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The Key Factors for Service Quality of Portal Website by Fuzzy DEMATEL

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ABSTRACT: In recent years, the Internet has developed rapidly and brought great impact to various industries. In it, the portal website is the gate to enter the Internet. By relying on the provision of many integrative services, managers hope to attract a large number of users to enhance advertising exposure with browse rate, forming vast opportunities. In the progress of development, the portal website has been reformed from single function to multifunction and categorized services which illustrate the importance of the site. However, the quality of each site that users conceive differs from person to person. Among them many intangible attributes are difficult to measure. Therefore, to overcome the obstacles of subjective respondents, we adopt fuzzy DEMATEL methods to create a system structure model to portray the influenced relationship combining SAW to rank each performance of service quality of portal website. In empirical results, the dimension "security/privacy" would be the most valued and the criteria "shopping information security" would be the most. And the example isultimately to present crucial the best improvement strategies for decision-makers to achieve the aspirational level.

KEYWORDS: Portal website, Fuzzy DEMATEL, SAW, Service quality.

I. INTRODUCTION

World Wide Web (WWW) has grown drastically which brings the user population new record high. Until the end of 2020, the statistics show that the above 12 years old users have been over 17 millions whereas the prevalence of the Internet hits 83%, the WIFI users to be 1683 millions, and the mobile net users are 1635 millions [7]. It shows that people are highly dependent on the Internet which in turn drives the high development of the Internet industries.

An individual can experience all activities online; however, due to the diversification of the Internet, users must enter the Internet via portal websites. Namely, portal websites are the gateway of the Internet [8]. This is because the portal website is the starting point for users to enter the Internet and has the characteristics of high traffic, so it has become a crucial market for EC operators and a mainstream business tool. Furthermore, they are followed by other user-orientated services in a greater scale. Such as e-mail, maps, search, news services, etc. Nevertheless, with more and more portal websites, the variety of services and service quality influence the perception of users entering the sites. Thus, the evaluation of the service quality of portal websites becomes an important issue.

The well-known for SERVQUAL scale [15] is an important tool which evaluates and analyzes service quality. However, many scholars [22] consider that the SERVQUAL scale must adapt moderately, so that it can be applied on related issues of online service quality. In addition, along with the progress of information technology, requirements for service quality of the Internet are constantly enhancing. This phenomenon is hard to be evaluated and explained by a single criterion, since it has become a decision problem of multiple criteria. And the further concerns are the subjective cognition which may be varied from evaluators to evaluators, including the unavoidability of uncertainty and fuzziness. Utilizing precise values does not express user's cognition for the service quality of portal websites.

In MCDM, DEMATEL is used for researching and solving the complicated and intertwined problem [19]. It can identify workable solutions by a hierarchical structure and reveal the relationships among factors. Next, with fuzzy set theory appearance and development, many decision-makings are widely applied to solve fuzzy problems because more exact and objective data can be obtained. Therefore, this paper adopts the fuzzy MDEATEL to consider the condition of the fuzziness and handle flexibly in fuzziness situation [20]. In addition, DEMATEL is used to determine the key criteria. Finally, a list of rating order on service quality of portal websites is generated by

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SAW, so that e-sellers can take this model as a reference for their managerial strategy in the business.

II. THE SERVICE QUALITY OF POTAL WEBSITE

The portal website is the first page for users enter into the Internet. Due to the large amount of information on the Internet, each user has different needs. Thus, the early portal website mainly provided the function of search engines to assist users find the information they need in the vast Internet. Subsequently, the portal website offers numerous services. Hence, the service quality for portal website is defined that it provides the place for Internet browsing, search engine, e-mail, specialized information content, chatrooms and other services [6]. In interactive process, user can sense the degree of service quality. Next, in measurement of service quality, SERVQUAL was proposed by PZB in 1988, which is the most evaluative tool in the service quality domain [15]. However, in the service quality evaluation of information service industry [10], there is still some debate about using the evaluative tools by the five dimensions of SERVQUAL. Therefore, some papers suggest that they have to be modified to adapt to different information service industries. According to the characteristics of information industry, Li et al. [12] thought it is SERVQUAL that we use to modify and develop appropriate measuring dimensions, such other related literatures are shown in Table 1.

