

The Study of Influencing Factors of Mobile E-commerce Software Use Intention-based on TAM and TRA

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Abstract

With the wide popularity of mobile devices, e-commerce software in the mobile client forms a larger consumer market, which makes the volume of e-commerce transactions having a wide range of growth. As the consumers have a frequent contact with mobile devices, which makes consumers pay more attention to security and entertainment of the e-commerce software. Past mobile e-business research typically focus on the related factors about transaction process, like interface design, services and user experience, but seldom study the factors about consumers. On the basis of the TAM, this paper not only added perceived security and perceived entertainment, but also the consumers' personality factors like subjective norm in TRA, into the model. The study shows that PU, PEU, PS and PE all will have direct or indirect effects on use attitude and use intention, and subjective norms and use attitude will directly affect the consumers' use intention. Through the empirical analysis we found that e-commerce operators not only make the consumers experience more of usefulness and ease of use, security, and entertainment in the technology and services, but also improve the popularity with the aid of the mainstream media propaganda and star power to enhance the public's normative beliefs, which will ultimately affect the user behavior of the consumers.

Keywords: TAM; Mobile e-commerce; Subjective norms

1. Introduction

With the increasing number of mobile terminal users, the mobile e-commerce has developed rapidly in recent years. According to I-research statistics, mobile Internet users in China reached 560 million in 2014. So study the influence factors of consumers' using mobile e-commerce software behavior is imminent. The rapid bumps of catering takeout in the past two years has proved that the mobile electronic commerce can further development in China. It is important to study the user behavior about mobile e-commerce software deeply. This article will study the following questions through the empirical analysis:

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- (1) When the consumers use the mobile e-commerce software, what factors affect the consumer's using attitude and intention?
- (2) How the Subjective norm and using attitude affect the consumers' using intention?
- (3) Whether the "sense of security" and "sense of entertaining" can influence the using attitude and intention?:

2. Literature Review

2.1. TRA (Theory of Reasoned Action) and TAM (Technology Acceptance Model)

TRA (Theory of Reasoned Action) is put forward by the American scholar Fishbein and Ajzen in 1975, which mainly analyzes how attitude consciously influence individual behavior, and also focus on the attitude formation process based on cognitive information. The main theory is that Attitude toward Behavior (A) and Subjective Norm (SN) simultaneously influence the Behavioral Intention (BI), and the model is shown in Figure 1. The theoretical assumption of the model: human beings are rational, who will be based on the overall view and system view to use the obtained information; human behavior will not be affected by the unconscious temptation or power; human behavior is completely can self-control. [1]

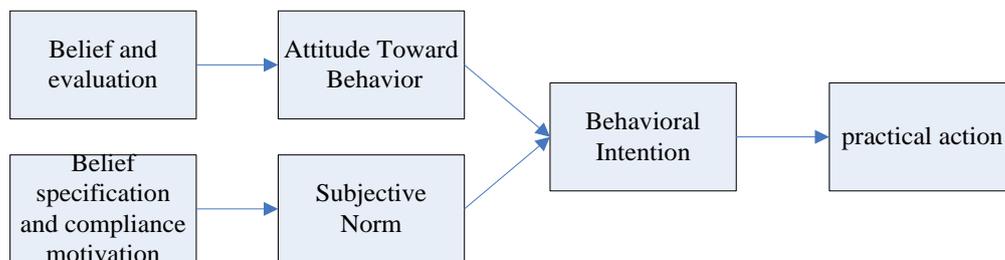


Figure 1. Theory of Reasoned Action Model

TAM (Technology Acceptance Model) was firstly proposed by Davis in his doctoral dissertation in 1989. The earliest TAM model is presented and explained the use attitude of an information system after using, and further studied the reason why they decided to use or give up the system. Based on the theory of TRA, absorbing the reasonable content of expectancy theory model and self-efficacy model, Davis put forward the model that Perceived Usefulness (PU) and Perceived Ease of Use (PEU) had obvious significance to Attitude toward Behavior (A). The model is shown in Figure 2.

Perceived usefulness (PU) is the most significant factors in TAM model, which mainly refers to the comfort level when using a particular software. Perceived ease of use is the individual perception when using a particular system or software feels effortless. When the user perceived more usefulness and more ease of use, the stronger using intention will be. The model also points out that PEU positively influence to PU, that is when a user perceived more ease, the more perceived usefulness it will be.^[2] Although Davis modified the model in 1993 and 1996, but they had little difference with original model. Therefore, this model can be used as a theoretical basis.

