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Abstract: With the development of 3G and a growing scale of mobile terminal holders, location based service (LBS) has the very broad market prospect. But now whether from the perspective of the cognitive degree or market scale, the application status of location based service are not satisfactory. At present, researches mostly stagnate in technical level, and less on consumers' behavior. In this paper, we establish the research model of consumers' intention to use location based service from the angle of perceived risks and apply the empirical test. The results of the study show that perceived service business risks, perceived service product risks and perceived financial risks have significant negative influence on users' intention to adopt LBS. In addition, whether the users have experience of using the LBS will influence usage intention to some extent. Overall, the results of this study can help mobile agents understand the sources of business risks, so that they can regulate their own behavior, formulate rational policy and eliminate the risks in order to promote the long-term development of LBS.

Keywords: mobile location services, perceived risks, usage intention

1. INTRODUCTION

Continuous improvement of the mobile communication infrastructure, integration development of the mobile terminal products and the fast spread of the mobile Internet promoted the rapid development of mobile value-added services. As an integrated business of mobile Internet and positioning service, LBS (Location Based Service) is also gradually developing and increasingly being mature. In some developed countries, LBS have entered into a stable development period. For example, Japan as one of the countries which has the best LBS development in the world, more than half of its domestic mobile phones have built-in GPS function; In Europe, nearly more than 1 million mobile users are using LBS in 2012. However, the development of LBS is faced with a difficult situation in our country. Despite the rapid growth of Chinese mobile communication market and the building of the early mass communication base station system have laid a solid foundation for the development and popularization of LBS, but in the practical application, LBS is still in the pilot marketing----the user scale is small, the proportion of total revenue from value-added services is still low and the situation of accepting this market has not been optimistic.

In recent years, LBS has become a hot topic that has been studied and focused on in mobile commerce or mobile data service field, but the present researches are mainly focused on developing technology and inventing the service mode. There are relatively less researches about consumer perception and usage intention. The studies on consumer behavior and psychology are still in early stage. However the main problems should be paid more attention is that customers' perceived risk is still relatively high toward LBS application. Therefore,

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the purpose of this paper is trying to research the factors which affect the consumer's intention to use the LBS from the perspective of perceived risk, finding out the consumers' concerns and the key factors hindering accepting market, so as to offer some targeted proposal to improve the customer service quality for the LBS service providers.

2. REVIEW OF RELATED RESEARCHES

Through retrieving the database of EBSCO, Emerald, CNKI, we collected more than one hundred related papers about mobile service and found that only a few references are about mobile service consumer behavior, and the main model is about technology acceptance and its extended model, some researches regard perceive risks as one of the independent variables which influence the usage intention in acceptance model. For example, Anckar etc (2003) queried using TAM to explain mobile business service users and pointed out that when taking traditional dimensions into consideration, we should also consider business technology factors, the non-transaction dimensions, a multiple-choose situation, social influence and perceived risks factors, and put forward that perceived risks have important negative influence [1]. Existing references on the factors affecting consumers' mobile service focus on the perception of interests, including perceived usefulness, perceived ease of use, perceived mobility, perceived interesting, etc.. The research angle has certain limitations.

Perceived risk which was introduced in the field of marketing in 1960 for the first time by Harvard University professor Bauer, refers to that in a purchasing process, consumers can't predict the consequence of purchasing thus creating a feeling of uncertainty. The uncertainty comes out in product, brand, product or service providers and purchase patterns, etc. Stone and Gronhaug (1993) concluded that in the traditional environment, almost 88.8% overall perceived risk was captured by the six dimensions including financial risk, function risk, time risk, physical risk, psychological risk and social risk [2], many of the perceived risks researches adopted the six dimensions. Perceived risks depended highly on various situations. Under the electronic commerce circumstances, shopping mode has changed, so the dimension of the perceived risks will be different accordingly. Featherman and Pavlou (2003) put forward that economic, function, psychological, social, privacy and time risk are six risk dimensions in online shopping [3]; Conchar, etc. (2004) divided risk dimensions into seven kinds, including financial, performance, physical, psychological, social, time/convenience and the related decision-making risk [4]; The domestic scholars Dong Dahai, Li Guanghui and Yang Yi(2005) get the four dimensions of consumers' perceived risk in online shopping through the factor analysis，which are network retailers core services risk, accompanied risk of online shopping, personal privacy risk and fake risk [5]. And in the mobile business, usually buying a kind of business will follow a variety of services or many related mobile web merchants, the multiple correlation of the purchase target will no doubt increase dimensions of consumers' perceived risks.