Table 1: The service quality measurement in priori researches

Scholars	Research Topic	Dimensions
Chiang Chi et al. [4]	Portal website	Responsiveness, Personalization, Site features and security.
Wang, T. C. & Liu, S. L. [18]	Portal website	Search engine and website catalog, personalization, electronic commerce, community, life information and other information.
Ye, D. Y. et al. [23]	Portal website	Tangible, reliable, completeness, convenience, immediacy, personalization and security.
I. Shpolianskaya et al. [16]	Education portal	System quality, service quality and information quality.
W. J. A. Al-nidawi et al. [1]	E-Government	System availability, privacy/security, efficiency, fulfillment, reliability, information, ease of use, website design, interactivity and responsiveness.
Xiao, J. [21]	E-Government	Information quality, design & function, reliability, security & privacy and responsiveness.
Liu & Arnet [13]	Electronic commerce	Information and service quality, system use, playfulness and system design quality
Swaid & Wigand [17]	Electronic commerce	Website usability, information quality, reliability, responsiveness, assurance and personalization.

III. RESEARCH METHOD

3.1- Fuzzy set theory

Fuzzy set theory was proposed by Zadeh [24] in 1965, and he applied the concept of the fuzzy set to emphasize that the degree of things should be described by the fuzzy logic for catching up on the difficulty of the direct description in the real life. A classical set is a set with a crisp boundary; i.e., an element of the universe either belongs or does not belong to the classical set. Compared with a classical set, a fuzzy set is a set without a crisp boundary. The transition between full membership and non-membership is gradual. A fuzzy set $\tilde{A}$ in a universe of discourse U can be defined as a set of ordered pairs,

$$\tilde{A} = \{(x, \mu_{\tilde{A}}(x) \mid x \in X)\} \quad (1)$$

where $\mu_{\tilde{A}}(.)$ is called the membership function of $\tilde{A}$ which takes values in the interval [0, 1] and $\mu_{\tilde{A}}(x)$ is the degree of membership of x in $\tilde{A}$.

3.1.1- Linguistic variables

According to Zadeh [25–27], it is very difficult for conventional quantification to

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reasonably express situations that are overtly complex or hard to define. Thus, the notion of a linguistic variable is necessary in such situations. A linguistic variable is a variable with lingual expression as its values. The possible values for this variable could be "no influence", "very low influence", "low influence", "high influence" or "very high influence". The evaluators were asked to conduct their judgments, and each linguistic variable can be indicated by a fuzzy number within the scale range of 0-1. Also the evaluators can subjectively assume their personal range of the linguistic variable.

3.1.2- Defuzzification

The result of fuzzy synthetic decision of each alternative is a fuzzy number. Therefore, it is necessary that the nonfuzzy ranking method for fuzzy numbers be employed during service quality comparison for each alternative. In other words, defuzzification is a technique to convert the fuzzy number into crisp real numbers, and the procedure of defuzzification is to locate the Best Nonfuzzy Performance (BNP) value. This paper adopts the Center-of-Area method due to its simplicity and doesn't require analysts' personal judgment [2]. The defuzzified value of fuzzy numbers can be obtained from Eq. (2).

$$BNP_{ij} = [(\tilde{U}_{ij} - \tilde{L}_{ij}) + (\tilde{M}_{ij} - \tilde{L}_{ij})]/3 + \tilde{L}_{ij} \qquad (2)$$

3.2- Fuzzy DEMATEL

The matrices or digraph a contextual relation between the elements of the systems, in which a numeral represents the strength of influence. Hence, the Fuzzy DEMATEL can convert the relationship between the causes and effects of criteria into an intelligible structural model of the system [3, 11, 14]. The Fuzzy DEMATEL consists of the following steps:

STEP 1: Defining the evaluation criteria and design the fuzzy linguistic scale. Gathering the relevant information defines the goals for further developing related dimensions/criteria in order to examine the interrelationships of dimensions/criteria in uncertainty. Thus, DEMATEL must replace the comparison scale with the fuzzy linguistics scale to test the influence of each dimensions/criteria. Then, the respondents were asked to evaluated the interrelationship of each dimensions/criteria using five scores in linguistic term: 0(no influence), 1(very low influence), 2(low influence), 3(high influence), and 4(very high influence). The influence is the degree of the dimensions/criteria affect each other To ensure the relationships among the evaluation dimensions/criteria, it is necessary to consult the respondents to confirm reliable information of the dimensions/criteria influences and directions using a survey instrument (see Table 2).

Table 2: The correspondence of linguistic variables and fuzzy numbers.

Linguistic variable	Influence score	Fuzzy numbers
No influence	0	(0, 0, 0.25)
Very low influence	1	(0, 0.25, 0.5)
Low influence	2	(0.25, 0.5, 0.75)
High influence	3	(0.5, 0.75, 1)
Very high influence	4	(0.75, 1, 1)

STEP 2: Establishing the directed-relation matrix. To measure the relationship between criteria C = {C_i = 1,2,...,n}, a decision group of e respondents were asked to make sets of pairwise comparisons in terms of linguistic terms. Here, e fuzzy matrices $\tilde{Z}^1, \tilde{Z}^2, \ldots, \tilde{Z}^e$ each corresponding to a respondent and with triangular fuzzy numbers as its elements, were obtained. Fuzzy matrix $\tilde{Z}$ is called the initial direct-relation fuzzy matrix. For simplicity, we denote $\tilde{Z}$ as

$$\tilde{\mathbf{Z}} = \begin{array}{c} \\ C_1 \\ C_2 \\ \vdots \\ C_n \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{bmatrix} 0 & \tilde{Z}_{12} & \cdots & \tilde{Z}_{1n} \\ \tilde{Z}_{21} & 0 & \cdots & \tilde{Z}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{Z}_{n1} & \tilde{Z}_{n2} & \cdots & 0 \end{bmatrix} \end{array} \qquad (3)$$

where $\tilde{Z}_{ij} = (l_{ij}, m_{ij}, u_{ij})$, which are triangular fuzzy number, the elements $\tilde{Z}_{ij}$,i = 1, 2,,,.n.

STEP 3: Establishing and analyzing the structural model. The linear scale transformation is used here as a normalization formula to transform the criteria scales into comparable scales. Let

$$\tilde{a}_{ij} = \sum_{j=1}^{n} \tilde{Z}_{ij} = (\sum_{j=1}^{n} l_{ij}, \sum_{j=1}^{n} m_{ij}, \sum_{j=1}^{n} u_{ij}) \qquad (4)$$

and

$$u = \max_{1 \leqslant i \leqslant n} (\sum_{j=1}^{n} u_{ij}) \qquad (5)$$

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Then, the normalized direct-relation fuzzy matrix, denoted by X, equals $\tilde{X} = r^{-1} \tilde{Z}$,then

$$\tilde{X} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn} \end{bmatrix} \quad (6)$$

where,

$$\tilde{X}_{ij} = \frac{\tilde{Z}_{ij}}{u} = \left(\frac{l_{ij}}{u}, \frac{m_{ij}}{u}, \frac{u_{ij}}{u}\right) \quad (7)$$

As that in crisp DEMATEL, we assume as least one i such $\sum_{j=1}^{n} u_{ij} < u$ and $\lim_{k\to\infty} \tilde{x}^k = [0]_{n\times n}$.

