

Analysis of Factors Influencing Consumer Behavior of Mobile Commerce based on Factor Analysis

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Abstract—The research on the influencing factors of mobile commerce consumer behavior is beneficial for the mobile commerce platform to provide better services for consumers. This paper uses factor Analysis to analyze and correct the influencing factors of mobile commerce consumer behavior, and obtain the index system of influencing factors with weight. According to the analysis results, it concludes the high efficiency, risk and commodity characteristics of mobile commerce, which has important influences on the consumption behavior of mobile commerce. Based on the contribution of secondary indicators, the paper puts forward suggestions for the improvement and perfection of mobile commerce platform.

Keywords—*Mobile Commerce; Consumer Behavior; Factor Analysis; Influence Factors*

I INTRODUCTION

According to the 41th *China Internet network development state statistical report* issued by CNNIC (China Internet Network Information Center) on January 31, 2018, till December 2017, China's Internet users plan to reach 772 million, of which 753 million are mobile phone users, mobile phone users is up to 97.5%, desktop computers, notebook computers and tablet computers have declined in usage. With the increase of mobile Internet users and the popularization of e-commerce mobile APP, until December 2017, the scale of online shopping users in China is 533 million, among which the mobile online shopping is 506 million, accounting for 94.9% of online shopping. With the popularization of mobile network and e-commerce mobile phone APP, mobile commerce consumption has become the main force of consumer shopping. By analyzing the influencing factors of consumer behavior of mobile commerce, mobile commerce platform can deeply understand the characteristics and behavior of users and grasp consumer demand more accurately. Therefore, the platform can serve customers better and improve enterprises competitiveness.

II EXISTING RESEARCH ON MOBILE COMMERCE

CONSUMPTION BEHAVIOR

At present, there are many researches on consumption behavior in China, but there are fewer researches on mobile commerce consumption compared with the rapid development of mobile commerce. Through searching on the topic of "consumption behavior" in CNKI, it shows that about 2,000 related research papers are published annually from 2011 to 2017. The research focuses on the relationship between

consumption behavior and urban residents, rural residents' identity, consumer's commodity category and other aspects. In CNKI, by searching the topic of "mobile commerce, mobile e-commerce", about 300 relevant research papers are published annually from 2011 to 2017. However, as for the subject of "mobile commerce consumption, mobile e-commerce consumption", there are 17 articles in 2011-2017, about 2.4 articles per year. From the perspective of data, there is a large gap between the research intensity on the consumption behavior of mobile commerce and the development speed of mobile commerce consumption, so the research intensity should be strengthened urgently.

Some scholars have conducted research from the aspects of mobile commerce consumption purchasing behavior, mobile commerce consumption satisfaction, credibility and so on. Liao Weihong (2016) analyzed the factors influencing decision-making of mobile commerce consumers' purchasing behavior, and pointed out that the network quality, stability and reliability of the wireless network system services, the promotional efforts of businesses and the impact of group and the personality characteristics of consumers' daring to innovate had positive significant effects on decision-making of purchase behavior [1]. Luo Hanyang (2016) constructed a three-stage dynamic model of consumer trust evolution from the three stages: pre-purchase preparation and post-purchase interaction and relationship commitment, and proposed that consumers' satisfaction and loyalty have a greater impact on credibility. Based on the static and dynamic perspectives of mobile commerce user satisfaction [2], Xu Chaoyi (2017) carried out a comprehensive analysis, and proposed that the user satisfaction of mobile commerce is to follow the main line of specific transaction satisfaction, cumulative satisfaction and relationship satisfaction, which constantly extends [3]. Dai Fang (2018) studied the influence of commodity, service, risk, software, social and cost factor on consumer behavior by establishing the structural equation model of influencing factors of mobile e-commerce behavior [4]. Song Lei (2015) constructed a C2C mobile e-commerce model through the structural equation, and made a directional analysis. He believed that buyer's online shopping experience, seller's reputation, mobile terminal level, mobile client technology, wireless network technology, website reputation and website management system had a positive impact on the buyers' information [5].

On the basis of studying the research results of mobile

Fund project: Humanities and Social Sciences Research Project of Hubei Provincial Education Department (Project No: 17G092); Youth Fund Project of Humanities and Social Sciences Research of the Ministry of Education (Project No: 17YJCZH185)

commerce consumption behavior, this paper takes core consumers of mobile e-commerce as the research object, adopts factor analysis method to study the three aspects of mobile commerce: usefulness, convenience and risk of mobile commerce consumers. He analyzes the important factors affecting mobile business consumers via questionnaire and finds out the indicators affecting mobile business consumer behavior of mobile commerce.