There is less literature about perceived risks in LBS and only a small number of papers mentioned that we should focus on consumers' perceived risks in promotion of position service. Lu Jiajia and Ji Chen (2008) argued that, security and privacy are primary issues based on the development of position information service [6]; Bedford, etc. (2005) mentioned the position correlation of the mobile business in the empirical research of usage intention and use behavior in mobile commerce technology, and thought the development of mobile data technology enhances the ability of mobile agents to collect users' personal information and to access preference data [7]. The easier it is to collect the privacy information, the more likely they are to be abused.

For the relationship between perceived risks and usage/purchase intention, Garretson & Clow (1999) pointed out that in the consumers' purchase decision process, consumers will perceive all kinds of risks [8]. When the risk is significant, it will influence the consumers' intention to buy. That is to say, the greater the perceived risk is, the smaller is the consumers' purchase intention. Consumers are likely to generate perceived

risks when a new product or service is introduced in early stage. Bahli & Benslimane (2004) argue that, in mobile communication environment, consumers can feel higher risk, because who will be responsible for the loss is always not clear in such an environment led by technology [9]. Newe11 ~ Lem0n (200l) pointed out that the spread of mobile transaction service mainly depends on the perceived risks of consumers [10].

To sum up, the consumers' perceived risks have important influence on using a new product or service. However, most current studies have not yet fully grasped how perceived risks affect consumers' purchase decision-making behavior about innovative products or services. And in the researches about the perceived innovative products of customers, the research objects mostly focus on physical goods instead of service products, perceived risks have not been endowed with an important role. In this paper, we will introduce perceived risks into the research about usage intention of LBS, look for main perceived risks, confirm the constitution of perceived risks of LBS users, and separately inspect the influence of the perceived risks on usage intention of consumers. The results have great significance in theory and practice.

3. RESEARCH MODEL AND HYPOTHESIS

Based on existing research results of perceived risks and the specific characteristics of LBS, this paper choose the mainly five kinds of perceived risks in LBS users to research. They are perceived risks on the service system, perceived risks on business behavior, perceived risks on the product, perceived risks on the consumer's own and perceived financial risks. In addition, studies have shown that, people who have different age, gender, social status have different level of risk perception and the effect of perceived risks on their usage intention is also different, the influence of perceived risks on usage intention of LBS is undoubtedly regulated by some factors. Previous researches pointed out that the more experience the users have, the more vulnerable they will be affected by functional expectations and expressive expectations, because they are more familiar with application, they don't want to believe a new business, therefore in this article we select users' experience of LBS to study whether it will impact the effect of perceived risks on usage intention. Based on this, we establish the research model of the effect of LBS users' perceived risks on usage intention, as shown in figure 1.
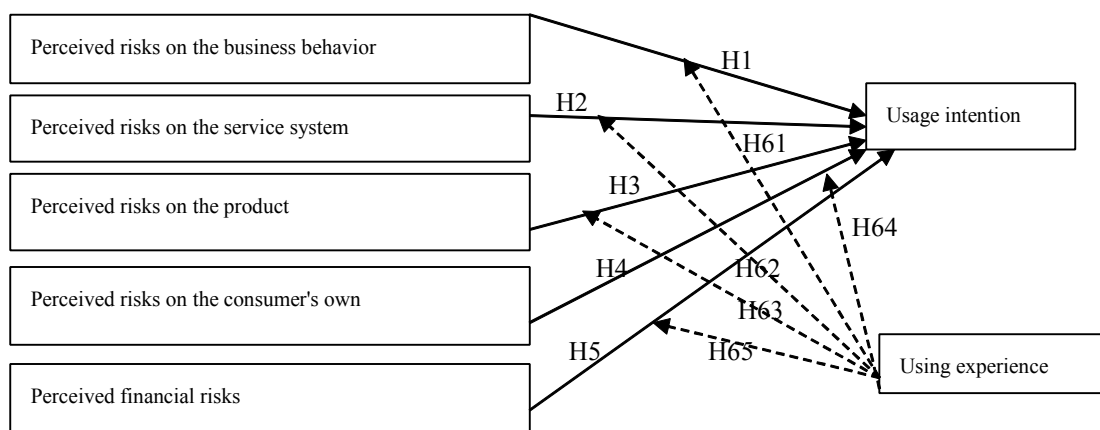
Figure1.   The research model of the effect of LBS users' perceived risks on usage intention