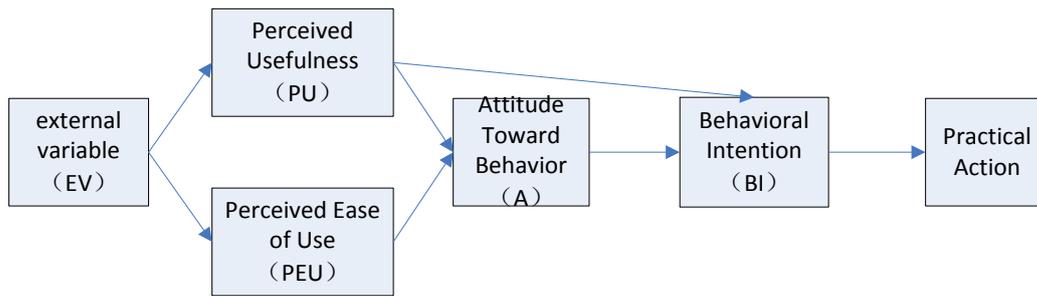


Figure 2. Technology Acceptance Model

Since its advent, TAM has got many attention, and many scholars adopt the model as the theoretical basis to research user's attitude and use attention toward different aspects of mobile technology. When South Korean scholar Park and Cheong [3] studied the use intention to the mobile internet, they added several external variables, such as perception level of prices, perceived entertainment, internet experience, perceived content quality and perceived system quality, into the original model, and found that perceived usefulness, perceived entertainment and perceived value were significantly affect the using attitude through the empirical study. Taiwan scholar Chun-Hsiung Liao *etc.* [4] added Perceived Entertainment into TAM, to study Taiwan use intention to 3G network, and the empirical study showed that perceived usefulness, perceived ease of use and perceived entertainment have significant effects on use intention to mobile technology.

2.2. Perceived Security (PS)

Perceived Security refers to the user's subjective feeling of property, privacy and health not being infringed on. Fung found that the characteristics of the Internet's openness and non-controlled globalization make transaction security issues become more prominent. Ming-Xia Wei [5] found that perceived security and perceived privacy will be the electronic commerce trust conditions. With the data of 2006 and 2009 in China, Guo-Xin Liu *etc.* [6] studied the influence factors of China's e-commerce online shopping behavior and its evolution, and they found that Perceived Security is one of the factors to influence use attitude. Perceived insecurity lead to Perceived risk. Yu-Feng Zhang's [7] paper showed that perceived risk had a significant negative effect on consumers' online shopping intention; Yu-Chuan Lin [8] studied the use intention of mobile e-commerce, and through empirical found that risk perception will negatively affect consumers' use intention; Miao Jing [9] also proved that perceived risk will affect consumers' online shopping intention. Mobile e-commerce software is rapidly developed in recent years, due to its more intimate than fixed equipment, making more serious privacy and safety of payment problems. Compared with other software, users also facing food security, which is health security, in the food take-away software. So users' perception of the safety has positive effect on using attitude.

2.3. Perceived Entertainment (PE)

Perceived Entertainment refers to users' subjective sense of joviality when using computer software. Since TAM's advent, it received widespread attention, but it still has been questioned by many experts and scholars. Moon thought PE is the inner beliefs of users when they use the information technology, and through empirical analysis he proved that the extension model had a stronger explaining ability than the original model, and PE, PU and PEU had combined action to using attitude. About the follow-up study of perception entertainment, the scholars who in different fields of electronic commerce had empirical proofs: the research on 3G multimedia use intention of Pagani *etc.* [10], the research on mobile 3G services use intention of Chun - Hsiung Liao [4], the research on

mobile Internet users use intention of Cheong Park [3], and the research on mobile chat services use intention of Nysveen *etc.* [11] all made PE (Perceived Entertainment) as a factor to influence use intention. Catering takeout e-commerce is the integration of traditional food industry and electronic commerce, which is the manifestation of services and technology innovation. When consumers using the software, through comparing with the traditional way of catering, they will have different consumption experience. Combined with the improving multiple services, consumers can get sense of entertainment from Catering takeout e-commerce. Therefore, the use of food take-away software will make consumers to perceive entertainment, which will affect the use attitude.