III QUESTIONNAIRE AND DATA PROCESSING

A. The questionnaire design

According to the research purpose, research team design the questionnaire, "mobile commerce consumer behavior influence factor", which focus on understanding the influential factors and changing trend of consumption behavior of the main groups of mobile commerce consumers in China during the process of mobile business consumption.

TABLE I. QUESTIONNAIRE INDEX DESIGN

No.	Primary Targets	The Secondary Indicators
1	The Usefulness of Mobile Commerce	Commodity Price Advantages
		Comprehensive of Product Information
		Authenticity of commodity Information
		Convenience of Transaction Payment
		Business Service Quality
		Timely Merchants Communicate
		Efficiency of Shopping
		Maturity of Consumption Platform
		Validity of Shopping information
		Timeliness of Shopping information Push
2	The Convenience of Mobile Commerce	Convenience of Operation
		Convenience of Learning
		Convenience of Shopping
3	The Risk of Mobile Commerce	Security of Funds
		Security of Personal Information
		Overall Risk of Shopping

B. Data source and processing

This questionnaire survey was conducted online, and the respondents were the main users of mobile business consumption. Totally 400 questionnaires were issued and 353 questionnaires were collected, among which 305 were valid. Basic statistics of the questionnaire collection: from the perspective of age distribution, the objects of this study are mainly concentrated in 18-25 years old, accounting for 55.52% of the total sample, followed by 25-35, accounting for 42.86% of the total sample and the other accounted for 1.62%. From the perspective of educational structure, it mainly concentrated on junior college and undergraduate education, accounting for 91.56% of the total sample, 3.9% of the total graduate education or above, and 4.55% of the other academic qualifications.

C. Data validation

1) Data reliability test

The questionnaire content includes two parts: mobile commerce consumers' basic information, the influential factors of mobile commerce consumption behavior. The basic information of consumers is mainly set up by single-choice and multiple-choice combination from the aspects of age, educational background structure, disposable funds, mobile business consumption platform and so on. The influencing factors of mobile commerce consumption behavior are mainly analyzed from the three aspects of usefulness, convenience and risk compared with the consumption on the computer. For the influence factors of mobile commerce consumer behavior, this paper uses Likert scale method [6]: each measurement is divided into 5 levels, for which each level given different scoring record for 1, 2, 3, 4, 5 points. For the corresponding respondents attitude to the project are divided into strongly disagree, disagree, generally, agree, very agree, specific scale situation as shown in table 1.

Reliability is to examine whether there is a high degree of internal consistency between projects. This paper adopts Alhpa reliability coefficient method to test the reliability via SPSS software. The overall reliability of the 16 variables included in the questionnaire is tested and the test results are shown in Table 2. The Cronbach α of the survey data was 0.915, indicating high reliability, indicating the ideal internal consistency of the questionnaire.

TABLE II. RELIABILITY STATISTICS

Cronbach's α	Cronbach's α based on standardized terms	Number of terms
.915	.913	16

2) Data validation

The validity degree reflects the authenticity degree of the concept to be measured, which mainly includes content validity and structure validity [7]. In this paper, KMO sample measure and Bartlett spherical test are used for valid sample

data, and the data obtained is shown in table 3. The value of KMO statistic is between zero and one. The larger KMO value is, the more suitable the data is suitable for factor analysis. In general, KMO is greater than 0.7, which means it is suitable for factor analysis. It can be seen from table 2 that KMO is 0.899 and Bartlett test P is 0, indicating that the correlation between variables is strong, the validity of this questionnaire is acceptable, and it is suitable for factor analysis.

TABLE III. KMO and Bartlett tests

Kaiser Meyer-Olkin metric to sample enough		.899
Bartlett's Test of Sphericity	The approximate chi-square	3091.230
	DF	120
	Sig.	.000

D. Factor analysis of influencing factors of mobile commerce consumer behavior

Factor analysis is a kind of data simplification technology. It is a multivariate statistical method, which uses the thinking of reduction to study the internal dependence of the original variable correlation matrix, and to classify the multivariate variables into a few independent comprehensive indicators, which contains most of the information of the original variables. The advantage of factor analysis is that it is not affected by subjective factors and the factors obtained are independent of each other, which can better reduce the cross

TABLE IV. TOTAL VARIANCE DECOMPOSITION

Ingredients	Initial Eigenvalue			Extract Sum of Squares and Load		
	Total	The variance %	Accumulate %	Total	The variance%	Accumulate %
1	7.076	44.222	44.222	7.076	44.222	44.222
2	2.150	13.435	57.657	2.150	13.435	57.657
3	1.720	10.749	68.406	1.720	10.749	68.406
4	1.575	4.845	73.251	1.575	4.845	73.251

In order to represent the modified variable factor structure clearly, this paper adopts the rotation component matrix to adjust the factor structure, and the rotated component matrix is shown in Table 5

By analyzing modified 16 factors, 3 variables by reliability analysis, the analysis of credibility contributes to 4 factors with characteristic roots greater than 1. The influencing factors of mobile commerce consumer behavior in this research are modified to four kinds of factors. Observing the corresponding factors reflected by each factor, we could find that the secondary index system has not changed in the process of revising the index system. However, the factors with different degrees of influence in the original index are separated and reorganized and the primary index is from the initial three indicators into four.