This research model has five independent variables, their meanings are as follows: perceived service business risks refer to the perception of risks which users create because they don't trust behavior of LBS merchants, including the traditional concept of the perceived privacy risks, the perceived service risks and the perceived spam risks, the variable is named SJPR, by eight items to measure. Perceived service system risks refer to the perception of risks the users create when they mistrust LBS system, including the system equipment

operation or time loss risk brought by system delay, as well as the perceived technology risk measured by maturity and skilled degree of using the service system technology, the variable is named XTPR, composed of six items to measure. Perceived service product risks are the perception of risks users create because they distrust the services' quality and function, including the concerns resulted from the discrepancy between LBS performance and users' expectations. And users can't know exactly the specific content, form, inner quality and function of the LBS. The variable is named CPPR, by four items to measure. Perceived risks on the consumer's own refer to the perception of risks the users create because they worry that using LBS may cause physical injury. For instance, if time positioning mobile phones have great radiation, it may cause potential harm to consumers; dependence on mobile phones and mobile network may also bring other potential side effect, the variable is named YHPR, by three items to measure. Perceived financial risks refer to the perception of risks that users create because they fear monetary losses resulted from using LBS. Financial risks may be related with the price, such as whether the service price is reasonable or transparent, etc., the variable is named CWPR, by three items to measure.

Use intention as the dependent variable is named WILL by four items to measure, which means the possibility consumers think that they will use LBS in the future when the price is acceptable.

Use experience as moderating variable is named EXP, which means individual experience of using LBS, including having experience and no experience.

Referring to existing research conclusion, this paper argues that LBS consumers' perceived risks have reverse effect on usage intention according to the research model in figure 1. Verify the correctness of the model through testing the following hypotheses.

H1: LBS users' perceived risks on service business behavior have reverse effect on usage intention.

H2: LBS users' perceived risks on the service system have reverse effect on usage intention.

H3: LBS users' perceived risks on the product have reverse effect on usage intention.

H4: LBS users' perceived risks on the consumer's own have reverse effect on usage intention.

H5: LBS users' perceived financial risks have reverse effect on usage intention.

Based on the previous related research conclusion and limited by the research object and sampling condition, we think consumers' experience of adopting LBS has very important regulating effect, so we put forward the following hypothesis.

H6: if users have LBS experience, the influence of perceived risks on accepting this service is bigger than those having no experience.

H61: if users have LBS experience, the influence of perceived service businesses risks on accepting this service is bigger than those having no experience.

H62: if users have LBS experience, the influence of perceived service system risks on accepting this service is bigger than those having no experience.

H63: if users have LBS experience, the influence of perceived product risks on accepting this service is bigger than those having no experience.

H64: if users have LBS experience, the influence of perceived consumers' own risks on accepting this service is bigger than those having no experience.

H65: if users have LBS experience, the influence of perceived financial risks on accepting this service is bigger than those having no experience.

4. DATA ANALYSIS

This research questionnaire is based on the model in table1, all the core variables are used seven-liker-scale to measure items, in addition to regulating variable, data collection are mainly through the online questionnaire

survey. Business groups, sales groups and the enterprise staffs in the MSN and QQ are our investigation objects. We got 278 usable questionnaires and the response rate was 90.55%. In the sample, women accounted for 28.3% and the men were 71.7%; the users whose age are between 20 and 40 accounted for the majority, of which the users between 21 and 30 accounted for 91.3%, and the users between 31 and 40 accounted for 2.9%; the users having bachelor degree or above are the majority, they accounted for 64.1%; users with LBS experience accounted for 54.3% and the proportion of users with no use experience was 45.7%.

4.1 The reliability and validity

First, we analyzed the reliability and validity of the questionnaire data, the results are shown in table 1. From the data analysis results, all variables' Cronbach's α is higher than 0.8. It shows that, the study scale has high internal consistency reliability. The standardization loading coefficient of each variable in the item mostly is higher than 0.7, although the values of SJPR4, SJPR5, XPPR2 and XTPR6 are slightly lower than 0.7. It's acceptable because the difference is negligible. At the same time, the Average Variance Extracted (AVE) of all variables is greater than critical value of 0.5. The data analysis results showed that each variable has good convergent validity.

