

Research Article

Empirical Study and Model of User Acceptance for Personalized Recommendation

Zheng Hua

School of Information and Statistics, Guangxi University of Finance and
Economics, Nanning, 530003, China

Abstract: Personalized recommendation technology plays an important role in the current e-commerce system, but the user willingness to accept the personalized recommendation and its influencing factors need to be study. In this study, the Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM) are used to construct a user acceptance model of personalized recommendation which tested by the empirical method. The results show that perceived usefulness, perceived ease of use, subjective rules and trust tend had an impact on personalized recommendation.

Keywords: Ease of use, personalized recommendation, technology acceptance model, the theory of reasoned action, usefulness

INTRODUCTION

As scale of various e-commerce grows nowadays, types and amount of commercial goods grows quickly as well. How to make customers easily look for their desired goods in such huge amount of information is an open and critical question for e-commerce vendors. Personalized recommendation can provide the information and goods in terms of customers' shopping behavior and interests and has achieved great success in e-commerce field. Personalized recommendation system can be shorted as Recommender System, which is an information filtering based advanced intelligent commercial system (Jannach *et al.*, 2011). It is to recommend useful information or stuff (for instance, movie, tv, music, book, news, picture, webpage, etc.) to potentially users or customers and to help e-commerce website to provide personalized decision making support and information service support (Ricci *et al.*, 2011). Amazon is a pioneer of using personalized recommendation in its website. Data shows that 35% of its sales come from its personalized recommendation directly and 60% of its sales are impacted by its personalized recommendation directly or indirectly while the Chinese counterparts have only 0.5% transfer rate from customer access to customer order. Therefore, from e-commerce website runner's perspective, in one hand, they need to know customer's behavior urgently, understanding why customers would like to accept take personalized recommendation, which factors play roles in customers' selection of personalized recommendation, in the other hand, they have to pay more attentions to dig and cultivate customers' potential

shopping intendency, improves accuracy of recommendation. The second aspect is the mainstream of current research (Liu *et al.*, 2009). They mostly go from technology's point of view, focusing on personalized system architecture design, recommending algorithm development and improvement. The research associated with the first aspect, personalized recommendation user behavior model, is rarely found in Chinese academic community. Ma *et al.* (2009) use a e-commerce recommendation system as its research target, through field experiments, proving positive mood would have impact on user's intention of taking new information technologies (personalized recommendation). Kai *et al.* (2010) use rational behavior theory, analyzing the impact of personalized recommendation to customer's shopping decision and the impact mainly reflects in 4 aspects: improving decision quality; strengthen decision maker's confidence; strengthen decisions' satisfaction; impact on final decision of purchase. This study will investigate personalized recommendation users' acceptance model in terms of rational behavior theory and Technology Acceptance Model (TAM), analyzing the factors which would have impact on user's acceptance for personalized recommendation based on questionnaire survey data. The result of this investigation will play an important role on improving enterprise's on-line sales, customers' loyalty and satisfaction to a website.

LITERATURE REVIEW

Theory of reasoned action: Fishbein and Ajzen (1975) proposed a theory of reasoned action, which is a social-

psychological theory to predict personal behavior and attitude of human being. It mainly is used to analyze how the attitude intentionally exerts impact on personal behavior, focusing on the attitude forming process based on cognitive information. Its basic assumption is: human being is rational. Before he take action to do anything, he will analyze all sorts of associated information to determine its significance and consequence, then finally decide if he will take this action. Therefore, theory of reasoned action has two assumptions:

- Most of human being behavior is controlled by rational will
- The intention of doing something determine if this action would be taken or not

In another word, the actual appearance of human being's behavior is determined by his intention and the intention is determined by his behavior attitude and his subjective feeling regarding to social rules and orders (Sheppard *et al.*, 1988).

