Comprehensive Evaluation System and Selection Method of Tax Software

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Received: January 19, 2011 Accepted: March 2, 2011 doi:10.5539/cis.v4n3p60

Foundation items: The article was funded by National 863 Project (2006AA04A126), Project of National Natural Science Foundation (70771037) and the humanities and social sciences research of the Department of Education(09YJC630055), the Natural Science Foundation of Anhui Province of China under Grant No.090416247

Abstract

Tax software has direct influence on the work efficiency and service quality of tax department. How to evaluate objectively and make the correct choice are problems that must be solved in the construction of tax informationization. The comprehensive evaluation system of tax software is firstly designed by its performance factor, developer factor and cost factor according to the industry characteristics of tax work, Then, corresponding evaluation selection method is given which combined by weighted arithmetic averaged operator. The software section of the state taxation bureau in certain city is taken as an example to explain the effectiveness of the evaluation system and method.

Keywords: Tax software, Evaluation system, WAA operator

Informationization construction is an effective way to improve work efficiency and optimize tax work environment(Jin, Renqing, 2002). With the continuous improvement of informationization construction level, different kinds of tax software are developed and used, for example, tax declaration software, tax evaluation software, tax audit software(Li, Yanjji, 1999)(Li, Yanjji, 1999). The State Administration of Taxation put forward the requirement of organizing and developing tax-paying credit rating software in 2010 in the 2010-2012 tax-paying service work plan of national tax system(Jiang, Lihua, 2007). Different from other industry software, because the development of tax software started late and lack experience for reference in China, and some software need related historical data to support, whose quality influences directly the work efficiency and service quality of tax department, a complete and effective evaluation system and method is necessary, which not only provides reference for users to choose software, but also designs the clear direction for the development of tax software.

The comprehensive evaluation system of tax software is firstly designed by its performance factor, developer factor and cost factor according to the industry characteristics of tax work, and then gives corresponding evaluation selection method based on the principle of weighted arithmetic averaged operator. The software section of state taxation bureau in certain city was taken as an example to introduce the specific application of the evaluation system and method.

1. Comprehensive evaluation system of tax software

1.1Software performance

Software performance quality is a primary consideration in the evaluation system. The common quality evaluation models from 1970s up to date are: MaCall(1977), Boehm(1978), FUEPA(1987), ISO/IEC 9126: 1991(1991), IS0/IEC9126: 2001(2001). (WONG B, JEFFERY R. 2002). IS0/IEC9126:2001(2001) has been widely accepted and applied.

The article takes this as reference to set six indexes for the performance evaluation of tax software:

1) Usability: the software has a friendly user interface, error messages are clear and easy to be understood, the interfaces styles of different modules are consistent and the output of results is direct and reasonable.

2) Accuracy: the design of model is scientific and it can reflect practice situations of tax work generally; the software has accurate and clear hints for common operation errors of users, and has warnings and

acknowledgements about the deletion of important data.

3) Sharing: The index systems, code systems and standards systems between different software, software and public management departments are consistent.

4) Stability: keeping the operation of the software smoothly, low failure rate, easy to the maintenance.

5) Extendibility: the design of software foundation frame is reasonable; when the business needs change, software adapts to the changes in time and adds new functions to the system flexibly.

6) Security: providing effective security to ensure the safety of storage system, operation system and database system, especially business application system.

1.2 Developer factor

As the main body of software development, the factors such as the technical levels and experiences of developers determine the performance quality of software. In the specific field of tax software, developer factor has more obvious influence on software. Therefore, when tax departments choose corresponding software, they should consider the influence of developer.

1) Related software development experience: developer's experiences accumulated in the former related software development may be beneficial for better understanding software functions requirements and designing frames.

2) Technology development capabilities: developer's technology development capabilities decide whether the software is finished on time and achieves its design requirements.

3) Quality of technical support service: After the development of software is finished, it is may be updated with business expansion. Without perfect technical support service, usable functions of software will decrease gradually and finally leave unused.

1.3 Cost factor

Cost factors mainly include three aspects as follows:

1) Software development factor: averaged the fees needed by developer in the total process from investigation, analysis, design, coding test.

2) Training fees: averaged the fees that developer takes training about software application for tax staff.

3) Upgrade and maintenance fees: averaged the fees that developer makes changes and extension in software according to business extension.

After confirming each evaluation factor, their weights need to be ensured further. There are two kinds of methods to subjectively or objectively determine the weight of indexes and the article adopts subjective method to obtain the weight of each index as shown in table 1.

2. Evaluation section method

After establishing perfect evaluation system, scientific evaluation section method is needed. In the practical process of decision making, the easiest information form for decision makers to express their preferences is natural language when they make judgments, for example, "Good" and "in", "poor", so recently research on theories and methods for group decision-making based on natural language evaluation information has aroused scholars' wide attention home and abroad(Wang, Xinrong & Fan, Zhiping, 2003)(Ding, Yong, Liang, Changyong, et.al. 2010)(Wang, Xiaodun & Xiong, Wei, 2010). Considering that the other indexes except cost factor in the evaluation system cannot be given accurate values to describe, the article adopts linguistic form to describe evaluation information, and uses weighted arithmetic averaged operator to aggregate the evaluation information that experts give and choose optimal solution.

