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The Evaluation System of New Digital Home Shopping Service

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Abstract

This paper mainly discusses the evaluation system for the users of the new digital home shopping service based on HD (High Definition) -interactive shopping platform. The suggestion is to change from the channel with playing functions to the column with interactive functions for public goods since HD -interactive digital shopping is a Chinese government policy for three networks convergence, and it is a new model to provide the home shopping directly and realize economic objectives for telecom operators.

Keywords: *Evaluation System, HD-Interactive TV Platform, Digital Home Shopping Service*

1. Introduction

It is expected in the coming future that customer stay at home to enjoy HD-interactive shopping while it is also important for them to protect users' rights effectively by making comprehensive evaluation of service quality through the angles including service image, service level, and service progress.

Unlike the traditional shopping way based on radio and TV where the channel resource is limited and the threshold of the goods saling on TV is a little higher and service quality cannot be guaranteed , HD-interactive shopping model is to satisfy the demand of the "one-stop" integration service, since users put forward new requirements of time and interactive functions in the service process, where the information service institutions pay attention to shorten users' waiting time and realize the users' expecting time step by step that result in the emerge of the interactive information service model or platform.

The establishment of HD-interactive platform is to make users give their own information conveniently, interact with other users, share their wisdom and enjoy shopping on HDTV.

2. New Digital Shopping Service Based on HD-Interactive TV Platform

HD-interactive TV platform means family customer can apply fixed or wireless network as whole-home interactive HD. Based on HD-interactive shopping service platform,the new digital shopping service model can be established through the function of VOD (time shift, TVoY, on demand, *etc*.) .This model integrates well-known logistics enterprises, consumers' association, insurance companies,financial institution and other units together with HD-interactive cable TV network as the carrier, family users as the service object, family as the basic unit of the service platform (Shown in Figure 1).

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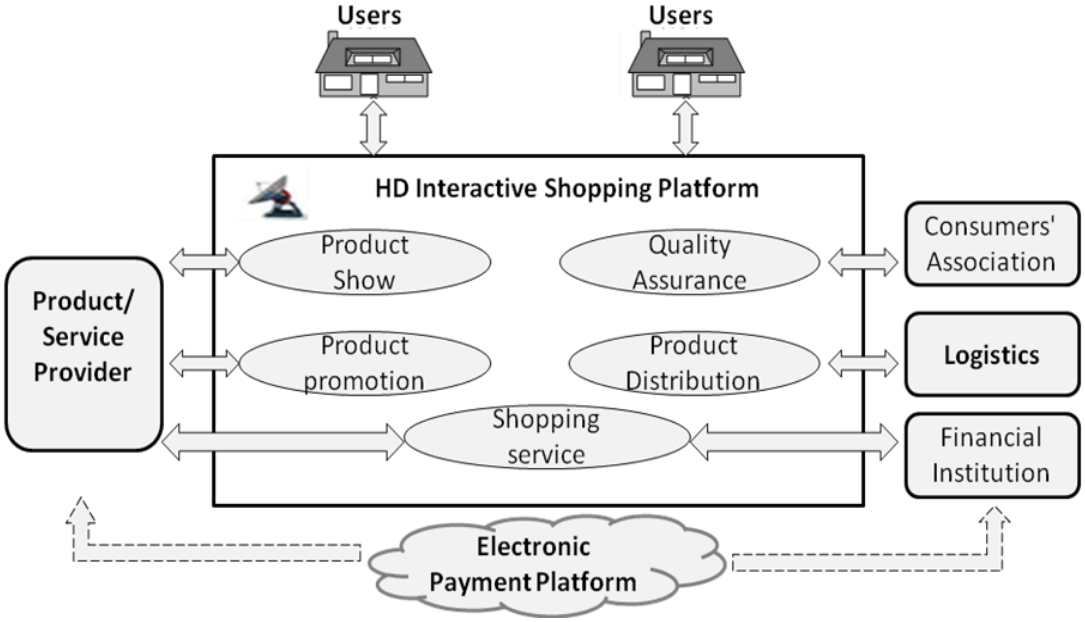

