Application of Artificial Intelligence Information Security Technology in the Construction of Enterprise Financial Shared Centers

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Abstract:

This work intends to assist SMEs in clarifying financial and enterprise management ideas in the functional implementation of the smart Financial Shared Service (FSS) Center and pointing out a specific optimal implementation path. To begin, this paper examines the primary variables influencing the smart FSS Center's functional orientation as a result of corporate demand and technical advancement. Then, utilizing the Grey Clustering Trigonometric function model, the smart FSS Center-oriented function Evaluation Index System (EIS) is built, and the functional evaluation indexes are weighted and evaluated. Finally, the 0-1 Integer Programming (IP) model is used to create the smart FSS Center-oriented function optimization path. Entropy Weight Method (EWM) and Decision-Making Trial and Evaluation Laboratory are used to determine the weight connection (DEMATEL). The findings demonstrate that the suggested smart FSS-oriented functional EIS overcomes challenges for domestic SMEs in building the smart FSS Center with limited cost, time, and technology. It can encourage the use of intelligent technology and innovative development in domestic FSS Centers. The findings have significant reference and guiding relevance for the establishment of China's smart FSS Centers.

Keywords: Functional orientation; Functional evaluation; Implementation path; Smart Financial Shared Service (FSS) Center; Information Security Technology

1. INTRODUCTION

Information Technology (IT) and the era of Big Data have helped popularize the Financial Shared Service (FSS) Center among Chinese Small and Medium-sized Enterprises (SMEs) [1]. In particular, an FSS Center is a new operation mode based on IT-driven management reform and technological innovation. Integrating and standardizing service management and reengineering the enterprise process can improve operation, reduce service cost, and improve service quality [2]. Under economic globalization, customized government policies, and science and technological advancement, the Enterprise Financial Model (EFM) has evolved to be more intelligent and digitalized [3]. As a result, the new generation of IT, such as Big Data, Artificial Intelligence (AI), Mobile Internet, Cloud Computing (CC), Internet of Things (IoT), and Blockchain (BC), is giving birth to the smart FSS Center [4]. Smart FSS Center upgrades and transforms traditional financial resource sharing through new technical means. It can make a broader range of enterprise services intelligent through intelligent technologies and improve traditional EFMs and Enterprise Process Management (EPM) [5].

Currently, the basic processes for SMEs to establish smart FSS Centers are chaotic, and no consideration is given to SMEs' different functional orientations at different stages [6,7]. Establishing a smart FSS Center includes collecting customer requirements, judging problems, setting tasks, designing schemes, carrying out applications, and optimizing functions. However, many companies follow blindly and lack consistency and planning when constructing the smart FSS Center. As a result, many functional implementations are stagnant and gaining undesirable Customer Satisfaction (CSAT) [8,9]. Indeed, smart FSS Center construction is a dynamic and iterative process. Thus, a comprehensive and scientific functional Evaluation Index System (EIS) and an optimal implementation path are essential [10].

As the primary focus of this work, the function evaluation theory and implementation component of the smart FSS Center serves as the research object. The primary focus of the research is on the creation of small and medium-sized businesses' functional orientation for smart FSS Centers, as well as FSS Center-oriented EIS and the best road forward for implementing smart FSS Centers. In the first place, this research examines the functional direction of intelligent FSS Centers by considering the progression of intelligent IT and the demand for talent from SMEs. Second, it sets up a functional EIS that is targeted at the needs of SMEs' smart FSS Centers. In conclusion, the most efficient way to deploy the smart FSS Center has been suggested by taking into account both the cost and the delivery time limits. In addition, in order to evaluate the proposed smart FSS center-oriented EIS and implementation approach, a case study that is based on data from wealthy individuals is being developed. The findings point out the procedure that users should follow in order to evaluate the capabilities of the smart FSS Center. In addition to this, the research provides a feasible method for the operational deployment of the intelligent FSS Center in Chinese SMEs.

