

Analysis of the Consumer Preferences toward M-Commerce Applications Based on an Empirical Study

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Abstract

In this paper, new concept of value proposition for m-commerce is set up based on the study on previous value propositions for m-commerce, and clustering a great number of m-commerce applications by 4 sectors.

These 4-sector applications are evaluated by 17 detail propositions. Then these propositions are reorganized structurally by factor analysis, of which result can be used point for drawing perceptual map. This paper identifies the degree of importance in respective propositions through experimental analysis. These experimental analyses are able to hold up objectivity of research methods, and suggest multi-points of view. This result can be used for setting up m-commerce strategy. The implications of this paper are providing diagnostic information to design a new applications or devices. And concretizing value propositions for m-commerce make a operators clear in their decision-making.

1. Introduction

Mobile commerce or M-commerce is the ability to purchase goods anywhere through a wireless Internet-enabled device. Mobile commerce refers to any transaction with monetary value that is conducted via a mobile network. It will allow users to purchase products over the Internet without the use of a PC. These trends create new mobile business model and change e-commerce paradigms. However, many researchers believe in the success of m-commerce. There are little research results how to develop a consumer-oriented m-commerce strategy. If we consider view of commerce, we don't ignore a consumer aspects and effects about m-commerce. Therefore, the purpose of this paper is to explore the

factors to affect the consumers' preference about m-commerce applications or services.

This research is consists of 3 parts for suggesting the consumers' preference. (1) Review the literature survey: Firstly, the literature survey is about the value propositions of m-commerce such as the 4-type classification and the 2-type classification. Second is about the successful applications of m-commerce. (2) Re-classify the value propositions and applications: In this research, it is attempted that simple arrangement on applications. We suggest the new value propositions list that composed 17 factors to analyze the consumer preference. (3) Screening the suitable applications based on consumer perception: There is survey by the consumers who have lots of acknowledge on m-commerce and mobile industry. The survey is to be done for investigating the state of consumers' perception about reclassified value propositions as 17 factors through factor and preference regression analysis.

2. Value Propositions for M-Commerce

Value propositions define the relationship between supplier offerings and consumer purchase by identifying how the supplier fulfills the customer's needs across different consumer roles (Porter, 1998). Specially, it specifies the interdependence between the performances attributes of a product or service and the fulfillment of needs. The value proposition furthermore solidifies the relationship between the consumer and various dimensions of product value. Thus, consumer satisfaction is merely a response to the value proposition offered by a specific product / service bundle. (Timmers, 1998)

2.1. Literature Reviews

The classification of 4 type-value propositions is due to value-for-time to users. When users access Internet through wireless device, users are able to realize additional value allowances for any specified period of time, which fixed-line users will not be able to achieve. Information becomes available anytime, anyplace, and on any device. There are M-commerce value propositions attributes.

Table 1 The 4 Value Propositions for M-commerce

Value propositions	Contents	Service
Ubiquity	The ability to receive information & to transit from any location on real time Offer the accessibility in simultaneously	News Sports Weather
Convenience	The agility & accessibility provided from wireless devices No limitations of time and place	Banking Communications
Localization	Know the location of Internet user Provide the information or service relevant to the geographic position of users	Coupons Customer service
Personalization	Used by a individual Provide the individual-based target marketing Offer the opportunity to personalize messages & contents to segments	Advertising Database

The classification of 2 type-value propositions¹ is constructed in a conceptual research effort based on theoretical reasoning with the objective of identifying the value-adding features of m-commerce. In the framework, a distinction is made between the value offered by the wireless Internet technology in itself; wireless value, and the value emerging from the actual mobile use of a device; mobile value.

Table 2 The 2 Value Propositions for M-commerce

Value propositions	Contents	Service Needs
Wireless Value	The use of any wireless device Irrespective of services Don't support mobility Offer some convenience that is created by wireless services	Access device Wireless convenience Familiarity with device

¹ Summary paper as Value Creation in Mobile Commerce, Bill Ankar, 2002 pp. 47~49

Mobile Value	The value arising from the mobility of the new medium Interfaces and electronic services that support our mobile lifecycle Offer flexibility, ubiquity and convenience	Entertainment needs Spontaneous needs Efficiency ambitions Time-critical arrangement
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2.2. Redefinition Value Propositions for M-commerce

We review the other literature results about the m-commerce value proposition's classifications. However, the results have some limitations. Firstly, the framework constitutes were thus established in a theory formation process in which we did not rely on prior empirical or anecdotal evidence. Secondly, the results are very abstract to adopt the real world. So, we don't use the results to explore the customers' preference in this paper and remake the new classification of value propositions.