Figure 1. Digital Shopping Service Model on The Hd-Interactive Digital TV Platform

On the one hand ,compared with the traditional television shopping, users are no longer limited by the restrict of viewing time, and the broadcast 24 hours time limit.On the other hand ,compared with shopping on the Internet, the high-resolution of product display, the convenience of payment and delivery, the reliability of the first pay from the third party is the biggest bright spot of the new digital shopping service model based on the HD-interactive digital TV platform. The new digital shopping service model can provide distinctivly integrated services including shopping services, promotion services, quality assurance services, products distribution service and so on.

The relationship among the main participants forms a service model based on the HD-interactive Digital TV Platform and the main bodies involved in the HD-interactive platform that is a construction of service evaluation are proved to be as follows:service/product provider, users ,logistics,HD-interactive TV Platform and electronic payment platform.So how to evaluate the new digital shopping service model based on the HD-interactive digital TV platform becomes a hop issue for the companies and the users.

3. Evaluation System of Digital Home Shopping Service

3.1. Mechanism of Service Evaluation System

The purpose of service evaluation model is to evaluate the process, content and form of the service, which is a mechanism contraction to the process of service quality: Users evaluate all links of service procedure; the evaluation information is collected on the HD-interactive platform, and the corresponding modules on the platform can process the information. On the other hand,the goods/services providers and electronic payment platform need to have a mechanism for good support both in technology and management to satisfy customers with more required services. Based on three rounds of 21 experts for Delphi study, the service evaluation mechanism is shown in Figure 2.

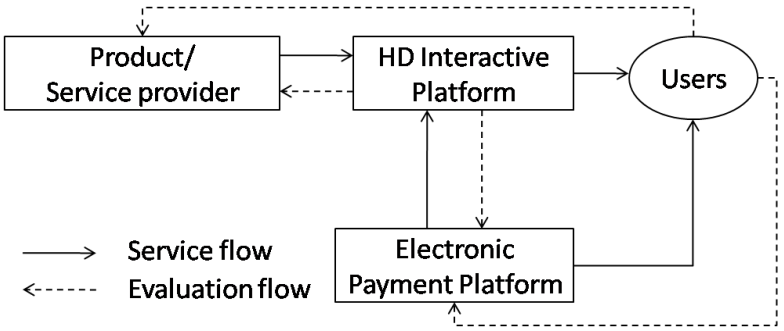

Figure 2. Mechanism of HD-Interactive Platform's Service Evaluation Model

3.2. Service Evaluation Indexes

According to the research above, there are three major aspects influcing the service evaluation of HD-interactive Platform, which are the product order, the product payment and the product distribution. We do research on three major aspects and then it can be concluded that there are 13 impact factors which can evaluate the service of HD-interactive Platform. Firstly,the product order project setting, product order fluent,product show,product price and product quality are the five important factors which can evaluate the proceeding of the product order;Secondly,the payment interface,payment process,convenience of payment and the safety of payment are the four important factors influencing the product payment.Thirdly,there are three major factors influencing the product distribution of the platform,which are the distribution costs,delivery staff service attitude and the distribution promptness (It is shown in Table 1).

Table 1. Service Evaluation Indexes of HD-Interactive Platform

	First –level Index	Second-level Index
Service Evaluation system of HD Interactive Platform	Shopping Platform	Product Quality
		Product Price
		Product Show
		Product order Fluent
		Product Order Project Settings
	Electronic Payment Platform	Safety of Payment
		Convenience of Payment
		Payment Process
		Payment Interface
	Logistics	Distribution Promptness
		Delivery staff Service Attitude
		Distribution Costs

3.3. The Main Research Method

3.3.1. Anp: Analytic Network Process, the expansion of AHP(Analytic Hierarchy Process),is a new decision-making scientific method.It mainly aims at the situation that the structure of the decision solving out problems has dependence and feedback.

