Research on the Costing and Data Mining Based on ABC in Logistics Firms

Dong Mu, Lingyun Zhou and Shoubo Xu

School of Economics and Management, Beijing Jiaotong University, Beijing 100044, P.R. China mueast@163.com

Abstract. The costing and data mining of logistics costs will become increasingly important to all firms seeking competitive advantages. Activity Based Costing (ABC) is considered as the optimized and most promising method of costing and controlling logistics cost now, and logistics cost data mining based on ABC is playing a very important role in business management. The paper firstly analyses the costing principle of ABC for logistics projects, and according to the basic principles of ABC and business management, the paper puts forward the basically technical route of logistics project costing and data mining based on ABC for business management and decision-making, moreover, the concrete costing process and model of applying ABC are deduced, then the further application forms of data mining based on ABC are summarized and elaborated for business management and decision-making.

Keywords: *Activity based costing, Costing, Data mining, Model, Decision-making*

l. INTRODUCTION

With the development of economy, the importance of logistics has been noticed by all countries. The growth in the importance of the logistics function has significant implications for a firm's cost accounting system and the management of logistics costs has become increasingly important due to their significant impact on product profitability, product pricing, customer profitability, and ultimately, corporate profitability. Logistics can offer a key source of competitive advantage through service differentiation or by reducing costs and increasing corporate profitability. Nowadays it develops fleetly, and it is playing a very important role in economy development, so the accounting and control of logistics costs will become increasingly important to firms seeking a competitive advantage. Logistics business is often operated according to logistics projects by logistics firms, thereby the cost of logistics project is more and more important for logistics project management and enterprise decision, so it must be calculated exactly. At present, most enterprises in China calculate the cost respectively with the traditional cost accounting method. However, the traditional costing method has limitations in the costing of logistics, which prominently displays that costing has not achieved the target of cost content integrity and indirect expense assignment rationality, so the costing results lose the objectivity and the policy-making relativity. Then, the cost accounting and

management not only is the bottle neck of the market development for logistics firms, but also is the sticking point of effective operation management and decision-making. So Chinese logistics firms will require more accurate and detailed logistics cost information from their cost accounting systems, and Chinese logistics managers require detailed information to determine how different products, customers, or supply channels affect the costs of providing logistics services. The detail and complexity of the cost information will correspond to the diversity products handled, customer requirements, or supply channels used. Activity Based Costing, which is considered the optimized and most promising method of costing and controlling logistics cost, so it is necessary and urgent to be introduced into the cost management of logistics firms [1]. And at present, more and more enterprises in China adopt ABC in cost management and get better effects.

2. THE PRINCIPLE OF COSTING AND DATA MINING BASED ON ABC IN LOGISTICS FIRMS

2.1 Costing Principle Based on ABC for Logistics Projects

Logistics business is often operated through logistics projects in Chinese logistics firms. According to the operation characteristics of logistics projects and the basic principle of ABC, namely that product manufacture induces activity and activity consume resources, then it induces cost[2], the consequence conclusion that the operation of logistics service project induces logistics activity and logistics activity consumes resources and induces logistics service cost is deduced. In order to narrate expediently, three concepts of proper cost, direct cost and overhead cost are introduced. Proper cost is the cost which can be carried up to specific logistics project and be paid to other enterprises or organizations directly, it includes the consigned logistics cost, compensation of breach of faith, insurance cost, cost of applying to customs and checkout cost, etc. Direct cost is the cost which can be carried up to cost object directly, so it concludes direct material, direct manpower and proper cost. Overhead cost is the cost which can not be carried up to cost object directly.