Technology acceptance model: Technology Acceptance Model (TAM) is a reasoned action theory based model proposed by Davis (1989) to investigate how a user accepts information system by reasoned action. The model can generally explain and predict influential factors of utilizing information technology (Lu and Xu, 2005, 2006). That is to say, this model provides a theoretical basis, explaining the users' sense is the starting point of his acceptance of information technology. The sense can be used to understand external factors' impact on users' belief, attitude and intention in heart and how they exert influence on technology utilization. TAM proposed two major deterministic factors:

- Perceived usefulness, reflecting the extent of taking advantage of using a specific system on improving his performance on his work.
- Perceived ease of use, reflecting how easy for a person to learn how to get familiar with a specific system. TAM believes system usage is determined by the behavioral intention, while the behavioral intention is jointly determined by attitude toward using and usefulness of sensibility.

The attitude toward using is determined by the usefulness of sensibility and ease of use. Perceived usefulness is determined by the perceived ease of use and external factors. Perceived ease of use is determined by external factors.

ASSUMPTION AND MODELING

User's personal characteristic feature: User's personal characteristic feature refers to user's gender, age.

Gender: The 2011 statistical report of CNNIC shows ratio of men is 54.8% and women is 45.2%. The popularity of men is higher than women's. Regarding to on-line shopping, women's satisfaction is lower than men's. Their trustworthy on the online shopping is lower than men. Men normally would like to think that on-line shopping is more convenient and easy to use. All these factors would have impact on the users' attitude toward personalized recommendation.

Age: The 2011 statistical report of CNNIC shows the ratio of internet users whose age between 10 and 19 is the highest, which is 31.8%. Compared to the data of 2009, the ratio of 30-39, 40-49 and 50-60 years old increased. They respectively are 22.8, 11.3 and 4.9%. This shows the population structure of internet user in China is changing. The internet popularity among ages is more various and youth people are the major market of on-line shopping. The people in this age would like to take more new things. It is more easily for them to accept personalized recommendation which can give them more options to choose while at the same time give them more satisfaction

Therefore, users' personal feature is associated with his internet experience, which indirectly influences the user's perceived usefulness, perceived ease of use and perceived risk of acceptance toward personal recommendation. Due to previous reasons, assumptions are proposed as following:

Assumption H1: Personal characteristic feature has impact on internet surfing experience.

Internet surfing experience: So called experience is knowledge collected and summarized from previous incidents. It is an objective result from previous behavior and it is the accumulation of previous knowledge. Previous knowledge not only has indirect impact toward attitude and intention but also play a role in adjustment attitude of a user's experience level associated with specific technology. Although internet experience doesn't have direct impact on user's acceptance of personalized recommendation, the more experience of surfing on internet, higher the frequency of searching commercial goods on-line. The personalized recommendation can help users finding the most needed goods. Here, the internet surfing experience can be understood as external factors in