This consists of 17 factors and these come from the opinions of general consumers and special lists in m-commerce research. Finally, we use the 17 factors as parameters in this paper's empirical study.

Table 3 17 Factors of Value Proposition for M-commerce

Item	Factors
1	Contents-updating frequency
2	Usefulness of contents
3	User-based interface
4	Compatibility of device
5	Accessibility of network
6	Affordability of price
7	Variety of contents
8	Mobility
9	Familiarity of graphic user interface
10	Vogue and trend of m-commerce
11	Cultural environment
12	Customized and personalized service
13	Security and privacy policy
14	Community
15	Simultaneous multitasking
16	Network reliability
17	Billing system

3. Applications for M-Commerce

3.1. Literature Reviews

In this part, we summarize that the others literature about the successful applications in m-commerce sector. In the case of the wired Internet, e-mail has played a significant role in the rapid increase of Internet service and most analysts are to agree that e-mail will emerge as an initial killer m-application.

The Major applications are Internet access such as weather reports, sports score. (Ghosh, 2001) However, the Yankee Group discovered limited consumer interest in such applications. In other views of the killer applications, there are interactive games, gambling, travel booking, and in dynamic transactions where continued interactivity is essential and useful such as auctions and stock trading. (Muller & Versee, 2000) Mobile applications related to the financial industry are interesting, for instance on-line banking, micro payments in shop and so on. Vittet-Philippe and Navaro (2000) contented that the radical changes in the retail sector, where it will offer many retailers the opportunity for service differentiation.

We list up the successful applications to be offered by many researchers. There are e-mail, banking service, news, stock trading, sports, book cinema tickets, payment and billing, book travel schedule, Internet auctions, communications with other people and so on.

3.2. Redefinition Application for M-Commerce

In this paper, we explore the consumers' preference about the m-commerce applications. So, we need to survey the consumer questionnaire but there are many applications scattered. In this situation, when they respond the questionnaire, consumers as respondents have some troubles because there are so many applications. We suggest the applications groups. The application groups are the bundle of applications that are same service attributes. The next table shows the result of remaking applications in this paper.

Table 4 the 4 application-groups for M-commerce

Applications	Services(example)
Information Applications	News and weather Travel relative service Video conference Scheduling and discounting info Emerging service info
Entertainment Applications	Sports Game and gambling Book, magazine, and music Movie and adult contents

Financial Applications	Stock price and trading Banking and auction Mobile(Micro) payment system Loan and insurance service Online shopping
Management support Applications	Retailing SCM Advertising DB development KMS Remote operation system

4. Empirical Study to Suggest Consumers' Preference for M-commerce

Three goals are pursued by empirical study as followed. Firstly, perceptual dimension of consumer is identified through factor analysis. Secondly, the relative position of each applications is identified through perceptual map. Finally, the weight of attribution is identified through preference regression.

4.1. Expert's Perception per M-commerce Application

Perceptual map² is enabling to understand easily the relative position of each group in m-commerce applications. The perceptual map can be drawn by various method that multidimensional scaling, discriminant analysis, factor analysis etc. In this research, factor analysis is selected for drawing perceptual map, which is going to identify the separate m-commerce applications' position.

Factor analysis is done to seize the situation of separate service in m-commerce applications. Factor analysis has different aspect, according to its option such that ① correlation calculation way, ② factor extraction way, ③ factor number decision way, ④ factor loading computation way, ⑤ factor rotation way.

In this research, the factor analysis is selected that considering its goal:

- Correlation calculation way: R-typed calculation is selected
- Factor extraction way: PCA(Principal Component Analysis) is selected
- Factor number decision way: Scree testing considered the ratio of common variance and total variance
- Factor loading computation way: As eigen value is more than absolutely 0.5, this is regarded as significant variable

² Perceptual map is represented by chart in plane for ease understanding the relative position of respective product or service.