Professor Saaty proposed the ANP officially in 1996 at the fourth international conference on AHP in Vancouver. After AHP gained the favor of scientific workers around the world after its formation, scientists launched many applications and research around the benefits, costs, opportunities, risks, and developed a user-oriented software named ANP.

3.3.2. Expert Evaluation Method: Expert Evaluation Method is a method to consult relevant experts anonymously, add up, process and analyze the expert advice, make a reasonable estimate on a lot of factors that cannot be analyzed quantitatively through technological methods, analyze the degree that value can be realized after several rounds of comments, feedback and adjustment.

3.3.3. Fuzzy Evaluation: Fuzzy theory is used to set pair analysis on doing the research on uncertainties from three aspects including system identity, difference and opposition of each two aspects.

3.3.4. Factor Analysis: The fundamental purpose of the factor analysis is to describe the connection and select factor among many factors by using and classifying several variables which are closely related to the purpose, and each variable becomes a factor that will influence the evaluation process.

4. Investigation Questionnaire

4.1. Questionnaire Design

This study uses the questionnaire survey method and chooses half quantitative method, *i.e.*, seven component methods, and then uses SPSS17.0 software to make statistical analysis on questionnaire results.

The methodology can be divided into two steps: First of all, do the validity and reliability analysis on variables, and delete the variables which don't meet requirements. The specific proceeding is using content validity to construct validity, and homogeneous reliability analysis, calculating Cronbach's αvalue to determine the variables. Reliability refers to the consistency of the variables in the questionnaire (or the entire questionnaire) The Cronbach's alpha are the most common method for social science researchers.The greater the value, the higher the internal consistency .It is to say the correlation between the factors inside is strong. Inspection standard is as follows: if Cronbach's α value is greater than 0.7, data reliability is high; when measuring dimension number is less than 6, if Cronbach's αvalue is greater than 0.6 ,the data reliability is high; Cronbach's αvalue can be less than 0.7, but should be greater than 0.5 in exploratory research.The result of the reliability test is shown in Table 2.

Table 2. Reliability Test Results

Reliability Statistics

Cronbach's α	Cronbach's α Based on Standardized Items	N of Items
.857	.883	12

From the table above ,it can be seen that the Cronbach's α is 0.857, therefore, generally speaking the scale has good reliability and it is approved to do the futher analysis.

And then the study does the factor analysis on variables of competitive resources and competitive abilities through the method of factor analysis, selects factors through principal component analysis method, and identifies or verifies three levels in classification through the factor analysis. Secondly, do the relevant analysis and relevant hypothesis of all kinds of competitive resources and competitive abilities through secondary classification of competitive resources and competitive abilities.

4.2. Model Analysis

4.2.1. Questionnaire: This study designs Expert Questionnaire to set up ISM(Interpretative Structural Model) to do analysis based on index system established, and this method pays attention to not only classification of competitive resources but also competitive abilities for the best matching. Respondents are from research scientists, executives and customers. 500 questionaires was handed out ,and the feedback number of qualified questionnaire actually is 480, including 144 ones from scientific research personals, 136 from the executives and 200 from customers.

4.2.2. Evaluation Model Construction: The key of evaluation model is to determine the weight values of all levels. Service index weight calculation is a multiple attribute decision-making issue. In view of the customer, products, spare parts, all kinds of complex relationship between service performance, as well as the fuzzy factors in the process of important degree judgment, this paper integrated ANP and Fuzzy theory together to get primary weight, secondary weight and comprehensive weight.

When comparing advantage degree by conventional ANP method, Saaty's 1 ~ 9 scale method is generally taken to measure the relative important degree of the objects. This scale method is simple and easy, but can't reflect the imprecision and fuzziness in the process of judgment. In order to more objectively and truly reflect the judgment results, this paper adopts triangular fuzzy scale instead of accurate scale to compare dominance.