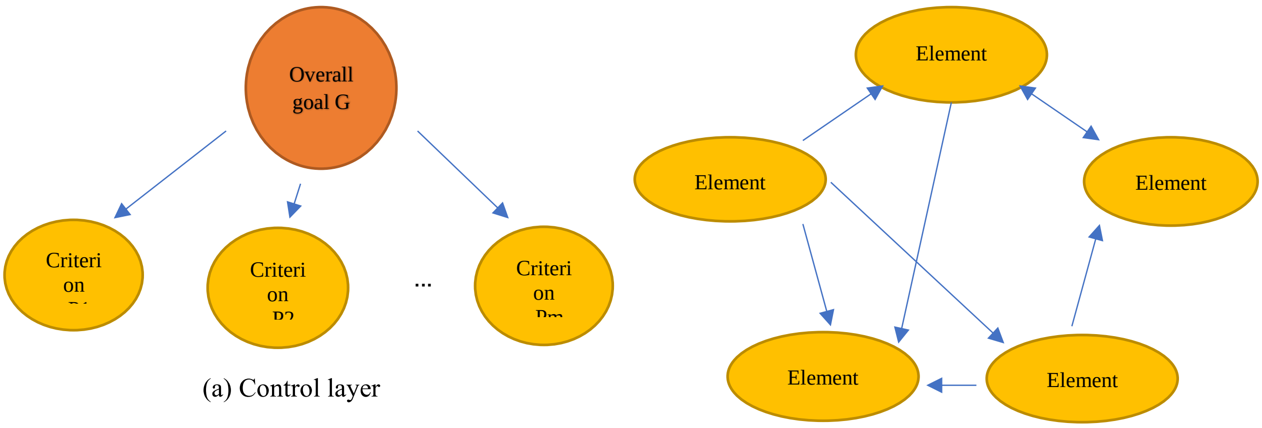
2. MODELING FINANCIAL SHARED SERVICES

2.1 Concept and characteristics of Financial Sharing

At the end of the 1990s, FSS first saw applications in some Chinese enterprises, revolutionizing their financial situation from financial management patterns, methods, and content. The idea of FSS greatly facilitated Enterprise Financial Management (EFM) and, thus, substantially improved enterprise development. Therefore, FSS has become an inevitable domestic enterprise financial development [11]. The EFM has developed rapidly with the support of management technical means and concepts, such as Customer Relationship Management (CRM) and Business Process Reengineering (BPR). Consequently, reorganization and distribution of enterprise resources become more convenient. FSS features several advantages: (1) standardization, (2) technicality, (3) scale, (4) service, and (5) marketization [12,13].

2.2 Network Analytic Hierarchy Process

Analytic Network Process (ANP), a generalization of the Analytic Hierarchy Process (AHP), selects the highest comparative significance of factors affecting the target [14, 15]. The AHP is shown in Fig. 1.



(a) Control layer

(b) Network layer

Fig. 1 ANP

This paper computes the subjective weight of ANP's smart FSS Center-oriented functional EIS. First, experts are asked to weigh each index in a Questionnaire Survey (QS) to evaluate the functional EIS. The evaluation matrix, as well as the unweighted hypermatrix and weighted hypermatrix, are constructed on this premise. Finally, the weighted functional indexes will be computed and ranked in order of relevance.

2.3 DEMATEL and Grey Clustering Evaluation (GCE)

Decision-Making Trial and Evaluation Laboratory (DEMATEL) is an experimental method for impact research and identification. It uses Graph Theory (GT) and matrix tools to identify the interaction between various factors [16, 17]. This section adopts the evaluation model of Whitenization Weight Function (WFF)-based Grey Clustering Evaluation (GCE) [18, 19]. The process of WFF-based GCE is given in Fig. 2.

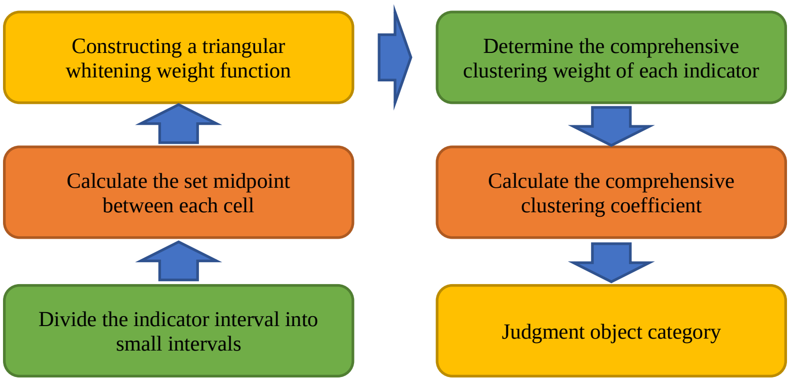


Fig. 2 Flow of WWF-based GCE

The WWF-based GCE can determine the cluster type and use it for evaluation. Meanwhile, the estimation range is very small, and the sample size is not specified. WWF-based GCE generates a result consistent with the qualitative analysis, which can judge the uncertain or incomplete information.

