Research on the calculation and improvement of a company's activity cost based on activity-based costing and industrial engineering method

Xiaoqin Gao

1Department of logistics engineering, Southwest Jiaotong University, Chengdu, Sichuan, 611700, China

*Corresponding author’s e-mail: 1484648072@my.swjtu.edu.cn

Abstract. The traditional cost management mode of China is used to make the cost of the production, and the cost management of the "commodity" is the cost management of the production process, the cost management of the product development and design of the pre-production, which is increasingly difficult to adapt to the needs of the modern social and economic development, has greatly hindered the improvement of the competition capacity of the enterprise commodity market. Based on the operation cost method, the paper will provide an example for the application of the operating cost method in manufacturing. In addition, the research on the final implementation of cost management is not very good. Combined with the methods of reducing the cost of industrial engineering, this paper continuously improves and controls the problems in the company's operating cost management, and verifies the feasibility through empirical research and a large number of experiments.

1. Introduction

First of all, the traditional cost accounting method assigns indirect costs to products, while the activity-based cost accounting method assigns processes, and divides the indirect costs borne by products into expenses generated by various activities. Therefore, the accounting results are more concrete and objective. Secondly, the traditional cost accounting method cannot accurately allocate indirect costs to products with different technical complexity. For example, when multiple products with different complexity are produced at the same time, the cost calculated according to the traditional cost method will be higher than the actual cost for large-scale and low-complexity products, while the calculation result will be lower than the actual cost for small-scale and low-cost products. Finally, the traditional cost accounting method mainly reflects the value of ending inventory. It will be affected by the initial product cost, and the calculation result will be distorted. Activity-based costing tracks the product cost in the whole process, is not affected by the initial product, is non-cumulative, and can reflect the product cost more truly. It can be seen from the above comparison that ABC is more closely integrated with business management. With the further development of market economy, it is an inevitable trend of modern enterprise management to replace the traditional cost management model with a new cost management model.

2. Investigation and analysis of the current situation of a company

Chengdu Chengxingda Machinery Manufacturing Co., Ltd. (hereinafter referred to as Company C) is a medium-sized auto parts and accessories manufacturer. The company's product categories include:
production, processing and sales of mechanical equipment, electromechanical equipment, auto parts, cabinets, sheet metal structures, etc. Due to the wide variety of products, imperfect production processes and inaccurate cost accounting, it has hindered Company C’s further business development and industrial upgrading. The main processes of the company's products include parts sorting preparation, automatic plug-in, manual plug-in, pressure welding, technical washing and drying, quality inspection and packaging. Among them, there are the following problems: the production process is complex, not only requires advanced automation equipment, but also requires a lot of manual input; the bill of materials and process are complicated, the product types and quantities are large, and the logistics management is difficult. The traditional cost method is used to calculate product costs, and the allocation is based on direct labor hours, resulting in uneven cost distribution and confusion in cost data. The company now uses the traditional activity-based costing method, and its cost information is shown in Table 1.

\[
\text{Distribution rate} = \frac{\text{Manufacturing cost}}{\text{Direct salary}} \quad (1)
\]

\[
\text{Apportion manufacturing cost of each product} = \text{Annual direct labor hours} \times \text{Distribution rate} \quad (2)
\]

\[
\text{Total cost of each product} = \text{Direct material} + \text{Direct salary} + \text{Apportion manufacturing cost of each product} \quad (3)
\]

| Project                          | Product A | Product B | Product C | Total |
|----------------------------------|-----------|-----------|-----------|-------|
| 1. Production and sales volume   | 10000     | 20000     | 40000     | 238000 |
| 2. Direct material (yuan)        | 500000    | 1800000   | 800000    | 2340000 |
| 3. Direct salary (yuan)          | 580000    | 1600000   | 160000    | 3894000 |
| 4. Manufacturing cost (yuan)     | 3894000   |           |           | 3894000 |
| 5. Annual direct labor hours     | 30000     | 80000     | 8000      | 118000 |
| 6. Distribution rate             | 3894000/118000 = 33 |
| 7. Apportion manufacturing cost of each product (yuan) | 990000 | 2640000 | 264000 | 3894000 |
| 8. Total cost of each product(yuan) | 2070000 | 6040000 | 40000 | 5040000 |
| Output (piece)                   | 10000     | 20000     | 4000      | 302 |
| Unit product cost (yuan)         | 207       | 302       | 126       | |

3. **Put forward a cost control scheme based on activity-based costing and calculate the cost.**

In view of this situation, we take the three main products of C company based on activity-based costing as examples: dashboard, automobile wire and engine (represented by A product, B product and C product respectively). Through the specific data to calculate activity-based costing, test the difference between traditional activity-based accounting and activity-based costing accounting, and then control the cost. The implementation steps of activity-based cost management usually include: identifying and selecting main activities, centralizing resources and expenses on a unified cost basis, selecting cost drivers, calculating cost sharing rate, and calculating cost allocation rate. Assign the expenses in the activity base to the product, and calculate the product cost.