2.1 Description of linguistic evaluation information

The state taxation bureau in certain city plans to develop tax-paying credit rating software. Supposed $X=\{x_1,x_2,x_3\}$ are the solutions of software provided by three developers, $D=\{d_1,d_2,d_3\}$ is a group of experts who participate in evaluation section, $U=\{u_1,u_2\ldots\ldots u_{12}\}$ are factors for evaluation section, $S^q=\{s_i^q \mid i\in(0,1,...q-1)\}$ are linguistic term sets for evaluation, for example, good, indifferent, bad, among which S_i^q expresses the phrase *i* in S^q, q is called the granularity of S^q .

For arbitrary granularity of S^q, it should satisfy the following properties(Chen, Yan, Fan, Zhiping & Chen, Xia, 2007):

1) Order property: if $i \succ j$, then $S_i^q \succ S_j^q$.

2) existing an inverse operation: there is negative operator $\mathrm{neg}\left(s_i^{\ q}\right) = s_j^{\ q}$, so that $j = q - i$.

3) maximum operation: if $s_i^{\ q} \geq s_j^{\ q}$ (no worse than), then $\max\left\{s_i^{\ q}, sj^q\right\} = s_i^{\ q}$.

In group decision-making, because of different habits of language description, different experts may have different linguistic phase numbers in the evaluation process, for example, the description of the expert x_1 is excellent, very good, good, indifferent, bad, very bad, extremely poor; the description of the expert x_2 may be very good, good, indifferent, bad, very bad; therefore, before aggravating the information, firstly the form of evaluation matrixes should be consistent, which averageds to express different granularities of linguistic evaluation information with the same phase in a linguistic term set for evaluation. In order to try to reduce the loss of decision-making information, the former discrete linguistic granularity $s^{\ q} = \left\{s_i^{\ q} \middle| i \in \left[0,1.....q-1\right]\right\}$ is expanded to continuous linguistic granularity $s^{\ q} = \left\{s_i^{\ q} \mid i \in [0, q-1]\right\}$. It's easy to prove that the expanded linguistic granularity still satisfies the three properties of discrete linguistic granularity. Supposed $s^{\ q} = \left\{s_i^{\ q} \middle| i \in \left[0,1.....q-1\right]\right\}$ and $s^{\ p} = \left\{s_i^{\ p} \middle| i \in \left[0,1.....p-1\right]\right\}$ are two arbitrary continuous linguistic granularity, their conversion function is defined as(Xu, Zeshui, 2005):

$$F : s^q \to s^p \qquad i' = F\left(i\right) = i\frac{p-1}{q-1} \tag{1}$$

$$F^{-1} : s^p \to s^q \qquad i = F\left(i'\right) = i'\frac{q-1}{p-1} \tag{2}$$

Using the formulas (1), (2), the evaluation information of different linguistic evaluation granularities the experts give can be consistent.

In the article, the evaluation information about solution x_1, x_2, x_3 of experts groups before and after conversion is shown in the table 2.

2.2 Weighted arithmetic averaged operator

Weighted arithmetic averaged operator is a common decision-making method in multi-attribute decision making. To obtain aggregation results through weighing the data has wide application in solution evaluation, talent evaluation and sporting events.

Definition (Xu, Zeshui, 2004): Supposed $WAA : R^n \to R,$ if $WAA_w(a_1, a_2, ..., a_n) = \sum_{j=1}^{n} w_j a_j$, among which $\omega = \left(\omega_1, \omega_2, ...\omega_n\right)$ are weighting vectors $w_j \in [0,1]$, $\sum_{j=1}^{n} w_j = 1$ of a group of dada $\left(a_1, a_2 ... a_n\right)$, then the function WAA is weighted arithmetic averaged operator.

The converted S_i^q is seen as a_j and the evaluation results of experts d_1 , d_2 , d_3 are obtained through weighted arithmetic averaged operator respectively as shown in the table 8.

The weights of experts are defined 0.40, 0.30, 0.30 respectively . By weighted arithmetic averaged operator, the evaluation results are obtained as follows: $\chi_1 = 4.0019$, $\chi_2 = 4.2799$, $\chi_3 = 3.4051$.

Solutions x_1, x_2, x_3 have their own characters in each evaluation index, so there's not the situation that a solution is inferior to others obviously, and linguistic evaluation granularities of experts d_1, d_2, d_3 are

different so it's difficult to make judgment directly. The article draws quantitatively the conclusion that x_2 is the optimum through comprehensive evaluation through granularities conversion functions and WAA operators so as to provide objective proof for the section of solution.

3. Conclusions

Tax software has important influence on raising tax work efficiency and improving tax service quality. The article combines the industry characteristics of tax and establishes comprehensive evaluation system, which includes three subsystems and twelve individual indexes, allows experts to evaluate in form of language, and make use of conversion function to make linguistic granularities of evaluation information become consistent so as to conform to practical decision-making environment more. WAA operator can aggregate consistent evaluation information effectively and thus make optimal choice. The evaluation system and method not only provides reference for users to choose software, but design definite direction for tax software development. Of course, because the development of tax software starts too late in China and its evaluation is an important but difficult field, the setup of indexes of the evaluation system in the article still needs to be refined further, which will become perfect and mature gradually in the practice.