2.4. Subjective Norm (SN)

Subjective Norm mainly refers to the degree of the consumer influenced by others' words, which is the result of Normative Belief multiply Motivation to Comply. Normative belief refers to the suggestion of other individuals or groups given to the individual's behavior, and Motivation to Comply refers to the extent of compliance in other personal or teams' opinion [12]. TRA thinks that use attitude (A) and subjective norm (SN) applies to use intention (BI) at the same time, and the planning theory of behavior (TPB) also thinks that SN is an important factor to consumer use intention. In subsequent studies, the research on mobile consumers use intention of chat services of Nysveen *etc.* [11], the research on consumers about the use intention of mobile commerce of Ming- Xiang Yi *etc.* [13], and the research on Content Delivery Mode mobile e-commerce motivation of Hong Ling *etc.*[14] all added SN to TAM. Therefore, "subjective norms" will one of the belief variables to study consumer use attitude.

3 Research Hypotheses and Model

After reading 20 articles about TAM applied in e-commerce at home and abroad, 7^[2-4,8,10-11,15] of them make Perceived Entertainment as the exogenous variable of TAM, 3^[5,6,21] of them make Perceived Security as the exogenous variable of TAM, and 5^[7-9,16-17] of them make Perceived Risk as the exogenous variable of TAM. PR is the reverse expression of PS, and PS can replace PR to have a positive influence to user's attitude and intention. So on the basis of TAM, we make Subjective Norm of TRA as one of the external variables. And combined with the above results, we also add PS and PE into the original TAM, and form an extended model shown in Figure 3.

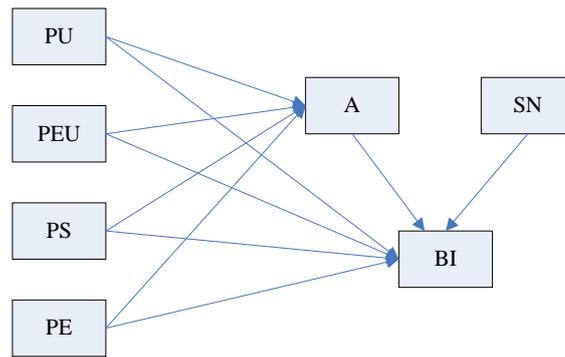


Figure 3. The Model of Third-party Food Take-away Software Use Behavior

In the original TAM model, PU and PEU are treated as external variables directly affect users' attitude. And in the empirical analysis, Davis found that PEU influences PU, and PU directly affects users' behavioral intention. But when the consumers use the third-party mobile food take-away software, PEU may also directly influence BI, thus we put forward the following hypothesis:

- H1a: PU has a significant positive influence on A.
- H1b: PU has a significant positive influence on BI.
- H2a: PEU has a significant positive influence on A.
- H2b: PEU has a significant positive influence on BI.
- H3: PEU has a significant positive influence on PU.

The rapid development of network technology not only brings people convenience, but also many unsafe factors, and some people even concern more about the security than the technology useless. Because the consumers need to upload their phone number and address into the internet, and electronic payment password is needed when consumption, which all will make the consumers feel unsafe with the mobile payment system, privacy and food quality. Above all these unsafe factors will affect the consumers' use attitude (A) and behavioral intention (BI), thus we put forward the following hypothesis:

- H4a: PS has a significant positive influence on A.
- H4b: PS has a significant positive influence on BI.

In the universal entertainment time, the consumers' requirements on the application of the software is not only the realization of the function, but also need a sense of belonging and entertainment. Third-party food take-away software not only can realize room home services, but also allows consumers interact with their friends in social platform, like WeChat, which makes reservation online becoming a new way of life. Above all, we put forward the following hypothesis:

- H5a: PE has a significant positive influence on A.
- H5b: PE has a significant positive influence on BI.

According to TRA, subjective norm is affected by consumers' subjective factors like personality, which will affect users' behavioral intention indirectly with the use attitude. The usefulness, ease of use, security and entertaining of the software make the consumers' use attitude. With the function of use attitude, consumers' trust propensity and adhesion to others' words have joint influence on use behavioral intention. Based on these, we give the following hypothesis:

- H6: A has a significant positive influence on BI.
- H7: SN has a significant positive influence on BI.

