Study on the Value Contribution Evaluation of Enterprise Financial Shared Service Center in the E-commerce Environment

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Abstract. In the e-commerce environment, with the advancement of technology, the financial management of enterprises presents the characteristics of informatization, electronization and virtualization. Financial shared service center (FSSC) ensures the timely circulation of internal financial data and information sharing, and urges the internal departments of enterprises to cooperate with each other, which makes corporate financial management more intensive and becomes a core factor for the performance of enterprises. Therefore it is an important task for enterprises to scientifically judge the value creation level of FSSC so as to understand the operating efficiency. On the basis of the analysis of the characteristics of the e-commerce environment in the digital age, this paper puts forward the concept of "value contribution", analyzes the connotation of FSSC's value contribution, and believes that the evaluation of FSSC's value contribution can objectively reflect its value creation level. Combined with the characteristics of the new business environment, the dimension and indicator set of the FSSC value contribution evaluation are reconstructed, and a comprehensive evaluation model is established based on the principle of game theory and the set pair analysis, where the weight vector of the indicator is determined by a comprehensive weight method, and the concept of "connection degree" is introduced to quantitatively analyze the key performance. A case study is conducted in the end, and the result of which shows that the FSSC system has a great value contribution in four aspects: supporting business development, achieving financial goals, optimizing operation management and controlling risk occurrence, but it does not perform well in promoting employee development and taking social responsibility.

Keywords: e-commerce environment · FSSC's value contribution · comprehensive weights · game theory · set pair analysis · evaluation

1 Introduction

In the e-commerce environment, the operation of the FSSC system is related to the overall development of the enterprise as it influences the trading efficiency. Researching and establishing a scientific operation evaluation system to objectively evaluate its

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function will help the enterprise to deeply understand the value creation and shortcomings of the FSSC, which is of great significance for enterprises to implement continuous improvement both in economic and social dimensions.

At present, scholars' studies on FSSC mainly focus on two aspects: one is the optimization of FSSC system and business process modules under the background of the wide application of new technologies. For example, Reference [1] tried to improve and optimize the operation process of enterprise financial information sharing based on the defect analysis of the financial information system of traditional commercial and trade circulation enterprises; Reference [2] studied the use of block chain technology on the re-optimization of FSSC system based on the perspective of business and financial integration; Reference [3] studied the optimization of FSSC accounts payable module based on RPA technology; The other is the performance evaluation of FSSC. For example, Reference [4] and [5] studied the FSSC management performance evaluation based on the application of the Balanced Scorecard, and analyzed the indicator weights through the analytic hierarchy process.

The existing studies have played a positive role in the upgrading and optimization of FSSC, and some study results are quite valuable. In order to enhance the understanding of the operation of the FSSC system and more accurately measure the level of its value creation, this paper reconstructs the evaluation dimensions and indicators set through analyzing FSSC's characteristics in new business environment, and establishes a comprehensive evaluation model by combining subjective and objective method of set pair analysis to evaluate FSSC's value contribution, and at the end a case analysis is implemented to verify the effectiveness of the evaluation method.

2 Methodology of FSSC's Value Contribution Evaluation

2.1 Evaluation Dimension and Indicator System

The e-commerce environment in the digital age presents five characteristics: the emergence of strong individuals, the change in the relationship between organizations and individuals, the strong link relationship, the factors that affect organizational performance shift from internal to external, technological innovation and the popularization of technological innovation. The speed of development has accelerated, and managing uncertainty has become the core of organizational management. The organization no longer has a steady state structure, "symbiosis has become the evolutionary path of future enterprise organizational development.

Different from the BSC four-dimensional evaluation model [6], this paper decomposes the FSSC strategic objectives from six dimensions that reflect the connotation of FSSC value contribution in the e-commerce environment, and obtains six-dimensional criterion level indicators W1, W2, W3, W4, W5 and W6. The first four dimensions are basically consistent with the traditional BSC evaluation model, and the two additional dimensions are social responsibility and risk control, because under the new business environment, as an organizational unit of society, if enterprises want to develop symbiotically with society, they must take the initiative to enter the society, integrate across borders, undertake certain social responsibilities, and enhance the value of goodwill. As for the financial risks control, by reducing costs and losses, it can help better manage

the "uncertainty" of future business, and improve corporate management performance. As shown in Table 1.