STEP 4: The total-relation matrix. Once the normalized directed-relation matrix into degree matrix X is obtained, the total relation matrix $\tilde{T}$ can be acquired by using the following equation.

$$\tilde{T} = \tilde{X} + \tilde{X}^2 + \cdots + \tilde{X}^k + \cdots = \tilde{X}(1 - \tilde{X})^{-1} \quad (8)$$

where $\lim_{k\to\infty} \tilde{x}^k = [0]_{n\times n}$.

$$\tilde{T} = \begin{bmatrix} \tilde{t}_{11} & \tilde{t}_{12} & \cdots & \tilde{t}_{1n} \\ \tilde{t}_{21} & \tilde{t}_{22} & \cdots & \tilde{t}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{t}_{m1} & \tilde{t}_{m2} & \cdots & \tilde{t}_{mn} \end{bmatrix} \quad (9)$$

where, $\tilde{t}_{ij} = (l_{ij}^n, m_{ij}^n, u_{ij}^n)$, $\left[l_{ij}^n = X_l \times (I - X_l)^{-1}\right]$, $\left[m_{ij}^n = X_m \times (I - X_m)^{-1}\right]$ and $\left[u_{ij}^n = X_u \times (I - X_u)^{-1}\right]$.

STEP 5: The sum of rows and columns.The sum of rows and the sum of columns are separately denoted as d and r within the total-relation matrix **T** through the following equations. $\tilde{T} = [\tilde{t}_{ij}]$, i, j ∈ {1, 2,..., n}.

$$\tilde{d} = (\tilde{d}_i)_{n\times 1} = [\sum_{j=1}^{n} \tilde{t}_{ij}]_{n\times 1} \quad (10)$$

$$\tilde{r} = (\tilde{r}_i)'_{1\times n} = [\sum_{j=1}^{n} \tilde{t}_{ij}]'_{1\times n} \quad (11)$$

STEP 6: Analyzing the results.Suppose $\tilde{d}_i$ denotes the row sum of i-th row of matrix $\tilde{T}$; then $\tilde{d}_i$ shows the sum of influence dispatching from factor i to the other factors both directly and indirectly. Suppose $\tilde{r}_j$ denotes the column sum of j-th column of matrix $\tilde{T}$. Then $\tilde{r}_j$ shows the sum of influence that factor j is receiving from the other factors.

Furthermore, when i = j, it means the sum of row sum and column sum $(\tilde{d}_i + \tilde{r}_j = \tilde{d}_i + \tilde{r}_i)$ shows the index of representing the strength of influence both dispatching and receiving, that is $(\tilde{d}_i - \tilde{r}_j = \tilde{d}_i + \tilde{r}_i)$ shows the degree of central role that the factor i plays in the problem. If $(\tilde{d}_i - \tilde{r}_j = \tilde{d}_i + \tilde{r}_i)$ is positive, then factor i is rather dispatching the influence to the other factors. And if $(\tilde{d}_i - \tilde{r}_j = \tilde{d}_i + \tilde{r}_i)$ is negative, then the factor i is rather receiving the influence from the other factors [5, 9].

IV. EMPIRICAL ANALYSIS

Based on the problems and purposes of this paper, this section includes the analysis portal website service quality and the measurement of the relationship among dimensions/criteria. We use this framework to find the key criteria for illustrating the user's perspective to factor.And three portal websites in China are as the objects of this paper.

The three portal websites, which provide relative service including responsiveness, personalization, site features, security/privacy and effectiveness, are selected to identify the critical dimensions of evaluating e-service quality for portal websites. The dimensions of above portal websites were the most directly choices from users'uses. Among 275 surveys, 36 were invalid for a return rate of 13%. The demographic statistics indicate that 53% of respondents belong to the age groups of 21-25 years, and 79% received at least college education.

In hierarchical structure, first, the related literatures of Table 1 are summarized. Next, three experts and two scholars are interviewed to construct this framework. Its content includes five dimensions and seventeen criteria. The dimensions are responsiveness, personalization, site features, security/privacy and effectiveness.The criteria include providing comprehensive services, responding customer's problems quickly, solving customer's problem effectively, providing personalized services, understanding customers' needs and preferences, function operation friendly, full services, catchy website, service scope, data transmission security, shopping information security, bank card payment security, personal information protection, system stability, intra-site search, search suggestions and information layout. The framework is shown in Figure 1.