4. Study Design

4.1. Questionnaire Design

The study variables and references shown in the table below:

Table 1. Variables in the Research

Variable	Serial Number	Question	Reference
PU	PU1	I think the third party food take-away software is useful	Davis ^[12]
	PU2	I can easily choose the food from the software	Davis ^[12]
	PU3	I think it's necessary to use the software	Davis ^[12]
PEU	PEU1	It's easy for me to use the software	Davis ^[12]
	PEU2	It will not spend me too much effort to learn the software	Davis ^[12]
	PEU3	The use steps of the software is easy	Davis ^[12]
	PEU4	It is not difficult for me to use the software	Davis ^[12]
PS	PS1	The software can ensure our food safety	New
	PS2	The software can ensure our property safety	Guo-Xin Liu <i>etc.</i> ^[6]
	PS3	The software can ensure our privacy safety	Ming-Xia Wei ^[5]
	PS4	In all, I think it is safe to use the software	Guo-Xin Liu <i>etc.</i> ^[6]
PE	PE1	The software brings me a lot of fun	Wu ^[18]
	PE2	The software makes my life more interesting	Yu-Chuan Lin ^[8]
	PE3	The software let me have more interaction with friends	New
A	A1	I think the software is very attractive to me	Davis ^[12]
	A2	I think it's worth to use the software	Davis ^[12]
	A3	I think the use of the software is a wise choice	Davis ^[12]
SN	SN1	Many people around suggested me to use the software	Bing Liu ^[19]
	SN2	A lot of my classmates, colleagues and friends is using the software	Yu-Chuan Lin ^[8]
	SN3	The people I valued and respected are using the software	Yu-Chuan Lin ^[8]
	SN4	I care about how the others appraise my personal taste	Yu-Chuan Lin ^[8]
	SN5	External environment makes me feel using the software is the development trend of the future	Yu-Chuan Lin ^[8]
BI	BI1	I will use the software in the near future	Davis ^[12]
	BI2	I will use the software as often as possible	Davis ^[12]
	BI3	I will recommend it to the people around	Davis ^[12]

According to the measurement of the item, we compiled the first draft of the questionnaire, and the questions in the questionnaire not only in the reference for the related questions of scholars both at home and abroad, but also refer to the five principles in the market questionnaire expression: monotonous content, the expression of the problems should be specific, accurate, and objective, and avoid to ask sensitive questions *etc.* [5]. Answers use 5 point Likert Scale method: "1" means "strongly disagree", "5" represents "strongly agree". Because when the answers more than 5, most of the respondents will be lack of sufficient discern ability [20], so we didn't adopt the 7 point Likert Scale.

In order to ensure the accuracy and reliability of the survey, we carried on the preliminary investigation before formal investigation. In order to ensure the accuracy and reliability of the survey, we carried on the preliminary investigation before formal investigation. We distributed randomly 100 copies of questionnaire, recycling of 94, 12 of them are invalid, and at last we got 82 valid questionnaires. We have the reliability and validity test to the questionnaire, and to eliminate the questions which have low correlation. Eliminate principle: when the Alpha Coefficient less than 0.7, or corrected item-total correlation of each measure less than 0.5, the question should be deleted. The corrected item-total correlation of PEU1 was -0.112, which less than 0.5, and the Alpha Coefficient of PEU increased significantly after deleted PEU1. The corrected item-total correlation of PS2 was 0.371<0.5, and the Alpha Coefficient of PS increased significantly after deleted PS2. The corrected item-total correlation of SN2 and SN4 were 0.222 and -0.394, which all less than 0.5, and the Alpha Coefficient of SN increased significantly after deleted SN2 and SN4. Therefore, after deleting PEU1, PS2, SN2 and SN4 of the original questionnaire, it formed the final questionnaire.

4.2. Samples of the Study

Formal research issued 230 printed and electronic questionnaire, 218 were back, and the recovery rate was 94.8%. 200 effective questionnaires were screened out, and the effective rate was 87%. The questionnaire been out were: filling in the questionnaire halfheartedly or the questionnaire had not been finished. Demographic characteristics of effective samples were shown in table 2.