- Factor rotation way: Orthogonal rotating Varimax is selected

The Question lists for factor analysis envelope various aspects of m-commerce applications as market side, industrial side, environmental side, and so on. In conclusion, the question lists are consist of seventeen items including these various aspects, and in the end of question is there an item to ask their preference. Finally this questionnaire has eighteen items. And it is carried out object ETRI researcher 17 persons from Jun. 4th 2006 to Jun.

The ratio of total variance to common variance out of factor analysis result is shown in following table.

Table 5 the result of total and common variance by factor analysis

Component	Initial Eigen-values			Rotation Sums of Squared Loading		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.503	26.488	26.488	3.712	21.836	21.836
2	3.726	21.919	48.408	3.035	17.855	39.691
3	1.183	6.956	55.364	1.802	10.598	50.289
4	1.109	6.524	61.888	1.800	10.586	60.875
5	1.052	6.187	68.075	1.224	7.199	68.075
6	0.819	4.819	72.893			
7	0.739	4.347	77.240			
8	0.680	3.999	81.239			
9	0.657	3.863	85.103			
10	0.509	2.991	88.094			
11	0.442	2.603	90.696			
12	0.365	2.145	92.841			
13	0.316	1.857	94.698			
14	0.304	1.787	96.485			
15	0.252	1.481	97.966			
16	0.195	1.150	99.116			
17	0.150	0.884	100.000			

Extraction Method: Principal Component Analysis.

The ratio of total variance to common variance is 68.075%, which means that there are information loss about 31% by factor analysis reduce seventeen components to five factors. And the test of Scree shows that five factors are making sense that from 6th factors their common variance increase steadily.

So the numbers of factors, in other words perceptual dimension about m-commerce applications, are determined to five, of which result is like following table.

Table 6 Rotated Factor Loading Matrix

Component	Factor				
	1	2	3	4	5
affordability of price	0.804	0.149	0.265	-0.046	-0.050
mobility	0.801	0.319	0.056	-0.134	0.068
customized(personalized) service	-0.786	0.160	-0.212	-0.062	-0.098
simultaneous multitasking	0.780	-0.009	0.199	0.236	-0.124
Billing system	-0.607	-0.016	-0.176	-0.039	-0.114
accessibility of network	0.357	0.667	0.002	-0.027	0.229
vogue and trend of m-commerce	0.326	-0.656	-0.020	-0.282	0.114
cultural environment	0.422	-0.655	-0.032	0.013	0.233
security and privacy policy	0.325	0.629	-0.097	0.148	-0.114
community	0.203	0.599	0.033	0.215	0.099
network reliability	0.051	-0.581	0.148	-0.311	-0.286
user-based interface	0.331	-0.064	0.880	-0.066	0.051
compatibility of device	0.335	-0.024	0.878	0.034	0.068
contents-updating frequency	0.110	0.128	0.030	0.870	0.082
usefulness of contents	0.116	-0.466	0.137	-0.600	-0.228
variety of contents	0.115	0.470	0.028	0.588	-0.300
familiarity of graphic user interface	0.079	0.170	0.115	0.069	0.894

Extraction Method: Principal Component Analysis.

According to the result of factor analysis, seventeen variables are reduced to five factors, which have about 69% explanation power. And the implication of five factors, about which naming is like following.

Factor 1 : 'main users needs' factor

Factor 2 : 'external condition and infra' factor

Factor 3 : 'convenience of equipment' factor

Factor 4 and 5 : 'abundance of contents' factor

4.2. Ideal Vector through Preference Regression Analysis

Perceptual map can be drawn by the prior analysis results, which play a role as axis in perceptual map. The dimension in perceptual map can be obtained by on the average factor score in separate m-commerce applications. And the number of axis in perceptual map can be maximum four, equal to the number of factor four, so what can be expressed in 2-dimentional plane is maximum six(4C2). Hereof all four factors cannot be the axis in perceptual map, so these are to be tested statistical significance or not through preference regression. At last the proportion of regression coefficients can drive ideal vector.

Hereinafter the result of regression analysis is shown. The preference regression model is set as dependent variable is preference to each m-commerce applications, and independent variables are factor scores by factor analysis.

Table 7 the result of ANOVA in regression model

	Sum of Squares	d.f	Mean Square	F	Sig.
Regression	68.282	4	17.070	19.975	0
Residual	142.718	167	0.855		
Total	211	171			

The table of ANOVA result shows that preference regression model is statistically significant, for its F-test statistics value is 19.975, which has 0% significance. Therefore Sig. F=0<0.05, this preference regression model make sense within the 5% confident level.