By analyzing the service evaluation index system and evaluation process, three groups (the electronic payment platform, customers, service/information providers) and each internal elements have been obtained. According to the relations of group internal elements , the network model of service index weight is established based on the principle of ANP, as shown in Figure 3.

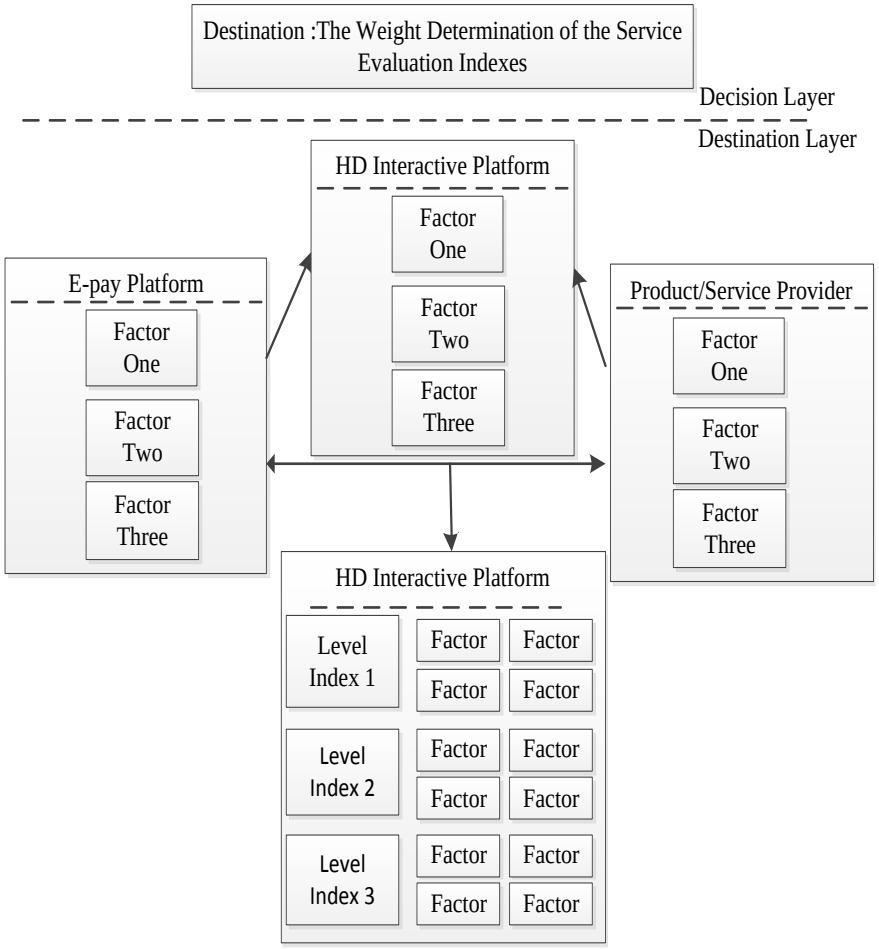

Figure 3. The Logical Model of Service Evaluation Index Model

4.2.3. Evaluation Process: The network structure of ANP model is formed by the relationship between and in groups. Group is composed of elements, and the relationship between the elements is to determine the relationship between groups. There are mutual influence between elements of different groups, and the internal elements of the same group can also have influence on each other."→"can be used to represent the interaction relations between various elements. Set A, B respectively represent two sets, a, c is the elements in the set A, and b, d is the element in the set B, if "a→b", namely the element a can be influenced by the element b, so"A→B"; if"a→b"and"d→c", "A←→B"; if"a→c","A→A".

The relationship between elements is based on the practical problems, to establish the relationship between various factors is to provide the basis for dominance comparison. For example, if "a→b"and"a→d", the element a were affected by the element b and d, and the relative important degree of element b and element d need a comparative. For convenience of expression, we call a as "parent element", b and d as "child element" in this case.