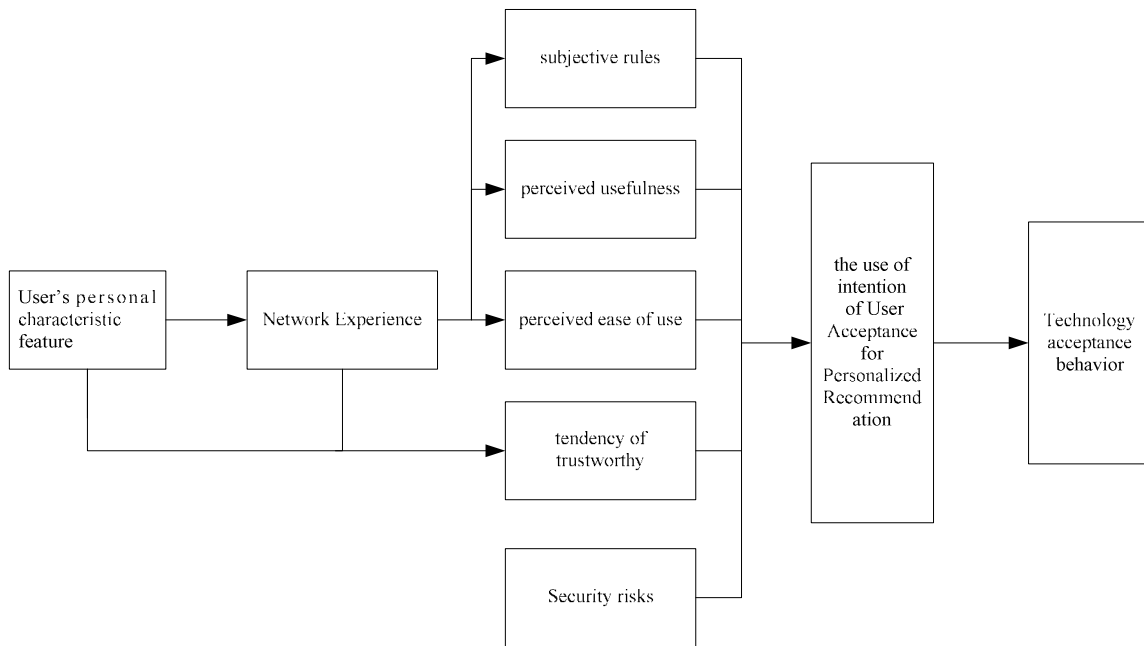


Fig. 1: The model of user acceptance for personalized recommendation

TAM. This study believes the longer using internet, the more experienced of its user and propose an assumption to measure the impact of this factor toward perceived usefulness and perceived ease of use.

- H2: 2a:** User's internet experience has positive correlation to perceived usefulness.
- 2b:** User's internet experience has positive correlation to perceived ease of use.

Personal tendency of trustworthy: Tendency of trustworthy is a consistent tendency of a person trusting the other people in mostly general condition. In economics people in the society are categorized as three types: risk fonder, risk neutralizer and risk avoider. Internet user's trustworthy tendency would increase or decrease the influence of trust factor toward trust itself. That is to say, given risks in the same level, risk fonder would more like to take personal recommendation than risk avoider.

Therefore, following assumption is proposed:

Assumption H3: User's personal trustworthy tendency positively associates with the acceptance of personalized recommendation.

Internet security: Transaction security and personal information security are critically important in e-commerce. Internet security includes transaction security and personal information security. It also controls the perceived risk of e-commerce transaction.

The perceived risk in the study consists of 2 layers, commercial risk and personal secrets risk. In most of research, people thought perceived risk is the biggest obstacle of people's acceptance toward personalized recommendation. Therefore, following assumption is proposed:

Assumption H4: User's perceived internet security has positive relation to acceptance of personalized recommendation.

Subjective rules: Based on TRA theory, behavior tendency is easily to be influenced by the subjective rules. In a field research, user's technological acceptance easily influences surrounding people. Therefore, acceptance of personalized recommendation technology is influenced by the subjective rules as well.

Assumption H5: User's subjective rule has positive association with acceptance of personalized recommendation.

Perceived usefulness: Perceived usefulness is the expectation of using a specific technology to improve his working performance. Generally, the higher interests that a user expects to use a new technology to bring, the more possible that user would take this technology. A lot of researchers investigated the relation between perceived usefulness and attitude, tendency of use. The research results show it has significant relation between perceived usefulness and

tendency of using the specific technology. Perceived usefulness directly determines the tendency of use. In the acceptance model of using technology, perceived usefulness is the deterministic elements of user's acceptance of personalized recommendation. It directly influences the attitude and tendency. Only the user thought the goods recommended by the personalized recommendation is useful, he would like to buy it.

Assumption H6: Perceived usefulness has positive relation with the acceptance of personalized recommendation.

Perceived ease of use: Perceived ease of use reflects how easily that a user thinks to use a specific system. From recommendation result's perspective, there are 4 factors that have impact on users' satisfaction: the novelty of recommendation, the reliability of recommendation, the variety of recommendation and the value of recommendation.

Assumption H7: Perceived ease of use has positive relation to the acceptance of personalized recommendation.

Theoretical model: From previous discussion, the study will use TAM proposed by Davis (1989) as basic foundation and combining the subjective rules in TRA into the system, proposed a theoretical architecture as shown in Fig. 1.

In the model, personal feature will have impact on internet experience. User's internet experience has impact on perceived usefulness, perceived ease of use, personal subjective rules. Among them, perceived usefulness and perceived ease of use are from Davis' TAM model, subjective rules from TRA model. Intermediate variables are tendency of trustworthy and security risk.