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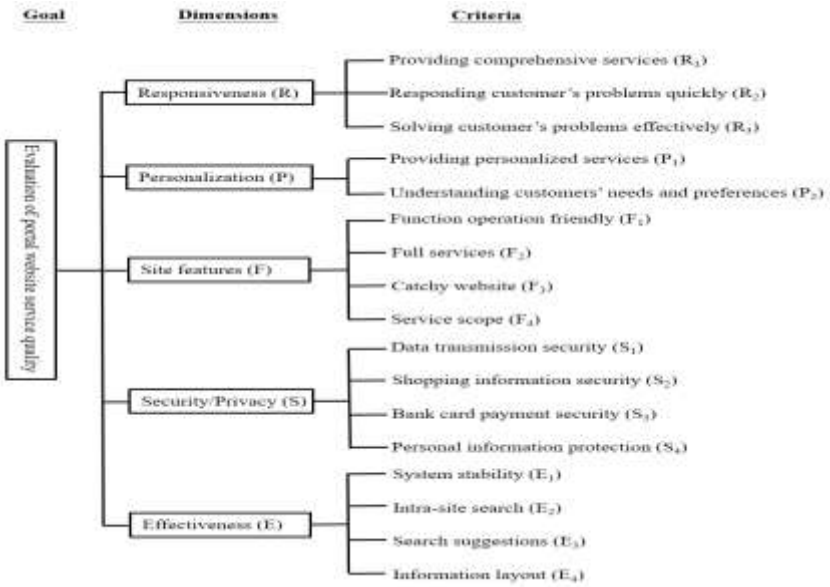

Figure 1: The framework for service quality of portal website

4.1- Analysis of results

Due to the concepts of hierarchical structure lack consideration in interactions of multi-dimension. In the real world, the independence of the dimensions or criteria does not exist. It is not only for the key success factors but also to evaluate the relationships among these criteria. Service quality is an interactive process and is influenced by many factors. Hence, we understand the thinking of users by using Fuzzy DEMATEL method to discuss the service quality of portal website and how the operators apply this information to make relative decisions. According to the formula of Fuzzy DEMATEL, we find the influence value of dimensions and criteria; they are shown as Table 3 and Table 4.

Based on the Step 4 and Step 5 of Fuzzy DEMATEL method, a causal diagram is created. The features of decision criteria are visualized as the oriented graphs. This paper uses the threshold value (p) to obtain the total relationship follow different matrix. It is the most appropriate value to acquire a suitable relationship. Using the threshold values of dimensions (0.074) and criteria (0.075), we illustrate the diagram of the total relation of dimensions and criteria shown in Figure 2 and Figure 3.

Table3: The total direct-relation matrix $\tilde{T}$ of five dimensions

	R	P	F	S	E
R	0.056	0.072	0.062	0.058	0.082
P	0.066	0.065	0.077	0.073	0.076
F	0.082	0.084	0.073	0.070	0.069
S	0.087	0.075	0.091	0.082	0.081
E	0.077	0.070	0.083	0.078	0.071

Note: threshold value of average is 0.074.

In Figure 2, it can be seen that evaluation dimensionshave interaction and feedback relationships.Thus, we obtain the weights of evaluation dimensions by the concept of FANP. We use the total direct-relation matrix $\tilde{T}$ of evaluation dimensions to get weights. Since the total direct-relation matrix $\tilde{T}$ is a geometric series. After timing to the 4rd power, it reaches the limit, the influence degree is stabilized, which generates a stable result. The weights of evaluation dimensions for FANP method is shown in Table 5.Similarly, this method can also calculate the weight value of the criteria, as shown in Table 6.