2.2 Determination of Indicator Weights

The indicator weight is an important parameter in the evaluation system. If the weight setting is unreasonable, it cannot reflect the real situation of the evaluation object. Most assessment calculations use a simple weighted average method, which is too crude. Using a single weight determination method has defects such as strong subjectivity and inability to take into account the horizontal influence between indicators, which easily

Table 1. HIERARCHICAL MODEL AND KEY PERFORMANCE INDICATOR SET

Target	Dimension	KPI	Dimension	KPI
FSSC's Value Contribution Level (P)	Supporting Business Development (W1)	Customer service satisfaction (W11)	Promoting Employee Development (W4)	Employee satisfaction (W41)
		Contract renewal rate (W12)		Employee loyalty (W42)
		Service agreement fulfillment (W13)		Employee innovation conversion rate (W43)
		Customer complaint handling rate (W14)		Training plan execution rate (W44)
		-		Skills exam pass rate (W45)
		-		Employee opinion acceptance rate (W46)
	Achieving Financial Goals (W2)	Turnover achievement rate (W21)	Social Responsibility (W5)	Internships and employment (W51)
		Profit margin (W22)		Number of teachers from industry (W52)
		Cost of business ratio (W23)		Number of industry-university-research cooperation projects (W53)
		Cost control rate (W24)		Social training person-times (W54)

(*continued*)

Table 1. (*continued*)

Target	Dimension	KPI	Dimension	KPI
	Optimizing Operation Management (W3)	Business completion rate (W31)	Risk Control (W6)	Risk management intelligence rate (W61) Risk handling efficiency (W62) Violation operation identification rate (W63)
		Process standardization Rate (W32)		
		Business pass rate (W33)		
		Business processing efficiency (W34)		

leads to weight distortion. Aiming at the above problems, a combination of subjective and objective methods based on the principles of game theory—the comprehensive weight method of game theory [7, 8] is proposed.

Various weight calculation methods are used to calculate the FSSC value contribution indicator, and [w_1, w_2, w_s] is to represent the basic weight vector set, the formula (1) represents the linear combination of the s weight vectors w_k:

$$w = \sum_{k=1}^{s} \alpha_k \, w_k^T \tag{1}$$

where α_k is the linear combination coefficient, $\alpha_k > 0$, w is a possible weight vector under the basic weight vector set. The possible weight set can be expressed as:

$$\left\{ w | w = \sum_{k=1}^{s} \alpha_k \, w_k^T \right\}$$

In order to find the consistency or compromise of the weight value, optimizing the s linear combination coefficients α_j in formula (1), so that the dispersion between the weight vector w and each weight vector $w_k$canbe minimized. Formula (2) is the introduced strategy model:

$$\min \left\| \sum_{k=1}^{s} \alpha_j \, w_j^T - w_i^T \right\| \tag{2}$$

$$\sum_{j=1}^{s} \alpha_j \, w_j \, w_j^T = w_i \, w_i^T \, (i = 1, 2, \cdots, s) \tag{3}$$

Equation (3) is the optimal derivative condition of Eq. (2).Solve Eq. (3) to obtain the weight coefficient vector (α_1, α_2, α_s), and then normalize it to finally obtain the combined weight, which is expressed by Eq. (4):

$$w^* = \sum_{k=1}^{s} \alpha_k^* \cdot w_k^T \tag{4}$$

2.3 Determination of Evaluation Grade

There are many uncertainties in the evaluation of the value contribution of FSSC. In this paper the method of set pair analysis is used, and the concept of "connection degree" is introduced to transform the understanding of uncertainty into a specific mathematical problem which can be quantitatively evaluated based on a set of original data, that is, it does not require a large amount of statistical data (such as principal component analysis) as other mathematical models, and can avoid the impact of human subjective judgment or choice on the evaluation results. (such as Analytic Hierarchy Process). In this way, it can effectively improve the reliability and validity of the evaluation results.