Table 2. Demographic Characteristics of Effective Samples

Demographic characteristic	Classification	Number of samples	Sample Percentage
Sex	Male	94	47%
	Female	106	53%
Record of formal schooling	College degree	23	11.5%
	Bachelor degree	87	43.5%
	Master degree	88	44%
	Doctoral degree	2	1%
Monthly disposable income	Less than ¥500	35	14.5%
	¥500-¥1000	125	62.5%
	More than ¥1000	38	19%
Annual Costs of Online Shopping	Less than ¥500	46	23%
	¥500-¥1000	87	43.5%
	More than ¥1000	67	33.5%

According to the report of Chinese take-out O2O industry development report in 2015 from I-research, student group is the mainly users to use the third-party delivery platform, and the number is 76.8%. This part of the crowd have a high degree, who can be more easily to contact with and accept new technology. Therefore, college students are the main investigator.

4.3. Reliability Analysis

Reliability analysis is used to measure the level of data consistency or stability, because surveys do not involve the same subjects repeat testing, so we only did the consistency test. This article use the Alpha Coefficient to test the reliability of the data, and the result is shown in Table 3. The table shows that the Alpha Coefficient of total variable is 0.943, and the minimum Alpha Coefficient of subscales is 0.844 > 0.8, therefore, the data has an acceptable credibility. The minimum corrected item-total correlation of each scale is 0.726 > 0.5, and if delete the minimum scale, the corrected item-total correlation has no significant improvement, which improves that the questionnaire has good internal consistency.

Table 3. The Result of Reliability Analysis

Variable Name	Serial Number	Alpha(α) Coefficient	Corrected Item-total Correlation
Total Variable	——	0.943	——
PU	PU1	0.874	0.731
	PU2		0.760
	PU3		0.782
PEU	PEU2	0.889	0.825
	PEU3		0.843
	PEU4		0.856
PS	PS1	0.867	0.851
	PS3		0.726
	PS4		0.847
PE	PE1	0.844	0.823
	PE2		0.765
	PE3		0.771
A	A1	0.888	0.860
	A2		0.890
	A3		0.763
SN	SN1	0.950	0.841
	SN3		0.915
	SN5		0.931
BI	BI1	0.918	0.815
	BI2		0.847
	BI3		0.857

4.4. Validity Analysis

Validity analysis refers to the measurement tools or measuring method to measure the degree of data accuracy. Measurement results and the need of the content are more similar, the validity is higher, which shows that the results of the measurement is more able to reflect the real characteristic, but vice versa. In this paper, we use the convergence structure validity analysis, which accepted by the academic circles.

Convergent validity also called convergent validity, which mainly refers to the similar degree of the same problem measured by different measurement method. Firstly, this

article used the SPSS to have the KMO test about the samples, and the minimum KMO was $0.68 > 0.5$, which proved that the data was suitable to do the factor analysis and the factor loading was credible. Secondly, we used the factor loading to calculate AVE (Average Variance Extracted) and CR (Composite Reliability), and the computational formula was showed below (λ_i is the factor loading showed in Figure 4)