EMPIRICAL STUDY

The objective of the empirical study is personal recommendation system of the www.dangdang.com This website is the world's largest comprehensive Chinese on-line shopping center. Therefore, it is quite a typical research objective. This research also uses statistical SPSS to analyze collected data to verify the effectiveness of users' acceptance of personal recommendation.

Questionnaire survey: The research uses randomly distributed question is survey quiz as data source. The 220 quiz were distributed. One hundred and eighty were returned. One hundred and seventy seven were valid. Feedback rate is 81.8%, validity rate is 80.5%.

Table 1: Gender, age statistics

		Number of people	Rate (%)
Gender	Man	92	51.9
	Woman	85	48.1
Ages	<18	5	2.8
	18~25	144	81.4
	26~30	23	13
	>30	5	2.8

Table 2: Network experience data statistics

	Time	Number of people	Rate (%)
History of internet surfing	<1 year	2	1.1
	1~3 year	6	3.4
	3~6 year	154	87.0
	>6 year	15	8.5
Everyday internet surfing time	<30 min/day	6	3.4
	30~60 min/day	34	19.2
	1~2 h/day	55	31.1
	>2 h/day	82	46.3

Question is survey consists of 2 sections. The first section is personal information investigation; the second section is the attitude and intention toward personal recommendation. Among these, the 2nd section uses the Likert's 5 levels to grade: 1 mean totally agree, 2 means agree to some extent, 3 means just so, 4 means disagree, 5 means totally disagree.

Sample analysis: By doing statistical analysis over valid question are survey quiz, among those interviewers, 51.9% are man, a little bit higher than women. But generally ratio between men and women are close to 50%. The analysis results, including interviewer's gender, age are shown in Table 1.

Questionnaire survey also asked the interviewers about their internet access history and familiarities. The internet access history of interviews is shown in Table 2. Most of interviews' history of internet surfing are more than 3 years, 95.5% among all those interviewers. (77.4%) of interviewers' everyday internet surfing time is more than 1 h. These data shows the interviewers are familiar with internet to some extent and have some experience, thus making the research on e-commerce personalized recommendation easier.

Data analysis:

Reliability analysis: Reliability analysis mainly investigates reliability and consistency among all sorts of empirical study. Joseph etc. (1998) thought Cronbach's α coefficient more than 0.7, meaning data reliability is high, while when the amount of field research is less than 6, the Cronbach's α coefficient more than 0.6, meaning data is reliable. The reliability of the questionnaire survey is shown in Table 3.

Table 3: All scale reliability analysis

Variable	Number of measurements	Cronbach's α
Perceived usefulness	4	0.827
Perceived ease of use	5	0.841
System trust (perceived safety)	5	0.803
Personal tendency of trustworthy	9	0.761
Subjective rules	7	0.774
Behavioral intentions	3	0.826
Total scale	33	0.903

Table 4: Correlation analysis between influencing factors and intention to use

		Use intention
Perceived usefulness	Pearson coefficient	0.863**
	Sig.	0.000
Perceived ease of use	Pearson coefficient	0.925**
	Sig.	0.000
Personal tendency of trustworthy	Pearson coefficient	0.821**
	Sig.	0.000
Security risks	Pearson coefficient	-0.178**
	Sig.	0.000
Subjective rules	Pearson coefficient	0.983**
	Sig.	0.000

Table 5: Correlation analysis between the demographic variables and intention to use

		Willingness to use
Gender	Pearson coefficient	0.007
	Sig.	0.876
Age	Pearson coefficient	-0.043
	Sig.	0.376
Network Experience	Pearson coefficient	0.051
	Sig.	0.262

Table 6: Overall parameters of stepwise regression model

Model	R	R ²	Adjusted R ²	S.E.E.
1	0.922 (a)	0.852	0.851	0.38311105
2	0.930 (b)	0.865	0.865	0.36654198
3	0.934 (c)	0.871	0.871	0.36652701
4	0.935 (d)	0.874	0.873	0.35565093
5	0.940 (e)	0.886	0.885	0.33981334