Assuming that the indicator for evaluating the contribution of FSSC value is set Z and the level is L, the evaluation level of the to-be-evaluated indicator of the set pair J(Z, L) can be demarcated by using the connection degree. Assuming that the FSSC value contribution level is divided into four levels: great, relatively great, normal and small, which corresponds respectively to A, B, C, and D, for each indicator, the connection degree can be determined successively through formulas (5-8) [9, 10].

$$\mu_{i1} = \begin{cases} -1, x_j \in \left[s_{j(0)}, s_{j(2)}\right) \\ 1+\frac{2\left(x_j - s_{j(3)}\right)}{\left(s_{j(3)} - s_{j(2)}\right)} \\ 1, x_j \in \left[s_{j(3)}, s_{j(4)}\right) \end{cases}, x_j \in \left[s_{j(2)}, s_{j(3)}\right) \tag{5}$$

$$\mu_{i2} = \begin{cases} -1, x_j \in \left[s_{j(0)}, s_{j(1)}\right) \\ 1 + \frac{2\left(x_j - s_{j(2)}\right)}{\left(s_{j(3)} - s_{j(2)}\right)}, x_j \in \left[s_{j(1)}, s_{j(2)}\right) \\ 1, x_j \in \left[s_{j(2)}, s_{j(3)}\right) \\ 1+\frac{2\left(x_j - s_{j(3)}\right)}{\left(s_{j(3)} - s_{j(4)}\right)}, x_j \in \left[s_{j(3)}, s_{j(4)}\right) \end{cases} \tag{6}$$

$$\mu_{i3} = \begin{cases} 1 + \frac{2\left(x_j - s_{j(1)}\right)}{\left(s_{j(1)} - s_{j(0)}\right)}, x_j \in \left[s_{j(0)}, s_{j(1)}\right) \\ 1, x_j \in \left[s_{j(1)}, s_{j(2)}\right) \\ 1 + \frac{2\left(x_j - s_{j(2)}\right)}{\left(s_{j(2)} - s_{j(3)}\right)}, x_j \in \left[s_{j(2)}, s_{j(3)}\right) \\ -1, x_j \in \left[s_{j(3)}, s_{j(4)}\right) \end{cases} \tag{7}$$

$$\mu_{i4} = \begin{cases} 1, x_j \in \left[s_{j(0)}, s_{j(1)}\right) \\ 1+\frac{2\left(x_j - s_{j(1)}\right)}{\left(s_{j(1)} - s_{j(2)}\right)} \\ -1, x_j \in \left[s_{j(2)}, s_{j(4)}\right) \end{cases}, x_j \in \left[s_{j(1)}, s_{j(2)}\right) \tag{8}$$

Among them, μ_{iu} is the connection number of indicator i with level u, x_j represents the actual value of the indicator, $S_{j(0)}$, $S_{j(1)}$, $S_{j(2)}$, $S_{j(3)}$, $S_{j(4)}$are the threshold values of the evaluation level, satisfying $S_{j(0)} < S_{j(1)} < S_{j(2)} < S_{j(3)} < S_{j(4)}$. After calculating the connection degree of each key performance indicator, then using the combination weight obtained by the comprehensive weight method, the total connection degree of n indicators can be calculated by formula (10):

$$\mu_u = \sum_{i=1}^{n} \mu_{iu} w^* \tag{9}$$

μ_u is the total connection degree of the corresponding grade of the evaluation indicator u, μ_{iu} is the connection degree of indicator i corresponding to the grade u, and w^* is the combination weight. Note $\mu_p = \max\{\mu_u\}$, $p \epsilon [1, 2, \cdots, m]$, where m is the number of grades of the evaluation grade, and the FSSC value contribution can be judged as grade P.

3 Case Study

Company A is a big e-commerce company and possesses its own FSSC. The AHP and entropy weighting method are used to get the weights of the FSSC indicators, the weight value of each indicator obtained under the two methods are represented respectively by weight 1 and weight 2. The calculation results are shown in Table 2.