2.4 0-1 Programming model and KANO

0-1 Integer Programming (IP) falls into a specific Linear Programming (LP) problem: it codes decision variables only with numerical values 0 or 1 [20]. (1) gives the general form of the 0-1 IP model:

$$\max(\min)z=c_1x_1+c_2x_2+\cdots+c_nx_n$$
$$\begin{cases} a_{11}x_1+a_{12}x_2+\cdots+a_{1n}x_n \leq (=,\geq) b_1 \\ a_{21}x_1+a_{22}x_2+\cdots+a_{2n}x_n \leq (=,\geq) b_2 \\ \cdots \\ a_{m1}x_1+a_{m2}x_2+\cdots+a_{mn}x_n \leq (=,\geq) b_m \\ x_i \in [0,1] \\ a_{ij} \text{ is any integer} \end{cases} \tag{1}$$

Here, $\max(\min)z=c_1x_1+c_2x_2+\cdots+c_nx_n$ is the Objective Function (OF), and the expression in the curly bracket denotes the constraint equation or constraint condition.

KANO model, created by Dr. Noriaki Kano from the Tokyo University of Science, can subdivide and sort demands. It studies and reveals the linear or nonlinear relationship between the implementation investment in product functionalities and customer satisfaction [21]. Fig. 3 details the KANO model.

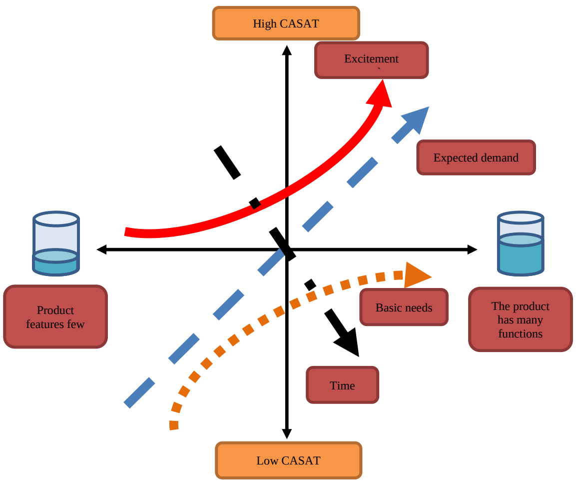


Fig. 3 KANO model demand types

According to the relationship between customer satisfaction and functionality implementation, customer needs are divided into basic needs (M), performance needs (O), excitement needs (A), indifferent (I), and dissatisfaction (R).

2.5 Function orientation analysis and EIS of smart FSS Center

According to EFM demands, a smart FSS Center can be moduled into accounting, risk management, and innovation, as illustrated in Fig. 4.

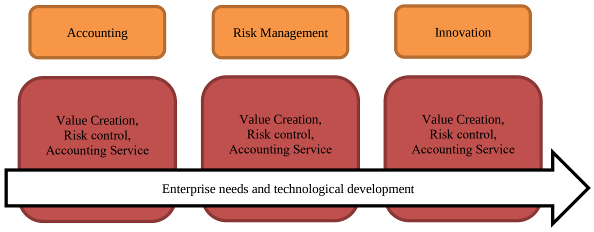


Fig. 4 Function orientation of smart FSS Center

Enterprise requirements for a smart FSS Center are always changing. As a result, three FSS modules (accounting, risk management, and innovation) are weighted differentially at different stages of enterprise development. A smart FSS Center is multi-objective and multi-dimensional and thus requires a comprehensive EIS. Accordingly, Fig. 5 demonstrates a comprehensive smart FSS Center-oriented functional EIS.