The following table show that the result of testing on each coefficient in preference regression model.

Table 8 the result of coefficient in regression model

	Un standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.500	0.070		35.467	0.000
Factor score 1'	0.572	0.071	0.515	8.096	0.000
Factor score 2'	0.181	0.071	0.198	2.544	0.034
Factor score 3'	0.258	0.071	0.232	3.648	0.000
Factor score 4	-0.069	0.071	-0.062	-0.977	0.330

* . Statistically significant variable within 5% confident level

According to the testing result on statistical significance of coefficient in preference regression

model, 1st-2nd-3rd factor is all statistically significant within 5% confident level except 4th factor. The sig. $F=0.330>0.05$ of which make 4th factor is not statistically significant. As a result that only three of four, main users need, external condition and infra, convenience of equipment, are accepted to the axis in perceptual map. These three axes can make three perceptual map on the 2-dimension plane. That is to say, the combination of 1st-2nd factor, 2nd-3rd factor, and 1st-3rd factor can make perceptual map.

The dimension and ideal vector is identified by what is described as before, and these are summarized as like following table.

Table 9 the dimension of perceptual map in M-commerce

Dimension of perceptual map	Coordinate in perceptual map		
	Factor 1 main users needs	Factor 2 : external condition and infra	Factor 3 : convenience of equipment
m-commerce application			
Sector1 : information app.	-0.412	0.834	-0.303
Sector2 : entertainment app.	-0.389	-0.095	-0.145
Sector3 : financial app.	0.090	-0.403	0.235
Sector4 : management support app.	0.607	-0.436	0.245
Ideal vector slope	0.572	0.181	0.258

4.3. M-Commerce Application Perceptual Map

Hereinafter perceptual map is drawn through the factor analysis, in which there are separate axis of m-commerce applications and ideal vector. In the end, there are 3-perceptual map through the combination of each axis.

4.3.1. Perceptual Map I: Main User Needs + External Condition and Infra

The 1st perceptual map is same as below figure, which is based on <Table 9>. The axis of this perceptual map consists of 'main user needs' and 'external condition and infra', which can be expressed in 2-dimentional plane. The ideal vector in perceptual map is near to horizontal axis, which is exactly 0.32 by the portion of 'main user needs' and 'external condition and infra'. ($0.32=0.181/0.572$).

In the 1st perceptual map, ideal vector is nearer to 'main user needs' than 'external condition and infra'. What the slope of ideal vector means is relative gravity in m-commerce applications. In other words, when 'main user needs' is supposed to be 1 in its gravity, the gravity of Present Marketability is 0.32. And 1st perceptual map has two group, one is composed of sector 1-2 in m-commerce applications, the other is composed of sector 3-4 in m-commerce. The sectors in same group can be regarding as similar characteristics each other.

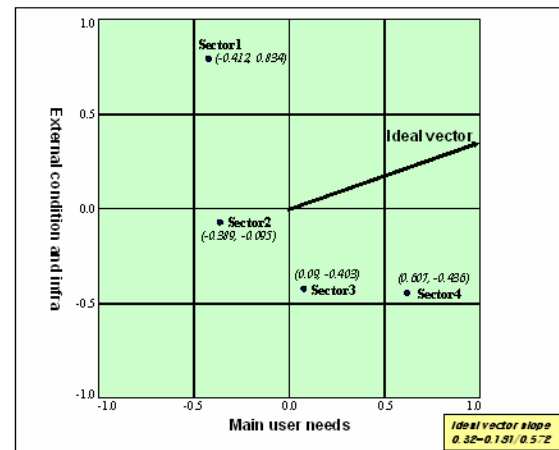


Figure 1 the 1st perceptual map

4.3.2. Perceptual Map II: Main User Needs + Convenience of Equipment

The axis of this perceptual map consists of 'main user needs' and 'convenience of equipment', which can be drawn in 2-dimentional plane. The ideal vector in perceptual map is near to horizontal axis, which is exactly 0.45 by the portion of 'main user needs' and 'convenience of equipment' ($0.45=0.258/0.572$).

The 2nd perceptual map is same as below figure, which can be drawn by the same method in 1st perceptual map.