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Table4: The total direct-relation matrix $\tilde{T}$ of seventeen criteria

	R1	R2	R3	P1	P2	F1	F2	F3	F4	S1	S2	S3	S4	E1	E2	E3	E4
R1	0.023	0.042	0.048	0.055	0.036	0.031	0.030	0.039	0.029	0.051	0.068	0.064	0.051	0.067	0.036	0.043	0.047
R2	0.041	0.044	0.055	0.050	0.038	0.033	0.043	0.038	0.041	0.058	0.059	0.079	0.053	0.088	0.035	0.044	0.053
R3	0.053	0.038	0.026	0.050	0.037	0.033	0.033	0.035	0.035	0.063	0.072	0.085	0.059	0.092	0.040	0.051	0.053
P1	0.035	0.030	0.039	0.048	0.050	0.045	0.043	0.029	0.029	0.046	0.058	0.076	0.094	0.118	0.039	0.041	0.053
P2	0.039	0.040	0.037	0.032	0.030	0.039	0.038	0.034	0.037	0.045	0.069	0.062	0.058	0.076	0.036	0.042	0.046
F1	0.034	0.039	0.052	0.039	0.027	0.045	0.039	0.036	0.038	0.058	0.082	0.071	0.065	0.106	0.040	0.041	0.053
F2	0.043	0.046	0.043	0.038	0.033	0.040	0.031	0.031	0.039	0.054	0.078	0.068	0.061	0.056	0.032	0.037	0.044
F3	0.031	0.048	0.046	0.042	0.049	0.037	0.032	0.030	0.031	0.063	0.079	0.085	0.060	0.082	0.041	0.044	0.056
F4	0.032	0.042	0.052	0.041	0.036	0.038	0.042	0.045	0.032	0.068	0.075	0.082	0.052	0.076	0.038	0.049	0.056
S1	0.046	0.046	0.056	0.048	0.054	0.056	0.045	0.044	0.053	0.060	0.062	0.112	0.057	0.072	0.066	0.058	0.060
S2	0.066	0.056	0.051	0.052	0.077	0.045	0.068	0.069	0.055	0.082	0.079	0.100	0.081	0.081	0.073	0.055	0.041
S3	0.046	0.048	0.044	0.048	0.050	0.052	0.054	0.066	0.059	0.060	0.075	0.072	0.057	0.077	0.036	0.051	0.050
S4	0.039	0.046	0.048	0.050	0.046	0.041	0.030	0.035	0.037	0.057	0.068	0.068	0.051	0.073	0.036	0.048	0.055

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E1	0.056	0.0680	0.043	0.045	0.052	0.056	0.049	0.049	0.052	0.051	0.0610	0.058	0.055	0.069	0.048	0.049	0.058
E2	0.030	0.0380	0.028	0.026	0.040	0.032	0.027	0.030	0.030	0.058	0.0600	0.078	0.051	0.082	0.038	0.042	0.048
E3	0.030	0.0410	0.029	0.043	0.035	0.032	0.030	0.037	0.030	0.052	0.0580	0.068	0.048	0.057	0.038	0.044	0.041
E4	0.040	0.0480	0.035	0.053	0.044	0.028	0.030	0.042	0.043	0.063	0.0520	0.053	0.043	0.085	0.037	0.050	0.053

Note: threshold value of average is 0.075.

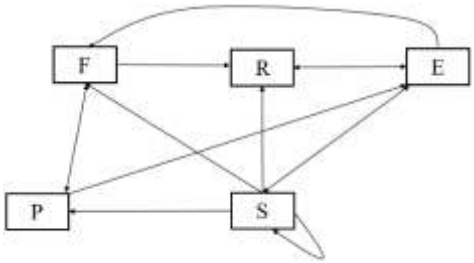

Figure 2: The impact-digraph-map of dimensions

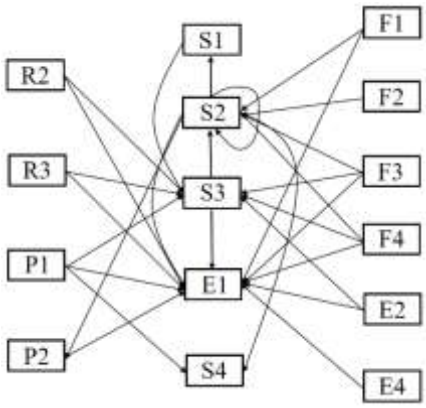

Figure 3: The impact-digraph-map of criteria

In Figure 2, it can be seen that evaluation dimensionshave interaction and feedback relationships.Thus, we obtain the weights of evaluation dimensions by the concept of FANP. We use the total direct-relation matrix $\tilde{T}$ of evaluation dimensions to get weights. Since the total direct-relation matrix $\tilde{T}$ is a geometric series. After timing to the 4rd power, it reaches the limit, the influence degree is stabilized, which generates a stable result. The weights of evaluation dimensions for FANP method is shown in Table 5.Similarly, this method can also calculate the weight value of the criteria, as shown in Table 6.