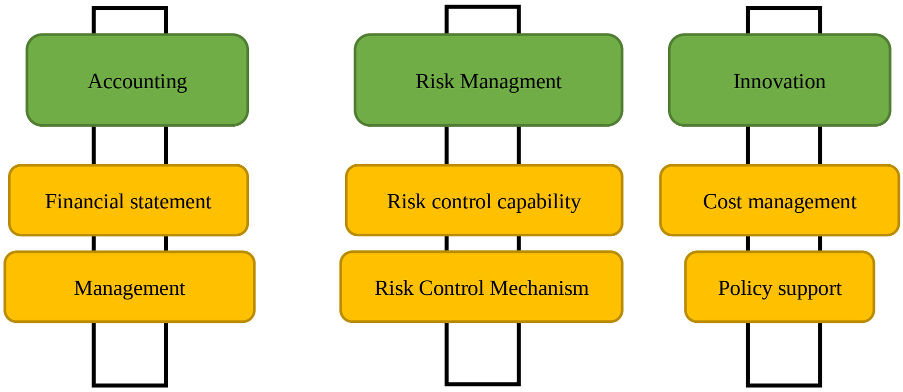


Fig. 5 Smart FSS Center-oriented functional EIS

As in Fig. 5, accounting, risk management, and innovation are all taken into account in the smart FSS Center-oriented functional EIS in accordance with their respective functional connotations. The three basic indexes are then broken down further into supplementary indexes, which can include things like financial statements, risk control capability, and cost management.

2.6 Subjective weighting EIS by ANP

Step1: Construct the judgment matrix of the smart FSS Center.

According to the proposed smart FSS Center-oriented functional EIS, three primary indexes (accounting, risk management, and innovation) are denoted as P_1, P_2, and P_3 in the standard layer. Then, six secondary indexes are represented by $C_1,C_2,\ldots,C_6$ in the network layer. Specifically, C_i comprises $e_{i1},e_{i2},\ldots,e_{in}(i=1,2,\ldots,6)$. Further, the secondary indexes are comparatively analyzed to determine whether there is an interactive relationship between the indexes. Afterward, $P_m(m=1,2,3)$ is cited as the main criterion, and ejl in e_{jl} is taken as the sub-criterion to compare the relative significance of two elements. The significance is scored on the 1-9 scale. Finally, the judgment matrix is constructed: $A=(a_{mn})_{n_i*n_i}$.

Step 2: Determine unweighted hypermatrix

The judgment matrix $A=(a_{mn})_{n_i*n_i}$ is standardized and transposed to obtain the root vector $w_{in_i}^{(jl)}$. Then, the consistency of the judgment matrix is verified. Simultaneously, the ranking vector is attained through the eigenvector, marked W_{ij}, as expressed in Eq. (2).

$$W_{ij}=\begin{bmatrix} w_{i1}^{(j1)} & \cdots & w_{i1}^{(jn_i)} \\ \cdots & \cdots & \cdots \\ w_{in_i}^{(j1)} & \cdots & w_{in_i}^{(jn_i)} \end{bmatrix} \tag{2}$$

Then, by combining the ranking vectors of each network layer element, the unweighted hypermatrix W is obtained, as exhibited in Eq. (3).

$$W=\begin{matrix} 1 \\ \cdots \\ n_1 \\ 1 \\ \cdots \\ n_2 \\ \cdots \\ 1 \\ \cdots \\ n_N \end{matrix}\begin{bmatrix} W_{11} & W_{12} & \cdots & W_{1N} \\ W_{21} & W_{22} & \cdots & W_{2N} \\ \cdots & \cdots & \cdots & \cdots \\ W_{N1} & W_{N2} & \cdots & W_{NN} \end{bmatrix} \tag{3}$$

Step 3: Obtain weighted hypermatrix

In order to obtain the order of significance, the unweighted hypermatrix must be standardized first. Then, the significance judgment matrix of all functions and the unweighted hypermatrix are multiplied by "$\overline{W}=a_{ij}W_{ij}$, a_{ij} to get the weighting factor. Finally, the weighted hypermatrix is $\overline{W}=(\overline{W})_{m\times n}$ determined.