2.2 Data Mining Technical Route Based on ABC for Logistics Projects

According to the basic principle and implementation step of ABC[3], the operation process of logistics project and the application route of logistics projects costing and cost management in Chinese enterprises[4], the technical route of applying ABC for logistics projects in china is studied, then is got and illustrated in Figure 1.
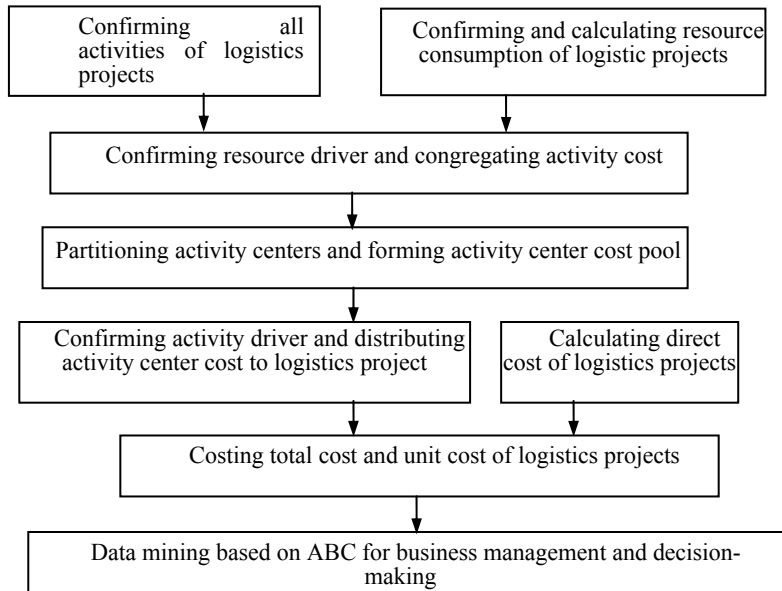
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┌─────────────────────────┐        ┌─────────────────────────────┐
│ Confirming         all  │        │ Confirming and calculating  │
│ activities of logistics │        │ resource consumption of     │
│ projects                │        │ logistic projects           │
└───────────┬─────────────┘        └──────────────┬──────────────┘
            │                                     │
            ▼                                     ▼
┌───────────────────────────────────────────────────────────┐
│   Confirming resource driver and congregating activity cost│
└───────────────────────────┬───────────────────────────────┘
                            │
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┌───────────────────────────────────────────────────────────┐
│ Partitioning activity centers and forming activity center  │
│ cost pool                                                  │
└───────────────────────────┬───────────────────────────────┘
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            ▼                                     
┌───────────────────────────────────┐  ┌─────────────────────┐
│ Confirming activity driver and    │  │ Calculating direct  │
│ distributing activity center cost │  │ cost of logistics   │
│ to logistics project              │  │ projects            │
└──────────────┬────────────────────┘  └──────────┬──────────┘
               │                                   │
               ▼                                   ▼
┌───────────────────────────────────────────────────────────┐
│   Costing total cost and unit cost of logistics projects   │
└───────────────────────────┬───────────────────────────────┘
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┌───────────────────────────────────────────────────────────┐
│ Data mining based on ABC for business management and       │
│ decision-making                                            │
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Figure 1. Technical Route of Applying ABC for Logistics Projects

3. COSTING STEP AND MODEL OF APPLYING ABC FOR LOGISTICS PROJECTS

3.1 Confirming Activities of Logistics Project

Confirming activities of logistics projects should follow the process.

(1) Firstly, activity information should be collected by using flow chart or gathering news.

(2) Secondly, activities are identified according to cost-benefit principle, and activity tache and amount are decided according to the cost nicety degree demand of logistics projects and enterprise management.

3.2 Confirming and Calculating Resource Consumption

The application of ABC doesn't change the total amount of resource. It changes the distributing rate of total cost between cost objects, so all resource consumption information can be gained from the accountant sort book.

3.3 Confirming Resource Driver and Congregating Activity Cost

The process should conform to the following approach.

The first step is confirming resource driver. At first, the amount of resource driver should be confirmed. The decision depend on these factors: the correlation degree between cost driver and resource cost, the expectation definition of cost, the complex degree of logistics service and so on. Then the right resource driver should be chosen. The choosing process should follow these principles, such as the cost-benefit principle, correlation principle, important principle and plenitude principle[5].

The second step is calculating resource driver rate by equation (1).

$$r_i = \frac{c_i}{a_i} \qquad (i = 1, 2, \cdots\cdots, \; n) \tag{1}$$

r_i, c_i and a_i are resource driver rate, resource cost and resource driver amount of resource i respectively.