Based on the established network structure, in view of all the parent element, the comparison of the importance of child elements is called dominance comparison. When comparing advantage degree, triangular fuzzy number scale is used to measure the relative important degree. Triangular fuzzy number scale is shown in Table 3.

Table 3. Triangular Fuzzy Number Scale

Accurate Scale	Definition	Triangular Fuzzy Number Scale
1	i , j two elements are equally important	$\tilde{1}$ = (1,1,1)
2	i is slightly more important than j	2 = (1,2,3)
3	i is a little more important than j	$\tilde{3}$ = (2,3,4)
4	i is more important than j	4 = (3,4,)
5	i is obviously more important than j	$\tilde{5}$ = (4,5,6)
6	i is strongly more important than j	$\tilde{6}$ = (5,6,7)
7	i is much more important than j	7 = (6,7,8)
8	i is almost definitly more important than j	$\tilde{8}$ = (7,8,9)
9	i is definitly more important than j	$\tilde{9}$ = (8,9,10)

The triangular fuzzy number scale is used to show the comparison between the relative important degree. For example, if elements a is slightly more important than the element b, triangular fuzzy number can be used to represent the relative important degree. On the basis of ANP method, mark 2 at line 1 column 2 of comparison matrix, at the same time mark at row 2 column 1. In triangular fuzzy number 2 = (1, 2, 3), "2" as the middle value of triangular fuzzy number, "1" and "3" respectively represent the upper and lower bounds of triangular fuzzy number, called fuzzy degree.

Set ANP in the network have N groups respectively for C_1, C_2, …, C_N, among them C_i has elements as $\{i_1, i_2, \ldots, i_m\}$, C_j has elements as $\{J_1, J_2, \ldots, J_n\}$.If $C_j \rightarrow C_i$, $j_h \rightarrow j_k$ ($j_h \in C_i$, $i_k \in C_i$),and triangular fuzzy number scale can be used in Table 3,to do the dominance comparison of all child elements in C_i. The dominance comparative matrix can be established as follows:

$$A = \begin{pmatrix} 1 & a_{12} & \ldots & a_{1m} \\ a_{21} & 1 & \ldots & a_{2m} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ a_{m1} & a_{m2} & \ldots & 1 \end{pmatrix} \quad (1)$$

In this formula, a_{ij} is a triangular fuzzy number, $a_{ij} = (l_{ij}, m_{ij}, u_{ij})$, and $a_{ij} = a_{ij}^{-1}$ .The eigenvector in dominance comparative matrix (1) is the local weight of the elements in group C_i relative to j_k.

Since the eigenvector of fuzzy matrix is difficult to solve, this paper uses the transformation method. The fuzzy matrix is transformed into a series of accurate matrix, by solving precisely matrix eigenvector,the local weight of element can be approximately solved. The fuzzy eigenvalue A in dominance comparative matrix is a fuzzy number, which can also meet:

$$A_{C_i J_k} \lambda = \lambda \tilde{X} \quad (2)$$

In this formula, $A_{C_i J_k}$ is a mxm fuzzy matrix composed of $\tilde{a}_{ij}$, x is a nonzero fuzzy vector mx1and $x = (x_1, x_2, \ldots, x_m)^T$。According to the fuzzy algorithm, formula (2) is equivalent to:

$$(\tilde{a}_{i1} \otimes \tilde{x}_1) \oplus \ldots \oplus (\tilde{a}_{im} \otimes \tilde{x}_m) = \lambda \otimes \tilde{x}_i, \forall 1 \le i \le m \qquad (3)$$

The confidence level a of interval number (a :the threshold of Sets) can be used to show the certain degree of dominance comparison from the decision makers, and for $\forall 1 \le i \le m$, based on triangular fuzzy number algorithm there are:

$$\tilde{a}_{ij}^{\,a} = [\tilde{a}_{ijl}^{\,a}, \tilde{a}_{iju}^{\,a}], \tilde{x}_i^{\,a} = [\tilde{x}_{il}^{\,a}, \tilde{x}_{iu}^{\,a}], \tilde{\lambda}^a = [\lambda_i^a, \lambda_u^a] \quad (4)$$