Step 4: Determine the weight of evaluation indexes

Here, the stability of the hypermatrix is weighted to clarify the influence of the functional evaluation indexes. Meanwhile, the limit of the weighted hypermatrix is calculated by Eq. (4) as $\overline{W}^{\infty}$. If the limit converges and is unique, a row of the matrix corresponds to the stability weight of an evaluation index.

$$\overline{W}^{\infty}=\lim_{k\to\infty}\left(\frac{1}{N}\right)\sum_{k=1}^{N}\overline{W}^{k} \tag{4}$$

2.7 Objective weighting EIS by Entropy Weight Method (EWM)

EWM is an objective weighting method to judge the dispersion of index scores. The higher the scored difference by the evaluation objects on the same index, the larger the index weight is. The specific steps of EWM are as follows:

Step 1: build the function evaluation matrix of the smart FSS Center. $p=\{p_1,p_2,...,p_m\}$ represents the evaluation object. $u=\{u_1,u_2,...,u_n\}$ denotes the function evaluation index, and p_{ij} refers to the significance scored by the evaluation object $p_i(i=1,2,...,m)$ on index $u_j(1,2,...,n)$. Finally, the evaluation matrix $P=\left(p_{ij}\right)_{n\times m}$ is obtained.

Step 2: standardize the evaluation matrix. $a_{ij}=\frac{p_{ij}}{\sum_j^m p_{ij}}$ standardizes the evaluation matrix P into $A=\left(a_{ij}\right)_{n\times m}$.

Step 3: calculate the entropy weight of the functional index. The entropy weight of the functional index of item i is $e_i=\sum_{j=1}^{m}a_{ij}\ln a_{ij}$. Let $r_i=\frac{1}{e_i}$, then the function is weighted $v_i=\frac{r_i}{\sum_{i=1}^{n}r_i}$, and $\sum_{i=1}^{n}v_i=1$.

Finally, the weight of the functional index $u=\{u_1,u_2,...,u_m\}$ can be obtained as $\sum_{i=1}^{n}v_i=1$

Now that ANP and EWM are respectively used to weight the function evaluation index, the comprehensive optimization weight of each function evaluation index is calculated by Eq. (5):

$$\lambda_i=\frac{w_i v_i}{\sum_{i=1}^{n}w_i v_i} \tag{5}$$

In Eq. (5), w_i and v_i are the weight of the ANP and EWM, respectively.

2.8 ANP model implementation

In the first step of the process, the impact evaluation matrix of the smart FSS Center-oriented EIS is constructed. On the other hand, due to the fact that the ANP system's calculation steps are laborious, the Super Decision (SD) software is utilized for the purpose of data processing[22-24]. After that, the ANP functional evaluation model that is targeted toward the smart FSS Center is applied, as portrayed in Fig. 6.

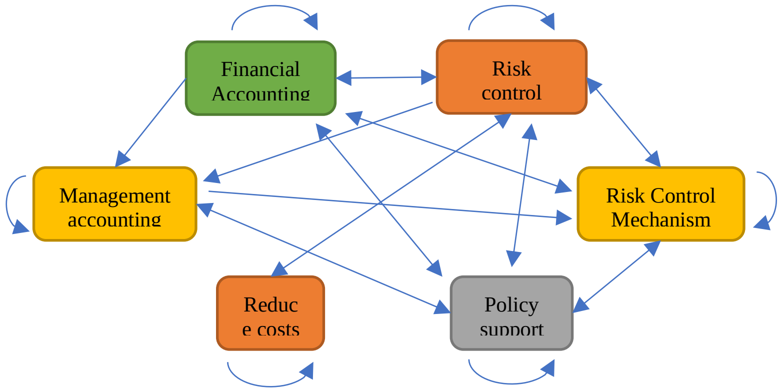


Fig. 6 Structure of smart FSS Center-oriented ANP functional evaluation model

Apparently, there is an interactive relationship between FSS functional evaluation indexes. The detailed rules of each index also have internal correlations. Therefore, the subjective weighting cannot be completed only by the ANP method. The introduction of software calculation can also improve the calculation accuracy and provide a reliable foundation for subsequent tests.

2.9 Research on the implementation path of smart FSS Center

The implementation path of the smart FSS Center is charted in Fig. 7.