The third step is distributing the resource cost to activity and forming activity cost pool. Activity cost can be calculated by equation (2).

$$c_j = \sum_{i=1}^{n} r_i \times q_{ij} \qquad (j = 1, 2, \cdots\cdots, \; m) \tag{2}$$

c_j is activity cost of activity j and q_{ij} is consumed resource i amount of activity j.

3.4 Partitioning Activity Center

There are some principles of partitioning activity centers, such as homogeneity principle, certain scale principle, cost costing veracity principle. Then activity center cost can be calculated according to these principles and equation (3).

$$B_k = \sum_{j=1}^{m} c_j \times w_{jk} \qquad (k = 1, 2, \cdots\cdots, \; q) \tag{3}$$

w_{jk} means whether j belong to activity center cost pool k or not. If j belong to activity center cost pool k, its value is 1, otherwise its value is 0. B_k is the total cost of activity center cost k.

3.5 Confirming Activity Driver and Distributing Activity Center Cost

There are some factors of confirming activity drivers, such as quantitative factor, homogeneity, the connection of between cost and benefit, the correlation degree of activity and consumed resources [6]. Then activity driver can be calculated by equation (4) .

$$R_k = \frac{B_k}{A_k} \tag{4}$$

A_k is activity driver amount of activity center cost pool k. R_k is activity driver rate of activity center cost pool k. Then cost is distributed to cost object from cost pool by equation (5).

$$C_p = \sum_{k=1}^{q} R_k \times Q_{kp} \quad (p =1,2,\cdots\cdots, s) \tag{5}$$

Q_{kp} is activity driver amount of activity center cost pool k by object p. C_p means the total overhead cost of object p.

3.6 Calculating Direct Cost of Logistics Project

Direct cost should be respectively calculated according to direct material, direct manpower and Proper cost. Direct material can be calculated by equation (6).

$$M_p = (1-w)\sum_{u=1}^{v} Y_u G_{up} \quad (u =1,2,\cdots\cdots, v) \tag{6}$$

In the equation, M_p is the direct cost of object p , w is the proportion of callback scrap relative to all materials, Y_u is the unit price of direct material u and G_{up} is consumed amount of direct material u by object p. Direct manpower can be calculated by equation (7).

$$L_p = \sum_{\alpha=1}^{x} T_{\alpha p}\mu_\alpha(1+\lambda) \quad (\alpha =1,2,\cdots\cdots, x) \tag{7}$$

L_p is the direct manpower cost of object p , $T_{\alpha p}$ is work time amount of work type α , μ_α is the average standard pay per an hour of work type α and λ is the proportion of accessional pay relative to standard pay. Because the range of proper

cost is big and proper cost of different logistics objects is different, proper cost of object p, namely Z_p, must be calculated according to idiographic conditions.

3.7 Calculating Total Cost and Unit Cost of Logistics Projects

According to above results, the total cost of logistics project p, namely T_p, can be calculated by equation (8).

$$T_p = M_p + L_p + Z_P + C_p \qquad (8)$$

According to the above got equations, outspread the equation step by step, equation (9) is gained.

$$T_p = (1-w)\sum_{u=1}^{v} Y_u G_{up} + \sum_{\alpha=1}^{x} T_{\alpha p}\mu_\alpha(1+\lambda) + Z_p + \sum_{k=1}^{q}\sum_{j=1}^{m}\sum_{i=1}^{n}\frac{c_i q_{ij} w_{jk}}{A_k a_i} Q_{kp} \qquad (9)$$

Because each logistics project can be cost and get accurate cost results, then unit cost of cost object can be also calculated through equation (10).

$$T_p{}' = \frac{T_p}{Q_p} = \frac{M_p + L_p + Z_P + C_p}{Q_p} \qquad (10)$$

$T_p{}'$ in the equation is the unit cost of logistics project p. Q_p is the unit amount of logistics project p. Every logistics enterprise can get different cost results according to different costing unit, then get wished data for cost management and enterprise innovation.

3.8 Calculating Total Logistics Cost of Enterprises

Because ABC is a complete cost calculating method, all logistics cost can be got through equation (11).

$$T = \sum_{p=1}^{s} T_p = \sum_{p=1}^{s}(M_p + L_p + Z_P + C_p) \qquad (31)$$

T of the equation means the total logistics project cost of one enterprise. It can offer a standard for cost control, capital budget, etc.