According to the combination of experience and mathematics, the factor load matrix is rotated orthogonally to maximize the variance of the factor load matrix and the rotated factor load matrix is obtained, which reflects the

of information [8]. At the same time, it preserves the original variables and reconstructs the data according to the information contained in the original variables include simplifying the data, making the factor variables with higher interpretability, so that the results of the analysis and evaluation more objective. This paper adopts factor analysis method to analyze the 16 variables at the beginning of the questionnaire, tests the index system initially constructed in the questionnaire design, and makes in-depth analysis.

1) Correction of the Indicator System

In the KMO value and Bartlett spherical test of sample, the closer the KMO value is to one, the stronger the correlation between the variables, and the more suitable for factor analysis. According to the data obtained in the validity test above, the KMO value can be known as 0.899. The KMO value of this survey is close to one and the P value of spherical test is zero. The null hypothesis reject to be zero, indicating that this questionnaire data is suitable for factor analysis.

Through using matrix in SPSS software, the non-negative eigenvalues are obtained and the calculation results show that the former four factors of variable characteristic value is greater than one [9]. At the same time, the cumulative variance contribution rate reached 73.251% via the variance of the maximum rotation, indicating the former four factors variables containing enough information that can be expressed by the 16 evaluation indexes of the original data.

relationship between common factors and each variable. The extracted factor is named according to the factor load. The first-level indicators of the new system are renamed as efficiency of mobile commerce, risk of mobile commerce, commodity characteristics of mobile commerce, service quality of mobile commerce platform and merchant respectively, thus completing the construction of the index system of factors affecting mobile commerce consumer behavior, as shown in Table 6. The scoring function of each single factor (I =1, 2, 3, 4) was obtained by using Regression Analysis Prediction Method, and the proportion of variance of each factor to the cumulative variance was used as the weight to obtain the scoring formula of comprehensive factor:

$$F = 0.4422F_1 + 0.1344F_2 + 0.1075F_3 + 0.04845F_4$$

2) Analysis of Indicator System

The new indicator system of factors affecting consumer behavior of mobile commerce is divided into two levels. The criterion layer includes four primary indicators and the indicator layer includes 16 secondary indicators. The

classification of secondary indicators has changed to a certain extent in the process of index correction. In addition, some indicators have been recombined to reflect the influence and importance of various factors on mobile business consumption behavior.

TABLE V. Rotational component matrix

	Ingredients			
	1	2	3	4
Convenience of Operation	.867			
Convenience of Shopping	.860			
Convenience of Learning	.796			
Timeliness of Shopping Information Push	.763			
Shopping Information Validity	.733			
The Efficiency of Shopping	.730			
Transaction Payment Convenience	.726			
Security of Personal Information		.900		
Overall Risk of Shopping		.868		
Security of Funds		.831		
Commodity Information Comprehensiveness			.820	
Commodity Price Advantage			.761	
Authenticity of Commodity Information			.745	
Business Communication Timeliness				.761
Business Service Quality				.681
Consumption Platform Maturity				.503

2) *Analysis of Indicator System*

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From the perspective of the indicator system, by comparing the modified index system with the original index system designed in the questionnaire, it can be found that after the revision of the indicator system, the mobile business risk index of the original indicator system has not change, while the useful index system of the original mobile business is split. Among them, the secondary indicators related to mobile commerce platform, merchants and commodities are separated from the first-level indicators of usefulness, forming new indicators. Other useful indicators and convenience indicators of mobile commerce are merged into the high efficiency of mobile commerce. From the perspective of factor weight, the weight of the service quality of mobile business platforms and merchants is less than 0.1, of which the impact is small. This indicates that mobile business

consumers are satisfied with the maturity of the platform, the timeliness of merchants' communication and the service quality in the consumption process, which has little impact on the consumption behavior of mobile business.

Therefore, three important indicators of consumer behavior of mobile commerce are summarized: the high efficiency of mobile commerce, the risk of mobile commerce, and the commodity characteristic of mobile commerce. In the preliminary design of influencing factors of consumers behavior of mobile commerce, the importance and specific weight of the first-level and second-level indicators are not sorting and comparison. The shortcomings are corrected and perfected by analyzing the survey data and the weights of affecting factors are determined by the variance contribution ratio of the common factor. Their important ranking is embodied in the index weights in Table 6. The factor analysis shows that the secondary classification of variables is basically reasonable, and the classification of some primary indicators needs further subdivision.