Table1. Analysis the reliability and validity of the model

Variables	Item code	The value of	The value of Cronbach's α	The value
Perceived risks on service business behavior	SJPR1	0.767***	0.947	0.5733
	SJPR2	0.724***		
	SJPR3	0.800***		
	SJPR4	0.610***		
	SJPR5	0.522***		
	SJPR6	0.848***		
	SJPR7	0.859***		
	SJPR8	0.856***		
Perceived risks on the service system	XTPR1	0.888***	0.904	0.624
	XTPR2	0.680***		
	XTPR3	0.820***		
	XTPR4	0.759***		
	XTPR5	0.875***		
	XTPR6	0.692***		
Perceived risks on the product	CPPR1	0.764***	0.963	0.7174
	CPPR2	0.880***		
	CPPR3	0.846***		
	CPPR4	0.892***		
Perceived risks on the consumer's own	YHPR1	0.714***	0.811	0.6183
	YHPR2	0.810***		
	YHPR3	0.830***		
Perceived financial risks	CWPR1	0.709***	0.920	0.556
	CWPR2	0.741***		
	CWPR3	0.785***		
Use intention	WILL1	0.922***	0.959	0.8904
	WILL2	0.960***		
	WILL3	0.953***		
	WILL4	0.939***		

Note：***means P<0.001

4.2 Model test

We used structural equation model to process and analyze the research model of influence of perceived risks on usage intention. We calculated path standardized regression coefficients and significant coefficients between variables and verified the relationships between the variables and significance of the related research hypothesis and constructed the final path relationship diagram through the software. After analyzing evaluation indicators, such as the goodness of fit and comparative fit in Lisrel, we found the fitting is good.

In addition, using T-value to test the significance of the relationships between the variables is common in the structural equation model. It is generally thought that if the absolute value of T-value is greater than 1.96, it's significant, otherwise it is not significant. The testing results of T-value revealed in generated path diagram in the Lisrel software are shown in table 2.

Table2．　The testing results of the model

Hypothesized relationship of variables	Regression coefficient	T-value	significance
Perceived risks on the product have reverse effect on usage intention	-0.47	7.03	significant
Perceived risks on the consumer's own have reverse effect on usage intention	-0.10	1.62	Not significant
Perceived risks on the service system have reverse effect on usage intention	0.06	1.12	Not significant
Perceived risks on service business have reverse effect on usage intention	-0.20	2.77	significant significant
Perceived financial risks have reverse effect on usage intention	-0.16	2.27	significant

From the results in Table 2, the T-value of the path of the influence of perceived service system risks on usage intention is minimum with the value 1.12, followed by the path of the influence of perceived consumer own risks on usage intention with the value 1.62, they are both less than 1.96, so we deleted the two non-significant paths and got the revised model after operating again. The output results of testing data are shown in table 3.

Table3．　The testing results of regulating model

Regulating relationship of variables	Regression coefficient	T-value	significance
Perceived risks on the product have reverse effect on usage intention	-0.20	3.04	significant
Perceived risks on service business have reverse effect on usage intention	-0.37	5.70	significant
perceived financial risks have reverse effect on usage intention	-0.31	4.45	significant

According to results shown in table 3, T-values of paths of the adjustment model are all greater than 2, so they are more significant. The effect of different perceived risks on usage intention of LBS can be seen from regression coefficients between variables. We ranked all the factors according to their effect on consumers' intention to use LBS, and the order is: the perceived service business risk (-0.37), the perceived financial risk (-0.31), the perceived service product risk (-0.20). After analyzing evaluation indicators of the revised model

again, such as the goodness of fit and comparative fit in Lisrel, we found the fitting is also good.

4.3 Regulated variable

In order to compare the models' differences of the influence of the users' perceived risks on usage intention between the users with experience and those with no experience, this paper investigated regulation effect of using experience, the users in sample are divided into two groups ,one group with LBS experience and the other with no LBS experience. We analyzed user data of two groups through the Lisrel software respectively and got path diagrams of the two models. Comparing models of two sample groups with different experience, the two models and the overall sample model do not have very big difference.

