, indicators can be dropped without affecting the meaning of the final construct [16]. However, this is not the case with formative models since all indicators help building the construct [15]. Reference [16] indicates that before dropping not significant indicators in a formative model based solely on Outer Model Weights Significance it is important to check Outer Loadings significance before removing the indicator. According to this criterion only indicators that have no significant Outer Model Weights and Outer Loadings should be removed. Based on the sample presented here only Perceived benefits (Q1, t=6.365), Innovativeness (Q2, t=3.051) and Perceived Enjoyment (Q6, t=5.136) have significant outer loading factors. It is important to recall that outer model weights are considered an estimator of the relevant contribution of an indicator to build the final construct.

In this paper convergent validity is assessed via redundancy analysis [16], [17] using indicator Q9 presented in Fig. 1. According to this criterion the path coefficient linking predictors to intention should be greater than or equal to 0.8 [16], [17]. In the analysis presented here this path coefficient equals 0.615. However, convergent validity remains a controversial issue in formative models [21] since convergent validity tests the degree of correlation among indicators. Indicators in well-defined formative models are likely to be uncorrelated.

One final aspect important to check in formative models is the issue of collinearity among indicators. Since indicators in formative models are considered different dimensions of the construct, it this expected that indicators are not highly correlated with each other. Therefore, collinearity should not be a problem. Collinearity is considered to happen when the variance inflation factor (VIF) excess a value of 5 and tolerance values are greater than 0.2 [15]. These two measurements are considered to provide the same information [15]. Tolerance can be obtained by subtracting 1 from R^2. In the present case tolerance equals (1- 0.378) =0.622. Tolerance values less than 0.20 signal issues with multicollinearity. In cases when the coefficient of determination is greater than 0.8, collinearity must be evaluated. Variance inflation factors for all indicators used in this research are less than cutoff value of 5 as presented in Table 1. Corresponding Inner VIF from predictors to Intention corresponds to 1.
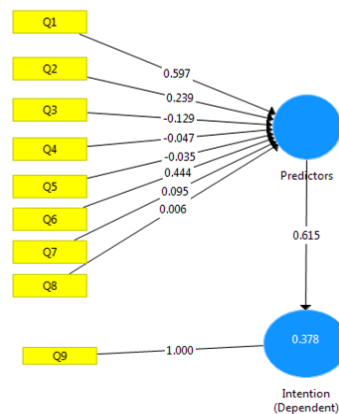

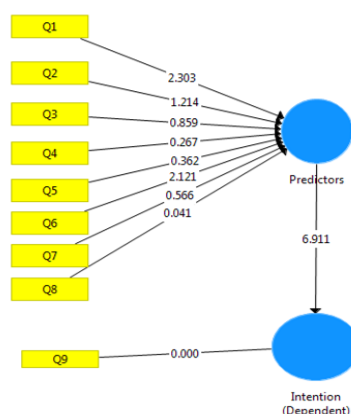Fig. 2. Outer model weights, inner model path coefficient and R^2 values.

Fig. 3. Inner model and outer model weights significance.

Table 1. Variance Inflation Factor

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
VIF	1.607	1.475	1.867	2.045	1.567	1.356	1.743	1.675	1.000

4. Discussion

This research presents a Structural Equation Model Partial Least Squares (SEM-PLS) to determine the intention to adopt a new mobile commerce application developed by JiuYao Pintuan. Model is formative in nature since the construct intention to adopt this new mobile application is built by all the indicators together, dropping not significant factors from the model affects the meaning of the final construct. In cases in which non-significant factors are important conceptually in building the final construct or when a non-significant factor is the only factor representing an indicator, researchers could decide to keep such non-significant factors [16]. In the research presented here perceived benefits (Q1) and perceived enjoyment (Q6) are two significant indicators according to outer loading factors; whereas innovativeness (Q2) has a significant outer loading factor. Therefore, these three factors are considered significant factors influencing the decision to adopt a new mobile commerce application. The path coefficient from predictors to Intention is significant indicating the potential of the model for exploratory analysis. Data collected for the indicators does not present multicollinearity corroborating that indicators are not highly correlated. Despite the limitations of the study due to small sample size, the results of this research are valuable since it focuses directly on the sellers and not on the buyers. Results from our study suggest that sellers would be more likely to adopt this new m-commerce application if they perceived it offers more benefits, more enjoyment for customers and it is on top of innovation. These suggestions have to be considered with moderation due to the value of the coefficient of determination R^2 and the sample size. Results from this study open the doors for further research in this topic.

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