According to the rules of interval arithmetic, formula (3) can be converted into:

$$[a^a_{ijl} x^a_{1l}, a^a_{ilu} x^a_{1u}] \oplus \ldots \oplus [a^a_{iml} x^a_{ml}, a^a_{imu} x^a_{mu}] = [\lambda^a_i x^a_{il}, \lambda^a_u x^a_{iu}] \quad (5)$$

That is if $\forall 1 \le i \le m$, then:

$$a^a_{i1l} x^a_{1l} + \ldots + a^a_{iml} x^a_{ml} = \lambda^a_l x^a_{il}$$

$$a^a_{ilu} x^a_{1u} + \ldots + a^a_{imu} x^a_{mu} = \lambda^a_u x^a_{iu} \qquad (6)$$

The best index θ is used to estimate the satisfaction of the dominance comparative matrix:

$$a^a_{ij} x^a_{1u} = \theta a^a_{iju} + (1-\theta) a^a_{ijl}, \forall \theta \in [0,1]. \quad (7)$$

When a and θ are given, the accurate matix can be obtained as follows:

$$A_{C_i j_k} = \begin{pmatrix} 1 & a_{12} & \ldots & a_{1m} \\ a_{21} & 1 & \ldots & a_{2m} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ a_{m1} & a_{m2} & \ldots & 1 \end{pmatrix} \quad (8)$$

By normalized process on the biggest eigenvector in $A_{C_i j_k}$, the local weight of the elements in group C_i relative to $j_k$can be approximately obtained.The eigenvector after normalized process can be shown as:

$$V_{C_i j_k} = (w_{i_1}^{\,j_k} w_{i_2}^{\,(j_k)} \ldots w_{i_m}^{\,(j_k)})^T \qquad (9)$$

By the advantage comparion on the elements in the group C_i based on all the parent element in group C_i,the advantage matrix W_{ij} can be obtained:

$$W_{ij} = \begin{pmatrix} w_{i_1}^{(j_1)} & w_{i_1}^{(j_2)} & \cdots & w_{i_1}^{(j_n)} \\ w_{i_2}^{(j1)} & w_{i_2}^{(j_2)} & \cdots & w_{i_1}^{(jn)} \\ \vdots & \vdots & & \vdots \\ \vdots & \vdots & & \vdots \\ w_{i_m}^{(j1)} & w_{i_2}^{(j_2)} & \cdots & w_{i_1}^{(j_n)} \end{pmatrix} \quad (10)$$

Each column of W_{ij} are the eigenvectors after normalized process which is generated by the advantage comparion such as formula (9) .

4.2.4. Index Weight: Through ANP method, firstly, choose a market area as evaluation objects, and make classification mark to the links of HD-interactive platform, electronic payment platform and logistics distribution in this area through ABC classification method. After classification, make classified statistics on business data based on evaluation index system to get the overall index respectively.The final results are shown in Table 4:

Table 4. Index Weight

Group	Internal Index	Second-level Index Weight	First –level Index Weight
Shopping Platform	Product Quality	0.884	0.851
	Product Price	0.801	
	Product Show	0.699	
	Product order Fluent	0.761	
	Product Order Project Settings	0.775	
Electronic Payment Platform	Safety of Payment	0.844	0.724
	Convenience of Payment	0.611	
	Payment Process	0.702	
	Payment Interface	0.600	
Logistics	Distribution Promptness	0.589	0.710
	Delivery staff Service Attitude	0.773	
	Distribution Costs	0.769	

Indexes of Level 1 reflects basic service of different main bodies in the service process; Level 2 reflects the overall service of the shopping platforms, the electronic payment platforms, and the logistics. From the comperhensive evaluation results,we can conclude that the service of shopping platform is the most important part influencing the HD-interactive digital shopping model.And the prodct quality ,safety of payment,product price ,prodct order project settings and the service attitude of the delivery staff are the first five main index which can evaluate the service of the HD-interactive platform.