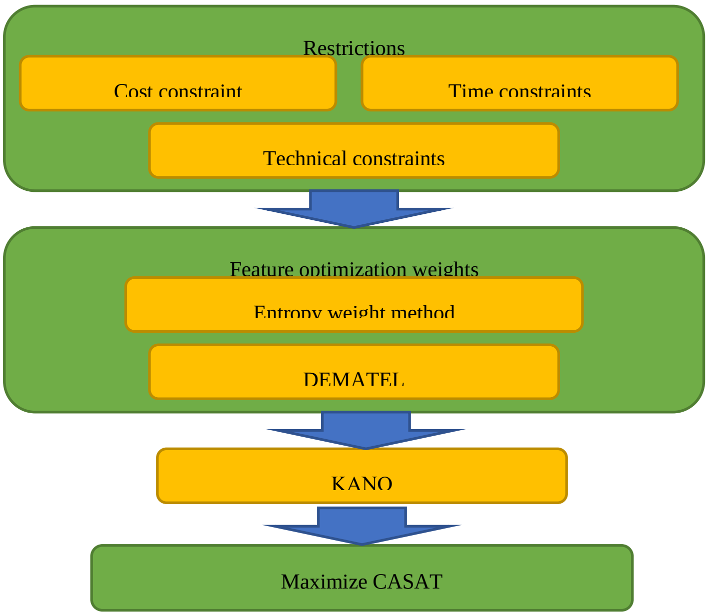


Fig. 7 Implementation path and thought of smart FSS Center

In Fig. 7, the 0-1 IP model establishes the implementation path of the smart FSS Center. The goal constraint function is established by factoring in cost management, work time limit, and technology. The OF is established with respect to maximizing CASAT by fusing EMW, DEMATEL, and KANO theory. Finally, the optimal scheme is proposed for the functional implementation of the smart FSS Center.

The five grade scale on CSAT QS is set as follows: all functions have not been realized; most functions have been realized; basic functions have been realized; a small part of the functions have been realized; no functions have been realized. Users can use a number from 0 to 100 for evaluation. The CSAT function is counted by Eq. (6).

$$S_i(d)=\frac{1}{m}\sum_{j=1}^{m} S_i^j(d), d=1,2,3,4,5 \tag{6}$$

Here, $S_i^j(d)$ represents the CSAT of user j on function R in terms of implementation degree d(d=1,2,3,4,5), and $S_i^j(d) \in [0,100]$. The expected CSAT is calculated based on m users' evaluation of function R_i.

User evaluation is mainly affected by the demand significance, type, and demand implementation. Therefore, the maximization OF of user evaluation for function optimization of smart FSS Center is expressed by Eq. (7).

$$MaxZ = \sum_{i=1}^{n} x_i w_i^T f_i(d) \tag{7}$$

In (7), x is the decision variable, and w_i^T denotes the correction weight of the *i*th function. $f_i()$ denotes the maximum CSAT function.

3. RESULTS AND DISCUSSION

3.1 Case analysis

By analyzing the QS results, the evaluation results of the functions of the z Group's smart FSS Center are plotted in Fig. 8.