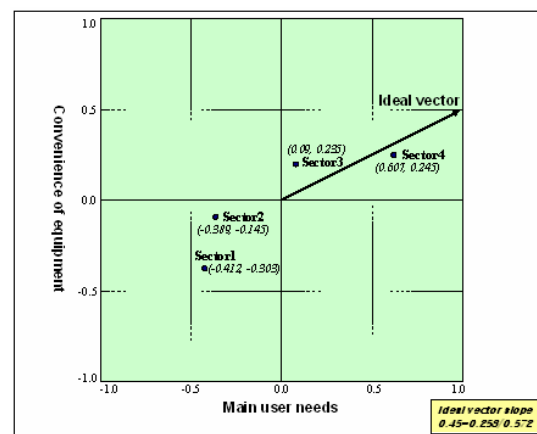


Figure 2 the 2nd perceptual map

In the 2nd perceptual map, ideal vector is nearer to 'main user needs' than 'convenience of equipment'. So the 'main user needs' is more important than 'convenience of equipment', and when 'main user needs' is supposed to be 1 in its gravity, the gravity of 'convenience of equipment' is 0.45. Similarly to 1st perceptual map, 2nd perceptual map has two group, one is composed of sector 1-2 in m-commerce

applications, the other is composed of sector 3-4 in m-commerce applications.

4.3.3. Perceptual Map III: External Condition and Infra + Convenience of Equipment

The axis of this perceptual map consists of 'external condition and infra' and 'convenience of equipment'. The ideal vector of perceptual map is near to vertical axis, which is exactly 1.43 by the portion of 'convenience of equipment' and 'external condition and infra' ($0.45=0.258/0.572$). The 2nd perceptual map is same as below figure.

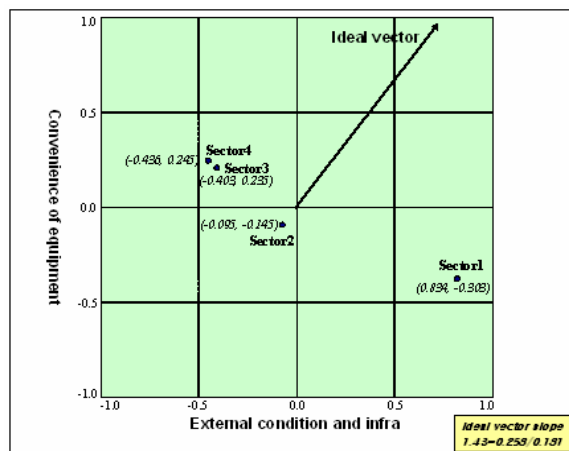


Figure 3 the 3rd perceptual map

In the 3rd perceptual map, ideal vector is nearer to 'convenience of equipment' than 'external condition and infra'. So the 'convenience of equipment' is more important than 'external condition and infra', and when 'external condition and infra' is supposed to be 1 in its gravity, the gravity of 'convenience of equipment' is 1.43. The 3rd perceptual map has two groups, too. One is composed of sector 1-2 in m-commerce applications; the other is composed of sector 3-4 in m-commerce applications. The position of separate sectors in m-commerce applications can be inferred through the prior results.

5. Conclusion

In this paper, new concept of value proposition for m-commerce is set up based on the study on previous value propositions for m-commerce, and clustering a great number of m-commerce applications by 4 sectors. These 4-sector applications are evaluated by 17 detail propositions. Then these propositions are reorganized structurally by factor analysis, of which result can be used point for drawing perceptual map. This paper identifies the degree of importance in

respective propositions through experimental analysis. These experimental analyses are able to hold up objectivity of research methods, and suggest multi-points of view. This result can be used for setting up m-commerce strategy. The implications of this paper are providing diagnostic information to design a new applications or devices. And concretizing value propositions for m-commerce make a operators clear in their decision-making.

However, there are some limitations in this paper.

This paper doesn't suggest detail executive strategies. So, the transition strategies are suggested by examining the general flow of telecommunications market and industries, describing the fundamental environments of m-commerce, classifying the importance of physical properties, and extracting prospective services in detail m-commerce market. In the result of this study, the functional detail strategies are not enough for the operator concerned m-commerce. Finally, the number of sample for empirical analysis is very small to be statistically justified. If these limitations are overcome and modified, then it is expected that the quality of this paper is more improved.

6. References

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