Next, the weights of evaluation dimensions are different from the ones of independent structure. These values obtained are lower but more accurate because these include three weighted conditions: independent, dependent and interaction. And then we rank three weights include two problems:

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independent and interaction. And then we rank three portal websites with SAW which is illustrated in Table 7.

In the criteria, we can see that evaluation criteria have interaction relationships in Figure 3. Then, we adopt the weights of the key criteria in Table 6 to rank the three portal websites by SAW, as shown in Table 8. From Table 8, it can be seen that the performance value of website C is the highest. In fact, the portal website C is ranked No. 1 in website rankings of China Webmaster. This means that portal website C is preferred and used by everyone. Therefore, we will establish a key success factor that portal website service quality is based on.

Table5: The weights of dimension for FANP method

Dimensions	Weights
Responsiveness	0.178 (0.161, 0.175, 0.199)
Personalization	0.192 (0.184, 0.190, 0.203)
Site features	0.204 (0.196, 0.200, 0.215)
Security/ privacy	0.222 (0.208, 0.224, 0.234)
Effectiveness	0.204 (0.192, 0.202, 0.212)

Table6: The weights of criteria for FANP method

Criterion	Weights	Criterion	Weights
R1	0.052 (0.040, 0.050, 0.065)	S1	0.069 (0.061, 0.068, 0.079)
R2	0.059 (0.046, 0.056, 0.075)	S2	0.079 (0.061, 0.075, 0.101)
R3	0.058 (0.052, 0.060, 0.062)	S3	0.066 (0.065, 0.066, 0.066)
P1	0.059 (0.058, 0.059, 0.060)	S4	0.057 (0.050, 0.055, 0.065)
P2	0.052 (0.047, 0.050, 0.058)	E1	0.065 (0.057, 0.069, 0.070)
F1	0.059 (0.056, 0.058, 0.063)	E2	0.050 (0.046, 0.049, 0.055)
F2	0.054 (0.048, 0.050, 0.064)	E3	0.049 (0.047, 0.049, 0.052)
F3	0.058 (0.056, 0.058, 0.060)	E4	0.055 (0.053, 0.053, 0.059)
F4	0.059 (0.053, 0.056, 0.068)		

Table7: The performance value was ranked by SAW

Dimension	Weights	Website A	Website B	Website C
Responsiveness	0.178	251.074	254.381	248.506
Personalization	0.192	152.528	155.236	160.002
Site feature	0.204	400.568	389.511	399.601
Security/ privacy	0.222	487.193	490.371	488.922
Effectiveness	0.204	370.874	380.686	375.568
Performance value		339.413(3)	340.979(2)	341.539(1)

Table8: The performance value of key criteria was ranked by SAW

Criterion	Weights	Website A	Website B	Website C
S2	0.079	80.268	83.216	89.632
S1	0.069	85.114	83.204	82.891
S3	0.066	88.210	92.661	87.982
E1	0.065	85.995	87.404	90.567
Performance value		23.646(3)	24.134(2)	24.513(1)

4.2- Discussions

In Figure 2, we can see more clearly that these dimensions: responsiveness (R), personalization (P), site features (F), security/ privacy (S) and effectiveness (E) are not independent. In the past studies, it was assumed that these dimensions are independent. Here, we prove that they have relations.

In Figure 2, security/privacy (S) affects other dimensions - responsiveness (R), personalization (P), site features (F) and effectiveness (E). It is visibly showing that the security/privacy (S) plays an important role in dimensions. Namely, these factors must be on security (S) to develop. Simultaneously, security/ privacy (S) is also influenced by effectiveness (E). These two factors are influenced by one another.