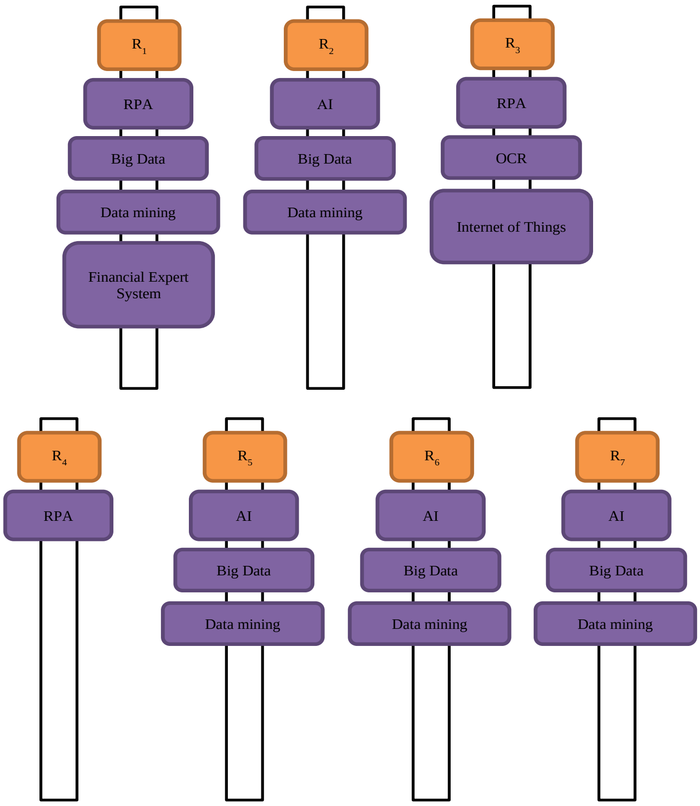


Fig. 8 Function optimization objectives and intelligent technology of z Group smart FSS Center

According to Fig. 8, the specific optimization objectives of z Group are plan formulation (R_1); budget evaluation (R_2); invoice duplication/verification (R_3); tax application (R_4); tax risk monitoring (R_5); investment/financing cost evaluation (R_6); and operational risk prevention (R_7). The present work investigates all intelligent technologies in z Group and matches them with various functions.

3.2 Determining the initial weight of optimization objective by EWM

According to the function optimization goal of the smart FSS Center, all functions are subdivided into different business modules, represented by $=(R_1,R_2,...,R_n)$. The EWM determines the initial significance of function optimization. m users of the enterprise's smart FSS Center form an expert panel $U=(U_1,U_2,...,U_m)$ to score the significance of function optimization objectives.

Step 1: based on the questionnaire method, the expert panel used the scale of 1, 3, 5, 7, and 9 to score the significance of the function optimization goal $R=(R_1,R_2,...,R_n)$, making a preliminary judgment. Then, they score the significance of the function optimization index. Finally, the initial weight of the function is obtained through the EWM: $w^0=(0.125,0.228,0.145,0.126,0.109,0.145,0.123)$. Further, DEMATEL is used to modify the function weight so that the interaction of various special functions can be expressed in the form of a matrix Y:

$$Y=\begin{bmatrix} 0 & 7 & 0 & 0 & 0 & 5 & 3 \\ 3 & 0 & 0 & 0 & 0 & 7 & 7 \\ 0 & 0 & 0 & 3 & 9 & 7 & 3 \\ 0 & 0 & 1 & 0 & 3 & 3 & 0 \\ 0 & 3 & 7 & 1 & 0 & 5 & 7 \\ 1 & 7 & 5 & 1 & 3 & 0 & 9 \\ 0 & 5 & 3 & 0 & 7 & 7 & 0 \end{bmatrix} \tag{8}$$

Next, the matrix is standardized to obtain the correction significance of the function to be optimized:

$$w^0=(0.111,0.132,0.166,0.057,0.175,0.188,0.171) \tag{9}$$

3.3 Function optimization

According to the investigation of the suppliers of z Group and the FSS Center, the project cost is expected to be no more than 200,000 RMB for the function optimization of z Group's smart FSS Center. The delivery date is within four months. The minimum-scale implementation of $R_1,\ldots, R_4$, R_5 and R_6, and R_7 is 4, 3, and 4, respectively. Then, according to the experience, Fig. 9 estimates the cost of each function optimization time and technology maturity.

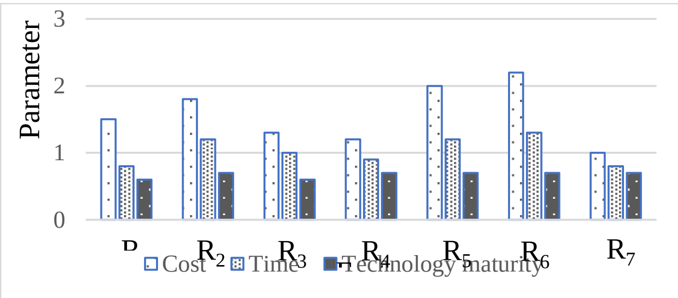


Fig. 9 Time and cost of function optimization

On the basis of the constraint needs and the satisfaction function, an establishment can be made concerning the implementation path model of the smart FSS Center for z Group. After that, in accordance with the 0-1 IP mode, the Lingo software model is utilized to compute the threshold for optimum functional satisfaction, which is determined to be 50.67. The optimal implementation path of the smart FSS Center, taking into account the constraints of cost, time, and technical conditions, refers to the use of information technology to optimize five primary functions. These functions are the evaluation of the budget, the duplication and verification of invoices, the monitoring of tax risk, the evaluation of investments and financing, and the warning of potential business risks.