5. Conclusion

It is a service evaluation from TV shopping model into HD-interactive digital shopping model. The relationship among the main participants forms a service model based on the HD-interactive Digital TV Platform and the main bodies involved in the HD-interactive platform that is a construction of service evaluation due to mechanism of HD-Interactive Platform's Service Evaluation Model has been set up.

Based on the investigation and application of ANP, ISM and SPSS17.0 software to make statistical analysis on the comprehensive evaluation results, we can get different service preferences of different customers and products, and the corresponding service based on all kinds of index weight and the final evaluation results gained through calculation. The suggestion is to change from the channel with playing functions to the column with interactive functions for public goods since HD -interactive digital shopping is a Chinese government policy for three networks convergence, and it is a new model to provide the home shopping directly and realize economic objectives for operators.

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References

[1] S. Deng and M. Zhang, "The Establishment of Interactive Information Service Model Based on User Experience", Journal of Library Science in China, vol. 1, **(2009)**.
[2] J. M. Peterson, "Digital Smarts", How to Stay Within a Budget When Shopping, Living, and Doing Business Online, Judy Monroe Rosen Publishing Group, vol. 12, **(2012)**.
[3] M. Yang and J. Zeng, "The Television Shopping Service Model Based on HD Interactive TV Platform", International Journal of u- and e- Service, Science and Technology, vol. 7, no. 6, **(2014)**.
[4] Y. Li, "Empirical Analysis Study on the Attitudes of Potential Consumers in TV Shopping", **(2008)**.
[5] H. Resit, Y. Semra, B. K. Goztepe, "Selection of dispatching rules in FMS", ANP Model Based On BOCR with Choquet Integral, The International Journal of Advanced Manufacturing Technology, vol. 8, **(2010)**.
[6] V. A. Zeithaml, L. L. Berry Ph.D., A. Parasuraman D.B.A., "The nature and determinants of customer expectations of service", Journal of the Academy of Marketing Science , vol. 1, **(1993)**.
[7] H. Lin, "Improvement and Application of Factor Analysis Model", the Mathematical Statistics and Management, vol. 6, **(2009)**.
[8] S. A. Zahra, H. J. Sapienza, P. Davidsson, "Entrepreneurship and dynamic capabilities", A review, model and research agenda, Journal of Management, vol. 5, **(2006)**.
[9] R. Paulrajan and H. Rajkumar, "Service Quality and Customers Preference of Cellular Mobile Service Providers", Journal of Technology Management & Innovation, vol. 6, **(2011)**.
[10] L. Shuyan, "Analysis of Cable Digital TV Platform Design", China Digital Cable TV, vol. 1, **(2012)**.
[11] C. Gronroos, "Service Management and Marketing", Customer Management in Service Competition, John Wiley & Sons Ltd, **(2007)**, New York.
[12] Dale F. Duhan,Scott D. Johnson,James B. Wilcox,Gilbert D. Harrell. Influences on consumer use of word-of-mouth recommendation sources, Journal of the Academy of Marketing Science ,4,**(1997)**
[13] R. E. Grinter, W. K. Edwards and M. W. Newman, "The Work to Make a Home Network Work", Proceedings of the Ninth European Conference on Computer-Supported Cooperative Work,（**2005**） September 18-22, Paris, France.
[14] C. E. Helfat, R. S. Raubitschek, "Product sequencing", co-evolution of knowledge, capabilities and products, Strategic Management Journal, vol. 3, **(2000)**.
[15] J. Singh and D. Sirdeshmukh，"Agency and trust mechanisms in consumer satisfaction and loyalty judgments"，Journal of the Academy of Marketing Science, vol. 1, **(2000)**.

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