Applying the game theory model to get the comprehensive weight coefficient:$\alpha_1 = 0.512$, $\alpha_2 = 0.488$, and then using the combined weight solution formula to obtain the combined weight value:

Table 2. CALCULATION RESULTS OF INDICATOR WEIGHT

Indicator	Weight 1	Weight 2	Indicator	Weight 1	Weight 2
W11	0.06	0.05	W42	0.025	0.03
W12	0.04	0.045	W43	0.035	0.03
W13	0.04	0.045	W44	0.025	0.025
W14	0.035	0.03	W45	0.03	0.035
W21	0.055	0.05	W46	0.025	0.02
W22	0.06	0.055	W51	0.03	0.025
W23	0.06	0.065	W52	0.025	0.03
W24	0.06	0.06	W53	0.03	0.03
W31	0.045	0.04	W54	0.03	0.035
W32	0.045	0.045	W61	0.05	0.045
W33	0.04	0.045	W62	0.045	0.045
W34	0.04	0.045	W63	0.04	0.045
W41	0.03	0.03			

W^* =0.05512,0.04244,0.04244,0.03256,0.05256,0.05756,0.06244,0.06,0.04256, 0.045,0.04244,0.04244,0.03,0.02744,0.03256,0.025,0.03244,0.02256,0.02756, 0.02744,0.03,0.03244,0.04756,0.045,0.04244).

Combined with the above quantitative evaluation and grading standard, the connection degree of each indicator/item is calculated, the calculation results are shown in Table 3.

Further calculation, the degree of connection between each indicator and grade is obtained as grade A: $\mu = -0.196$, grade B: $\mu = 0.642$, grade C: $\mu = -0.196$, grade D: $\mu = -0.893$. The degree of connection corresponding to grade B is the largest, and the maximum value function is used to determine that FSSC's value contribution is at a relatively great level. Next step, verifying whether the evaluation results are satisfactory: since 15 of the 25 indicators are at B level, accounting for 64% of the total, and the degree of connection is bigger than 0.5, which is basically consistent with the evaluation results, which indicates that the evaluation method is reliable and effective.

The conclusion of the case study: generally, the value contribution of FSSC is at a "great" level, indicating that the FSSC system performs well. From the perspective of key performance indicators of various dimensions, the FSSC system has made a great contribution to the aspects like business support, financial goals achievement, operation management optimization and risks control, especially in optimizing the financial management of enterprises, but poor performance in promoting employee development and social responsibility.

Table 3. CALCULATION RESULTS OF THE CONNECTION DEGREE OF EACH INDICATOR

Item	A	B	C	D	Item	A	B	C	D
W11	1	0.7	-1	-1	W42	1	0	-1	-1
W12	0	1	0	-1	W43	-1	0.5	1	-0.5
W13	0.3	1	-0.3	-1	W44	-1	-0.4	1	0.4
W14	-1	-0.7	1	0.7	W45	0.5	1	-0.5	-1
W21	0	1	0	-1	W46	-0.4	1	0.4	-1
W22	1	0	-1	-1	W51	0	1	0	-1
W23	0	1	0	-1	W52	0.3	1	-0.3	-1
W24	1	0.2	-1	-1	W53	0.2	1	-0.2	-1
W31	0	1	0	-1	W54	1	0.7	-1	-1
W32	0.1	1	-0.1	-1	W61	-0.4	1	0.4	-1
W33	-0.4	1	0.4	-1	W62	1	0	-1	-1
W34	0	1	0	-1	W63	0	1	0	-1
W41	0.2	1	-0.2	-1					

4 Conclusion

As "digital intelligence" is accelerating in the e-commerce environment, this paper innovatively introduces the concept of "value contribution" to scientifically and objectively evaluate the operational performance of FSSC from the perspective of value creation, which is conducive to measuring the objective level of its value creation ability and provides a reference for the enterprise's decision-making. In this regard, compared with the traditional FSSC performance evaluation, the value contribution evaluation of the FSSC has a deeper connotation and a wider extension, which is in line with the trend of paying more attention to corporate value creation in the new business environment.

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