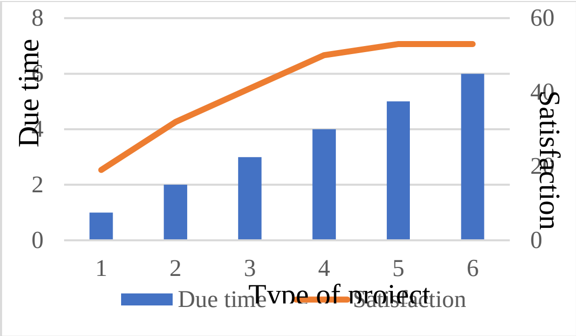
This works studies CASAT optimization as an OF determined by the delivery time limit and cost. Therefore, the sensitivity analysis is conducted to study the negative impact of the delivery time limit and cost on CASAT, as listed in Tables 1 and 2. The change curve is plotted in Fig. 10.

Table 1 CASAT under different delivery times

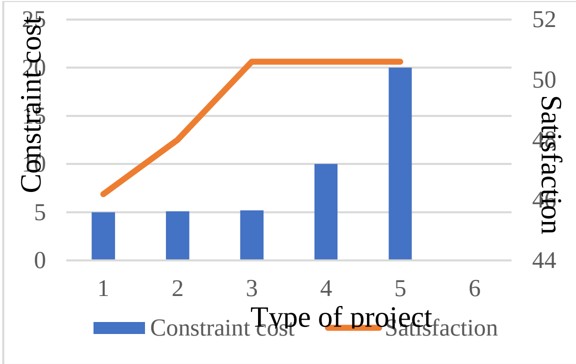
Delivery time/month	1	2	3	4	5	6
CASAT	19	32	41	50	53	53

Table 2 CASAT under different cost constraints

Cost constraint/10,000 RMB	5	5.1	5.2	10	20
CASAT	46.2	48	50.6	50.6	50.6



(a) Different delivery times



(b) Different cost constraints

Fig. 10 Diagram of CASAT under different constraints

Therefore, improving the delivery time limit and constraint cost improves CSAT. CSAT remains constant when the delivery time limit and constraint cost exceed the specified range. Before establishing the FSS Center, SMEs need to make a scientific and reasonable plan according to the cost and time limit to optimize CSAT with the minimum cost. In this work, the implementation path model of smart FSS Center using the 0-1 IP mode can effectively assist SMEs in putting forward implementation strategies. The proposed model can help SMEs formulate the optimal implementation route of the smart FSS Center using the limited cost and time limit and maximize CSAT.

4. CONCLUSION

The SMEs-oriented smart FSS Center has undergone significant changes thanks to the assistance of BDA, AI, and other information technology, which has contributed to the promotion of EFM reform. The "function evaluation and implementation path of smart FSS Center" is the primary emphasis of this body of work. In combination with the existing research theoretical basis and research results, the purpose of this work is to systematically analyze the role that the needs and information of SMEs play on the function orientation of smart FSS Centers, as well as to summarize the development path of smart FSS Centers and introduce the main content of function orientation. The ANP technique, EWM, and GCE are used in the design of the smart FSS Center-oriented EIS so that it can perform its functions in accordance with the function orientation. The integration of the EWM, DEMATEL, and KANO principles is made possible as a result of the assessment results, which also clarify the ability construction aim of the smart FSS Center. In addition, the ideal implementation route of the smart FSS Center is found to be constructed in accordance with the 0-1 IP mode.

The optimal implementation path that has been proposed optimizes function implementation in order to improve the CASAT while taking into account the production cost, time, and technological constraints. The ideal implementation path that has been given will assist SMEs in the construction of the smart FSS Center and will encourage the development of modern IT as well as upgrades to the smart FSS center's functions. The findings have significant application in the field of reference for the building of the intelligent FSS center.

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