4. DATA MINING BASED ON ABC FOR BUSINESS MANAGE-MENT AND DECISIONS

Activity Based Costing is the optimized and most promising method of costing and controlling logistics cost. The establishment of its application step and costing model is the kernel of applying ABC for any logistics project in Chinese enterprises. It decides the definition of enterprise cost data, then, it affects the enterprise innovation and decision.

However the ABC application of logistics enterprises is not merely one method accurate calculation cost, its real value should be the significantly auxiliary decision-making functions of using obtained correlative ABC cost data in different enterprise management aspects.

The main purpose of using the ABC for enterprises is as follows: the enterprise can obtains the particular and accurate cost data of each logistics activity of operation through the implementation of ABC [7], then enterprises use obtained cost data and make the further data mining and processing, thereby make ABC provide the supporting basis and the guidance function for enterprise's daily digitization operation and information management as well as the related forecast and evaluation analysis and so on According to the correlation analysis, the support business management applications of using obtained ABC cost data are elaborated for logistics enterprises, namely the application patterns based on ABC are concluded for logistics enterprises, such as the pricing decision-making application of logistics service projects, the application in logistics cost budget system, the application in logistics business process reengineering, the application in the performance evaluation based on activity, the analysis application of customer profit ability and decision-making, the cost control application of logistics activity and so on [8].The data mining modes based on ABC for business management and decisions is illustrated in Figure 2.
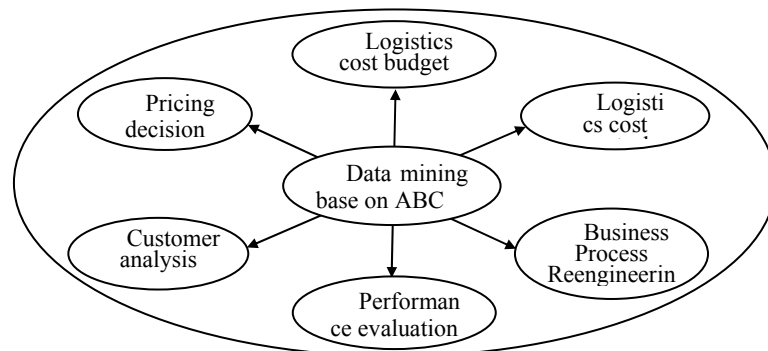

Figure 2. Data Mining Modes of ABC for Logistics Enterprises

In addition, the information obtained from ABC can support such key logistics decisions as determining needs for warehouse space, identifying warehouse locations, choosing between public or private ownership, implementing automation, etc.

5. CONCLUSIONS

According to the research, here we may draw the following conclusions.

(1) ABC achieves greater accuracy of logistics for Chinese logistics firms than traditional costing techniques by using multiple cost drivers. Traditional techniques typically rely on one to three volume based cost drivers to trace overhead costs to products. ABC uses multiple cost drivers to reflect different relationships occurring between activities and the resources they consume.

(2)The analyzed costing principle, step and model of applying ABC for logistics projects are logical and feasible in this paper. It can provide tracking of logistics costs for Chinese logistics firms. This can be of particular value in tracking logistics products or customers for Chinese logistics firms.

(3) ABC can provide financial support data structured for logistics projects in a fashion fundamentally different from accounting data provided in the general ledger. By associating cost to the logistics activity, a clear relationship can be established between sources of logistics activity demand and the related costs. This association can benefit the Chinese logistics firms in determining where logistics costs are being incurred, what is initiating the logistics costs and where to apply efforts to control inflationary logistics costs.

(4) The application of ABC is not merely one method of costing accurately, its real value should is the significantly auxiliary decision-making function in business management of Chinese logistics firms. ABC is a management decision-making tool. Chinese logistics firms can use obtained cost data and develop the further data mining and processing for cost management and relevant decisions. The increased visibility of logistics costs will serve several purposes for the Chinese logistics firms: the identification of more direct costs, a better understanding of price/volume relationships, the opportunity to address significant cost reduction opportunities, better evaluation and justification of logistics investments and customer, the budget of logistics cost budget, the cost controlling of logistics cost and so on.

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