According to the analysis results, among the four principal components, the first one has the largest impact on mobile commerce consumers, accounting for 60.36% of the total. In the first principal component, more factors are extracted, including convenience of mobile commerce platform operation, convenience of shopping, convenience of learning, timely push-shopping information, effective information of shopping is pushed, efficiency of shopping and convenience of transaction and payment convenience. It shows that mobile commerce consumers will pay great attention to the design of mobile commerce platform with humanization and convenience. Mobile commerce platform can push timely useful shopping information according to personal shopping features to improve shopping efficiency. At the same time, we will also consider whether the way of mobile commerce payment conforms to personal usage habits. It shows that current mobile commerce consumers have high expectations to meet personalized, efficient and convenient consumption behaviors. The proportion of the second principal component is 18.35%, which is not high compared with the proportion of the first principal component, but ranks the second among the four principal components, indicating that the risk management of mobile commerce platform has a great impact on mobile commerce consumers. It can be seen from the ranking of secondary indicators that mobile business consumers attach the highest importance to personal information security. The proportion of the third principal component is 14.68%, indicating that mobile commerce consumers consider the impact of the comprehensive information, authenticity and price advantage of the commodity of the consumption platform when choosing the consumption platform.

TABLE VI. CORRECTION INDEX SYSTEM OF FACTORS INFLUENCING CONSUMER BEHAVIOR OF MOBILE COMMERCE

Target Layer	Criteria layer(Primary Indicators)	Indicator Level (Level 2)	The Factor Weights
Indicator System of Influencing Factors of Mobile Commerce Consumer Behavior	Efficiency of Mobile Commerce	Convenience of Operation	0.6036
		Convenience of Shopping	
		Convenience of Learning	
		Timeliness of Shopping Information Push	
		Shopping Information Validity	
		The Efficiency of Shopping	
		Transaction Payment Convenience	
	The Risk of Mobile Commerce	Security of Personal Information	0.1835
		Overall Risk of Shopping	
		Security of Funds	
	Commodity Characteristics of Mobile Commerce	Commodity Information Comprehensiveness	0.1468
		Commodity Price Advantage	
		Authenticity of Commodity Information	
	Mobile Commerce Platform and Business Service Quality	Business Communication Timeliness	0.0661
		Business Service Quality	
Consumption Platform Maturity			

IV CONCLUSION AND SUGGESTION

In this paper, through the construction of mobile commerce consumers behavior influencing factors index system, adopting questionnaire survey to investigate the main group of mobile commerce consumption, using factor analysis method to modify the index system of influencing factors. Through comparative analysis, this paper believes that with the quickening pace of life and the universality of mobile commerce consumption, mobile commerce consumers first consider the efficiency and second is security. While consumers do not care too much about the maturity of the platform and the level of business services or basic recognition of the state.

More than 90% of the effective samples collected in this survey are between 18 and 35 years old, which is the core strength of mobile business consumers, which means that the survey results are highly representative. By analyzing the survey data, the following suggestions can be made for the functional development and improvement of mobile commerce platform. First, in the process of development and function improvement, the mobile commerce platform should focus on how to help consumers complete shopping efficiently and quickly. With the acceleration of life festival gathering, the amount of commodity information mobile commerce platform is huge and miscellaneous, and consumers hope to improve shopping efficiency in the process of shopping [10]. Second, mobile commerce platforms strengthen the protection of consumers' personal information and privacy. Mobile commerce consumers pay more and more attention to personal information and privacy security. In the process of mobile commerce, consumers will use personal private information such as mobile phone number, real name, home and work address, etc. Whether the mobile commerce platform can guarantee consumers' information security is an important influencing factor for consumers to choose the platform or merchants when they make mobile commerce

consumption. Thirdly, merchants on mobile commerce platform should describe the commodity information accurately and effectively. According to the data analysis results, accurate and perfect commodity information can effectively help consumers to select products. Due to consumers paying little attention to the maturity of merchant services and platform, consumers prefer to make independent judgment through commodity information in the process of shopping.

With the development of mobile network, mobile terminal and APP market, mobile commerce consumption has become one of the most important way of consumption in daily life. The focus of mobile commerce consumers' consumption has also change greatly. Therefore, the analysis of affecting factors on mobile commerce consumers' consumption behavior can more accurately grasp consumers' consumption habits and preferences, promote the healthy and rapid development of e-commerce industry.

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