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Table 1. Comprehensive evaluation system and index weight of tax software

target layer	subsystem	individual index	weight
Comprehensive evaluation system of tax software	Software performance A 0.6	Usability A_1	0.08
		Accuracy A_2	0.12
		Sharing A_3	0.10
		Stability A_4	0.10
		Extendibility A_5	0.10
		Security A_6	0.12
	Developer factor B 0.2	Related software development experience B_1	0.08
		Technology development capabilities B_2	0.08
		Quality of technical support service B_3	0.06
	Cost factor C 0.2	Software development factor C_1	0.08
		Training fees C_2	0.03
		Upgrade and maintenance fees C_3	0.05

Table 2. the decision-making matrix given by the decision-maker d_1 using linguistic term set for evaluation of granularity 7

	A_1	A_2	A_3	A_4	A_5	A_6	B_1	B_2	B_3	C_1	C_2	C_3
χ_1	s_3^7	s_4^7	s_6^7	s_3^7	s_4^7	s_5^7	s_4^7	s_5^7	s_4^7	s_5^7	s_4^7	s_3^7
χ_2	s_4^7	s_5^7	s_5^7	s_4^7	s_3^7	s_4^7	s_2^7	s_6^7	s_5^7	s_6^7	s_5^7	s_2^7
χ_3	s_2^7	s_3^7	s_5^7	s_2^7	s_3^7	s_3^7	s_5^7	s_3^7	s_3^7	s_4^7	s_3^7	s_4^7

Table 3. the decision-making matrix given by the decision-maker d_2 using linguistic term set for evaluation of granularity 5

	A_1	A_2	A_3	A_4	A_5	A_6	B_1	B_2	B_3	C_1	C_2	C_3
χ_1	s_2^5	s_2^5	s_4^5	s_1^5	s_2^5	s_3^5	s_2^5	s_3^5	s_2^5	s_3^5	s_2^5	s_1^5
χ_2	s_2^5	s_3^5	s_3^5	s_2^5	s_1^5	s_3^5	s_1^5	s_4^5	s_4^5	s_4^5	s_3^5	s_1^5
χ_3	s_1^5	s_2^5	s_4^5	s_1^5	s_2^5	s_2^5	s_4^5	s_1^5	s_2^5	s_2^5	s_1^5	s_2^5

ISSN 1913-8989 E-ISSN 1913-8997

Table 4. the decision-making matrix given by the decision-maker d_3 using linguistic term set for evaluation of granularity 9

	A_1	A_2	A_3	A_4	A_5	A_6	B_1	B_2	B_3	C_1	C_2	C_3
χ_1	s_4^9	s_6^9	s_8^9	s_5^9	s_6^9	s_7^9	s_6^9	s_7^9	s_6^9	s_7^9	s_6^9	s_5^9
χ_2	s_6^9	s_7^9	s_7^9	s_6^9	s_5^9	s_6^9	s_4^9	s_8^9	s_7^9	s_8^9	s_7^9	s_4^9
χ_3	s_5^9	s_4^9	s_6^9	s_4^9	s_5^9	s_5^9	s_7^9	s_5^9	s_4^9	s_6^9	s_5^9	s_6^9

Table 5. the granulation matrix corresponding with d_1

	A_1	A_2	A_3	A_4	A_5	A_6	B_1	B_2	B_3	C_1	C_2	C_3
χ_1	3	4	6	3	4	5	4	5	4	5	4	3
χ_2	4	5	5	4	3	4	2	6	5	6	5	2
χ_3	2	3	5	2	3	3	5	3	3	4	3	4

Table 6. the granulation matrix corresponding with d_2

	A_1	A_2	A_3	A_4	A_5	A_6	B_1	B_2	B_3	C_1	C_2	C_3
χ_1	3	4	6	3	4	5	4	5	4	5	4	3
χ_2	4	5	5	4	3	4	2	6	5	6	5	2
χ_3	2	3	5	2	3	3	5	3	3	4	3	4

Table 7. the granulation matrix corresponding with d_3

	A_1	A_2	A_3	A_4	A_5	A_6	B_1	B_2	B_3	C_1	C_2	C_3
χ_1	3	4.5	6	3.75	4.5	5.25	4.5	5.25	4.5	5.25	4.5	3.75
χ_2	4.5	5.25	5.25	4.5	3.75	4.5	3	6	5.25	6	5.25	3
χ_3	3.75	3	4.5	3	3.75	3.75	5.25	3.75	3	4.5	3.75	4.5

Table 8. the evaluation results of experts

	d_1	d_2	d_3
χ_1	4.25	3495	4.178
χ_2	4.27	3.87	4.703
χ_3	3.31	3.105	3.832

ISSN 1913-8989 E-ISSN 1913-8997