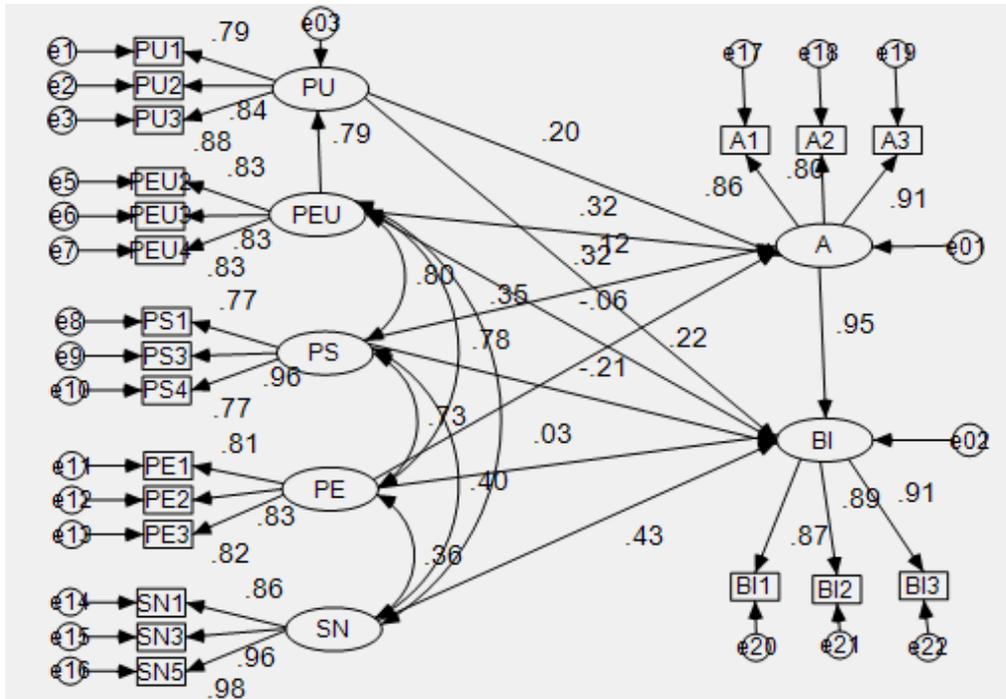


Figure 4. Structural Equation Model Validity Analysis Diagram

Table 4. The Result of Convergent Validity Analysis

Variable name	Serial Number	Factor loading	KMO	AVE	CR
PU	PU1	0.789	0.737	0.6985	0.8740
	PU2	0.842			
	PU3	0.874			
PEU	PEU2	0.833	0.746	0.6989	0.8744
	PEU3	0.842			
	PEU4	0.833			
PS	PS1	0.768	0.680	0.7020	0.8
	PS3	0.964			
	PS4	0.766			
PE	PE1	0.805	0.731	0.6681	0.8579
	PE2	0.829			
	PE3	0.818			
A	A1	0.859	0.684	0.7473	0.8984
	A2	0.800			
	A3	0.914			
SN	SN1	0.859	0.736	0.8707	0.9527
	SN3	0.959			
	SN5	0.977			

BI	BI1	0.868	0.747	0.7924	0.9197
	BI2	0.890			
	BI3	0.912			

Tai-Sheng Rong points out that when the standard load of the index greater than 0.7, AVE gr eater than 0.5, and CR greater than 0.6, the scale has good convergent validity [18]. The table 4 shows that the index of the variables on the standard load were greater than 0.7, the variables of AVE were greater than 0.5, and CR were greater than 0.6, so the scale has good convergent validity.

5. Hypothesis Testing and Analysis

5.1. Model Fitting

This article used AMOS17.0 to fit the model, and the Figure 4 shows that PU, PEU, PS, PE for BI path coefficients were respectively 0.15, 0.072, 0.203, 0.072, which all less than or close to 0, and P values were 0.233, 0.700, 0.068, 0.781, which were greater than 0.01, proved these hypothesis were invalid. Delete the above four paths, all the path coefficients of the model is positive, and conformed to the requirements. The hypothesis testing results was shown in Table 5:

Table 5. Hypothesis Testing Results

Hypothesis	Relationship Expression	Unstandardized Estimated Value	P Value	conclusion
H1a	PU-->A	0.260	**	support
H2a	PEU-->A	0.316	**	support
H3	PEU--> PU	0.644	***	support
H4a	PS-->A	0.297	***	support
H5a	PE--> A	0.241	**	support
H6	A--> BI	0.627	***	support
H7	SN--> BI	0.347	***	support

"* *" indicates $p < 0.01$, "***" indicates $p < 0.001$

After removed invalid path fitting, Modification Indices showed the M.I. value of e03 <---> PS is 28.273, greater than 15, when e03 and PS established bidirectional covariant relations, the path coefficient PU to A becomes bigger. At the same time, the M.I. value of e20 <---> e17 is 24.455, greater than 15, when the e20 and e17 established bidirectional covariant relations, the path coefficient PU to A becomes bigger. Then the M.I. value of Modification Indices had no greater than 15, and the final standardized model diagram was shown in Figure 5.