But from the difference of path coefficients, whether users have experience or not made the influence of the perceived risks on usage intention different. First of all, the influence coefficient of the perceived financial risks on usage intention of users with no experience is 0.15, while the influence coefficient of users with experience is 0.26, indicating that experienced users pay more attention to financial risks than those without using experience. Second, the influence coefficient of perceived service product risks on the usage intention of users with no experience is 0.37, significantly greater than the corresponding coefficient 0.21 of experienced users, showed the usage intention of users with no experience are more vulnerable to be influenced by perceived service product risks. Finally, in the path of the influence of perceived service businesses risks on usage intention, the two samples both have greater influence coefficient, they are 0.49 and 0.42, respectively, that's to say, no matter whether the users have using experience or not, the influence of perceived risks from all kinds of business bad behaviors on usage intention is the biggest.

5.   THE RESULTS OF THE STUDY AND MARKETING ADVICE

5.1 Research conclusion

Based on the previous researches, this paper established the model of the influence of perceived risks on usage intention. Though online questionnaire survey, data collection and Structural equation modeling analysis, the hypotheses have been proven. The results are shown in table 4.

Table 4.   The final results

Hypotheses	Whether it is verified
H1	yes
H2	no
H3	yes
H4	no
H5	yes

As table 4 shows, H1, H3 and H5 are verified, which shows that the perceived service business risks, the perceived service products risks and the perceived financial risks have a reverse effect on users' intention of using LBS. We ranked the three significant factors involved in this model according to their effect on the users' intention of using LBS, the order is: the perceived service business risks, the perceived financial risks and the perceived service products risks. All the effect is obvious.

However, H2 and H4 are not verified, which shows the effect of perceived service system risks and perceived users' own risks on users' intention of using LBS is not significant. Although consumers pay a certain degree of attention to the time loss brought by the service system, the technical problems which may exist and the physical injury resulted from using LBS; the two perceived risks don't make significant hinder to users' intention of using LBS. The risks factors which influence the users' intention to adopt LBS most are the

perception of economic losses and the distrust of product performance and business behaviors.

In addition, this research also examined the regulating effect of use experience. The results show that whether users have experience or not makes the influence of the perceived risks on usage intention different. Experienced users pay more attention to financial risks than those without using experience, and the effect of the perceived product risks is weakened. No matter whether the user has using experience, the influence of perceived risks from all kinds of business bad behavior on usage intention is the biggest.

5.2 Marketing suggestions

5.2.1 Regularize business behavior

In order to decrease the consumers' perceived risks on sellers and increase the intention to use LBS, the sellers can declare to abide by the rules, give promise, or give sincere services and so on, and then develop new customers and maintain relationships with old customers on basis of earning the trust of a great number of consumers.

5.2.2 Enrich product performance, highlight product differentiation

Customers' trust on the information service products comes from the high quality of the service products, which needs the joint efforts of operators and service providers. In addition to continuously provide preferential and reasonable profit distribution plan and the sincere cooperation pattern, operators should strengthen the communication and cooperation with service or content providers. They should bring LBS users with application of higher quality in order to consolidate the trust of users and usage intention. They can regulate the service content and the price, and design more perfect marketing channel and promotion plan according to the different segmentation consumers.

5.2.3 Definite price policy, reduce the financial cost of using the mobile LBS

Economic cost refers to the terminal cost, service fees, and the perceived cost in consumer's mind. Operators should reduce the price in order to attract more consumers to try this service and develop the user's consumption customs when they promote the LBS. In order to properly determine the terminal price and reduce hardware threshold for consumers using LBS, operators can strengthen the terminal control and regulate terminal standard, function and channel based on different market segments. This can reduce users' perceived financial risks and improve their perceived economy.

5.2.4 Strengthen experiential marketing, pay attention to word-of-mouth publicity

With the continuous promotion of concept of experience in the telecommunications service industry, its influence on consumers is growing. LBS as a new product of high-tech, the most important thing is to bring users personal experience. In order to attract the user's attention and interest, operators can widely set the function allowing users to try the LBS for free by launching new terminal products and new package service products, which users can experience pleasure and convenience bought by the service. Mobile agents can improve customer experience through the convenient operation and diversified function at the same time. In this process, operators will pay attention to how to guide customers' reputation, which can make the promotion effect better.

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