From the data we can see all the variables of Cronbach's α in the Table 3 are more than 0.7, the total

Table 7: Regression analysis of variance

Model		S.S.	Df	M.S.	F	Sig.
1	Regression	353.382	1	353.382	2407.662	0.000 (a)
	Residual	60.618	413	0.147		
	Total	414.000	414			
2	Regression	358.647	2	179.323	1334.717	0.000 (b)
	Residual	55.353	412	0.134		
	Total	414.000	414			
3	Regression	360.386	3	120.129	920.886	0.000 (c)
	Residual	53.614	411	0.130		
	Total	414.000	414			
4	Regression	362.140	4	90.535	715.762	0.000 (d)
	Residual	51.860	410	0.126		
	Total	414.000	414			
5	Regression	366.771	5	73.354	635.250	0.000 (e)
	Residual	47.229	409	0.115		
	Total	414.000	414			

amount of Cronbach's α coefficient reaches 0.9. That proves the questionnaire survey quiz has high reliability and fulfills the requirements of the empirical study.

Correlation analysis: The correlation between variables means there is certain relationship between two changing phenomenon. In this study, the correlation analysis is based on the Pearson coefficients in the SPSS tool:

- **Correlation analysis among the most significant factors:** From the data in Table 4, we can see the model is valid to some extent.
- **The correlation analysis between population statistics and intention of use:** An assumption had been made in previous section, user's age, gender and the other population statistics have impact on the users' intention of accepting personal recommendation. Therefore, the study will compare various aspects of population statistics with users' intention.

From Table 5 correlations among the basic element of population statistics, gender, age, internet experience and intention of acceptance are not very significant. Because most of the interviewers are students between 18 to 30 years old and their internet experience are similar, leading to no correlation between population statistics and intention of acceptance. The survey can't reflect the real case in the field and the assumption cannot be verified in such case.

Regression analysis: From correlation analysis, we know the factors significantly correlated to the intention of acceptance are: perceived usefulness, perceived ease of use, tendency of trust, subjective rules and security risk. In the analysis of this section, all of these factors can be seen as independent variable and intention of use can be seen as dependent variable. The results of regression analysis are shown in Table 6 and 7.