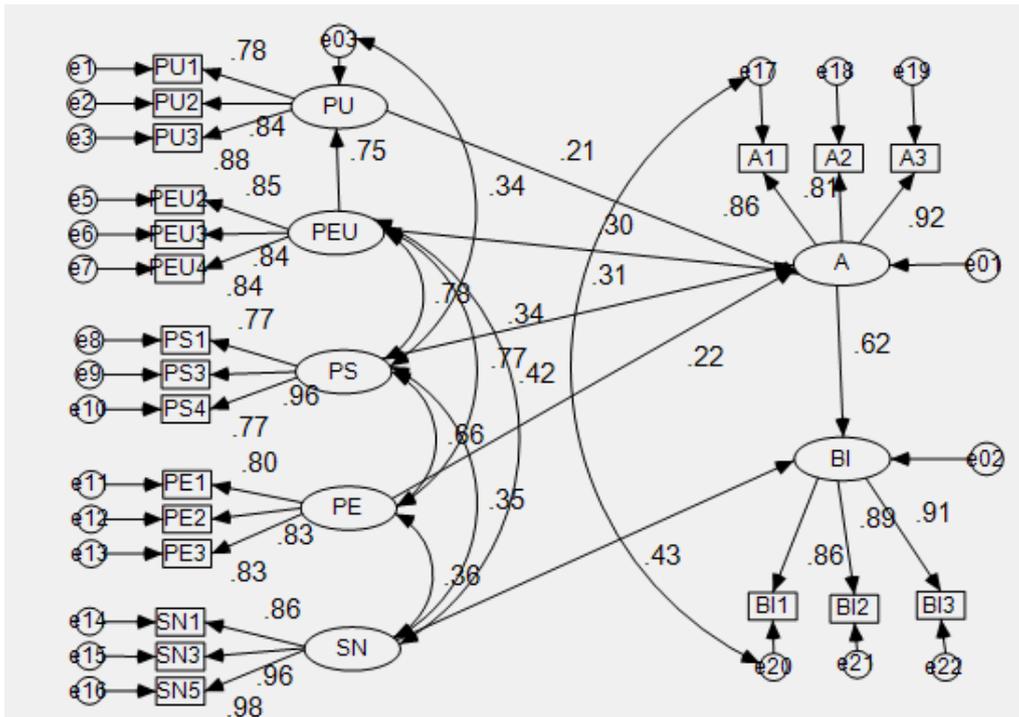


Figure 5. Standardized Model Diagram

The fitting of the model parameter values are shown in Table 6, which shows that every various fitting indexes meet requirements, so it has a good fitting degree between the proposed model and the data in our institute.

Table 6. Fitting Index of the Measurement Model

Fit Index	Judging Criteria		Actual Value of the Model	Imitative Effect
	Good	Wonderful		
CMIN/DF	2-3	<2	1.789	Wonderful
RMSEA	0.05-0.08	0.05	0.063	Good
GFI	0.8-0.9	0.9	0.878	Good
AGFI	0.8-0.9	0.9	0.838	Good
NFI	0.8-0.9	0.9	0.923	Wonderful
CFI	0.8-0.9	0.9	0.964	Wonderful
IFI	0.8-0.9	0.9	0.965	Wonderful
RFI	0.8-0.9	0.9	0.907	Wonderful

5.2. Discussion and Suggestion

Through empirical analysis, 4 of the hypothesis didn't pass the test, so the survey data concludes that: perceived usefulness, perceived ease of use, perceived security, perceived entertainment, use attitude and subjective norm will directly or indirectly affect consumers' use intention. In the unstandardized empirical model, the influence of PU to BI is 0.260, which shows that the particle value will be the key factor to the use intention, and ti is consistent with original model hypothesis. The directly influence of PEU to BI is 0.316 and the indirect effects is 0.167 (0.644 * 0.26), which shows that operability and practicability of the software design will greatly affect the use of the consumer attitude. The influence of PS to BI is 0.297, which shows that the consumers will pay more attention to the security issue, the safety factors such as product, privacy and payment safety will affect the users' use intention. The influence of PE to BI is 0.241, which

proves that except for the practical function, the additional functions and community belonging will also influence the use attitude, and then influence the final use intention. The influence of A to BI is 0.627, which shows that the consumers' use attitude will have a direct influence on use intention. The influence of subjective norms to use intention is 0.347, which shows that the recognition to the software will directly affect the consumers' attitude. Empirical analysis found that, in addition to the usefulness and ease of use, security, entertainment of the software, the social main body of public attitudes will also affect the use intention.

As the mass of software development in recent years, the similar software in the functional design, interaction design, and safety design *etc.* have no obvious difference, so popularity of the software will be the most important factor to the consumer. In this paper, the empirical shows that if mobile e-commerce software want to have a bigger market space, it not only should improve its interactivity and safety coefficient, in order to establish the user trust, but also needs to increase the visibility and recognition through the major social media or star power.

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