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Furthermore, the security/privacy (S) may affect itself, showing that security/privacy (S) is quite important. Next, the effectiveness of portal website must correlate with responsiveness (R), site features (F) and security/privacy (S). And the portal website with fine effectiveness needs good site features. Similarly, responsiveness must be also efficient. Thus, effectiveness (E) has positive relations. We also show that the effectiveness (E) affects responsiveness (R) and personalization (P) in Figure 2, and it is also influenced by security/privacy (S).

The operators must respond to solutions while users meet problems. This involves problems with personalization and security. Thus, it is obviously seen that responsiveness (R) is affected by site function (F), security/privacy (S) and effectiveness (E) in Figure 2. Personalization (P) affects responsiveness (R) and effectiveness (E), because portal websites can display through personalization. When users encounter problems, operators' ways are of handling personalization service. Thus, personalization affects responsiveness and effectiveness. The last dimension is the site functions. They are affected by personalization (P), security/privacy (S) and effectiveness (E). Since the use of site features, depending on the network security and system stability on connection and display, it provides complete or customized services to users. Thus, this criterion would be influenced with personalization (P), security/privacy (S) and effectiveness (E).

After analyzing the dimensions, we would illustrate the considered criteria. According to the results, we illustrate the impact-digraph-map of criteria in Figure 3. It is obvious that the fifteen criteria in total which with inner four criteria are key factors. Namely, users consider these four key criteria while using portal websites.

In user's expected criteria aspect, first, "shopping information security (S2)" is a very important criterion affecting the others. As present, online shopping has become universal. This criterion would affect how quickly one understanding customer's needs and preferences (P2), data transmission security (S1), personal information protection (S4) and system stability (E1). At the same time, it has feedback relationship. If these factors are well established, users can be relieved to purchase by online shopping. Next, the second important criterion is "data transmission security (S1)". In the transmission process, users are cautious about the safety during transaction. For the malware rampant worldwide, portal websites must execute precautionary measures. Thus, this factor is also considered by users. The related criterion is only bank card payment security (S3). Thus, data transmission security (S1) must be well established and developed to be loved by consumers.

Subsequently, the third important criterion is "bank card security (S3)". When paying by bank card, we must consider many factors such as responding customer's problems quickly (R2), solving customer's problems effectively (R3), providing personalized services (P1), catchy website (F3), service scope (F4), data transmission security (S1) and intra-site search (E2). If these factors are well established, users can be relieved to pay by bank cards. Finally, "system stability (E1)" is also an influential criterion. In the operational process, failing the online connection is not welcomed. Once the system is unstable, users do not like to operate it. Thus, the website will be gradually eliminated. Responding customer's problems quickly (R2), solving customer's problems effectively (R3), providing personalized services (P1), understanding customers' needs and preferences (P2), function operation friendly (F1), catchy website (F3), service scope (F4), shopping information security (S2), bank card payment security (S3) intra-site search (E2) and information layout (E4) are all influenced by system stability (E1). If these four key criteria are good, the portal website would be preferred and used by the majority.

V. CONCLUSION

Thanks to the advancement of IT, people can connect to various websites around the world via the Internet in anywhere. Thus, they can easily get the latest and fastest information. And the portal website is the direct gate to enter the Internet, it is not only the origin of information access but also the entrance to business and operations. However, the measure of service quality of portal websites is often of a multi-criteria problem rather than a single criteria issue. Furthermore, service quality has the characteristics which are not easily measured and intangible. Utilizing precise values does not express evaluator's cognition for service quality of portal website. Thus, this paper applies Fuzzy DEMATEL to solve the problem of integrating group decision-making and to find key success factors. The results of the paper show that security/privacy (S), effectiveness (E) and site features (F) are the key dimensions of service quality, while shopping information security (S2), data transmission security (S1), bank card payment security (S3) and system stability (E1) are key criteria. In addition, for the evaluation of service quality of portal websites, the performance values are ranked by SAW. Based on that, this paper offers the results to the operators for enhancement service quality of portal website.

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