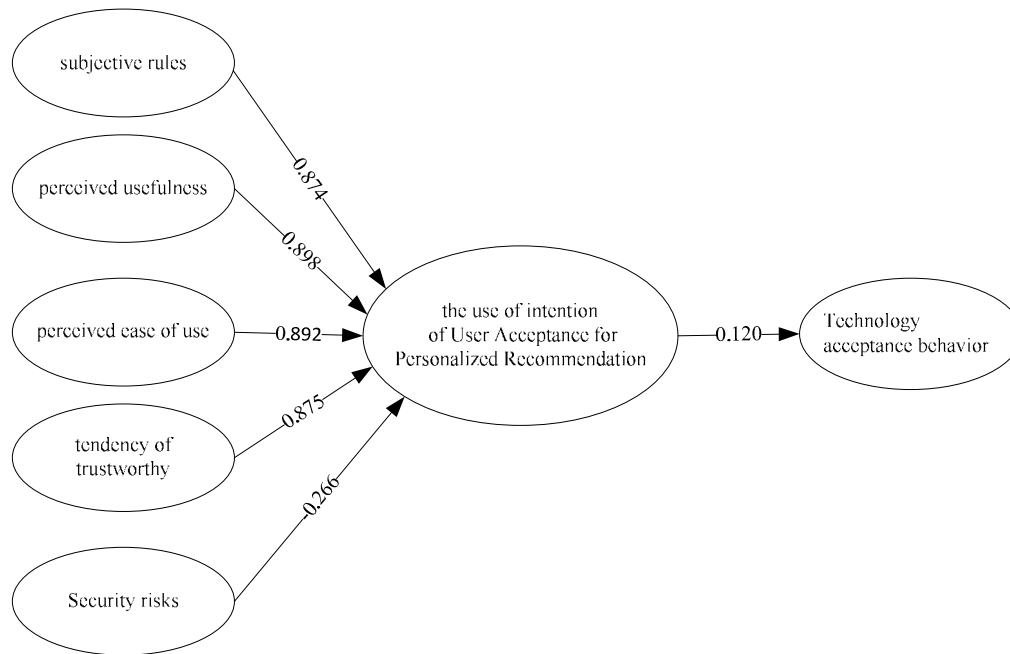


Fig. 2: The modified model

From the results of regression, the threshold coefficient is optimized to 0.885. The regression equation can be explained as 88.5% of total mutation. While at the same time, regression model has explained that variance is $F = 635.250$, its significance probability $\text{Sig.} < 0.01$. This explains the final regression effect has returned to a significant level.

Model adjustment: Through analysis of SPSS, the relation between intention of use and factors influenced by correlation analysis and regression analysis is investigated. By and large, the acceptance model of personalized recommendation makes sense. Only an exception is that population statistical factors had not been confirmed. Therefore, the modified model is shown in Fig. 2:

DISCUSSION AND CONCLUSION

This study found out the major factors which influence users' acceptance of personalized recommendation through investigating academic study s and field research. Several points had been summarized as follows:

- Population statistical factors make no difference on the consistent structure of various elements which influence on users' acceptance of personalized recommendation.

- The influential factors which influenced the intendency of using personalized recommendation technology include perceived usefulness, perceived ease of use, subjective rules, security risk and intendency of trustworthy.

Empirical study proves perceived usefulness, perceived ease of use, subjective rules and intendency of trustworthy have positive relation acceptance of personalized recommendation. Security risk has negative relation to attitude of using personalized recommendation. Perceived usefulness has the greatest impact on intendency of using personalized recommendation.

Due to the objective limitation, although the study investigates the influential factors of users' acceptance of personalized recommendation, the research is still far from perfect. The research objects are personalized recommended physical products, not included knowledge and services. In the future, our research will include how differences among various types of products or services influence the users' acceptance of personalized recommendation. The research in this study mainly discussed the major influential factors that have impact on users' acceptance of early stage personalized recommendation technology. After more and more users are accepting personalized recommendation, how to keep them interesting on it, strengthening their loyalty, in the next step research topic.

ACKNOWLEDGMENT

This study is supported by the 2011 National Social Science Fund Project of China (No. 11CTQ008) and the 2011 Guangxi College Talents Program (No. 201140).

REFERENCES

- Davis, F.D., 1989. Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quart.*, 13(3): 319-337.
- Fishbein, M. and I. Ajzen, 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Addison-Wesley, MA.
- Jannach, D., M. Zanker, A. Felfernig and G. Friedrich, 2011. *Recommender Systems: An Introduction*. Cambridge University Press, Cambridge.
- Kai, S., L. Yan and D. Yue, 2010. Impact of personalization recommendation system on mobile electronic commerce consumer's purchase decisions and its application strategy. *Value Eng.*, 29(35): 109-110.
- Liu, J., T. Zhou and B. Wang, 2009. Personalized recommendation system in progress. *Prog. Nat. Sci.*, 19(1): 1-15.
- Lu, Y. and B. Xu, 2005. A comparison study of TAM and its theory basis. *Technol. Prog. Pol.*, (10): 176-178.
- Lu, Y. and H. Xu, 2006. An empirical research on technology acceptance model. *R&D Manage.*, 18(3): 93-99.
- Ma, Q., K. Wang and L.C. Shu, 2009. Influence of positive emotion on users: Adoption intention on information technology: An experimental study with RA. *Stud. Sci. Sci.*, 27(10): 1557-1563.
- Ricci, F., L. Rokach, B. Shapira and P.B. Kantor, 2011. *Recommender Systems Handbook: A Complete Guide for Scientists and Practitioners*. Springer, New York, London.
- Sheppard, B.H., J. Hartwick and P.R. Warshaw, 1988. The theory of reasoned action-a meta-analysis of past research with recommendations for modifications and future-research. *J. Consum. Res.*, 15(3): 325-343.