3.1. **Assignment identification**

According to the situation of C company, according to the type of general operation center that serves the production of all products, the operation is divided into eight operation centers: assembly, material procurement, material handling, start preparation, quality control, product packaging, engineering processing and management.

3.2. **Cost collection**

Identify the resource costs associated with each activity and allocate them through existing metrics. The cost of these activities can be estimated by analyzing the time distribution of employees or functions on
activities. The analysis shows that the product cost composition of the company is mainly composed of production cost and cycle cost, and the cost details are shown in Table 2.

Table 2. Resource consumption schedule

| Operation center      | Resources consumed                                                                 |
|-----------------------|-----------------------------------------------------------------------------------|
| Assembling            | Labor costs, direct materials, rental fees, energy costs, equipment maintenance costs, depreciation costs. |
| Material procurement  | Labor costs, management costs, logistics costs                                     |
| Material handling     | Labor cost, direct material, lease fee, energy cost, equipment maintenance fee, depreciation fee, mold cost |
| Start preparing       | Labor costs, rental fees, energy costs                                           |
| Quality Control       | Labor costs, rental fees, energy costs                                           |
| Product packaging     | Labor costs, direct materials, rental fees, energy costs, equipment maintenance costs, depreciation costs |
| Engineering treatment | Labor costs, rental fees, energy costs, external service fees, logistics costs, equipment maintenance costs, depreciation costs |
| Administration        | Labor cost, external service fee                                                  |

3.3. Setting of cost library
Combining with the cost type set cost base of C company mentioned above, in theory, the activities in the homogeneous cost base are the same, and the same cost base corresponds to a large number of direct and indirect activities. After analysis and authentication, eight main operations, namely activity centers, are identified, and they are divided into several homogeneous cost libraries, and then indirect expenses are grouped into a cost base, and the results are shown in Table 3

Table 3. Indirect cost collection table

| Project                  | Assembling | Material procurement | Material handling | Start preparing | Quality Control | Product packaging | Engineering treatment | Administration | Total (yuan) |
|--------------------------|------------|----------------------|------------------|----------------|-----------------|--------------------|----------------------|---------------|--------------|
| Assembling               | 1212600    |                      |                  |                |                 |                    |                      |               |              |
| Material procurement     | 200000     |                      |                  |                |                 |                    |                      |               |              |
| Material handling        | 600000     |                      |                  |                |                 |                    |                      |               |              |
| Start preparing          | 3000       |                      |                  |                |                 |                    |                      |               |              |
| Quality Control          | 421000     |                      |                  |                |                 |                    |                      |               |              |
| Product packaging        | 250000     |                      |                  |                |                 |                    |                      |               |              |
| Engineering treatment    | 700000     |                      |                  |                |                 |                    |                      |               |              |
| Administration            | 507400     |                      |                  |                |                 |                    |                      |               |              |
| Total (yuan)             | 3894000    |                      |                  |                |                 |                    |                      |               |              |

3.4. Determine the cost driver and its allocation rate
Relevant costs are stored according to cost drivers. After selecting activity-based cost drivers, relevant costs are collected according to homogeneous cost drivers. Each cost base charges direct labor, direct materials, depreciation of machinery and equipment, overhead, etc. Here, the eight major activities of product A, Product B and Product C are summarized and counted. The statistical results are shown in Table 4. In the allocation of resource consumption cost, if the causal relationship between cost drivers is analyzed, the allocation has certain rules. The formula is as follows:

Driver distribution rate = the cost / total amount of activity drivers collected in an activity-based cost base.  

Table 4. Cost Driver Data Sheet

| Manufacturing costs | Cost driver | Workload |
|---------------------|-------------|----------|
|                     |             | Product A | Product B | Product C | Total    |
### 3.5. Calculate the product cost

#### 3.5.1 activity-based costing

The activity-based manufacturing cost is allocated to each product according to the unit activity cost. It is assumed that there is a quantitative proportional relationship between the activity-based cost and the activity driver of a product, that is, the more activities consumed, the higher the allocated cost. For example, generally speaking, the material cost directly corresponds to the quantity of the product. Expressed as a formula, as shown in Table 5.

\[
\text{Number of cost drivers} \times \text{unit activity-based cost} = \text{a certain activity-based cost of the product} \quad (5)
\]

#### Table 5. Activity-based cost sharing table

| cost task            | Unit activity cost | Product A | Product B | Product C |
|----------------------|--------------------|-----------|-----------|-----------|
|                      | Workload           | Activity cost (yuan) | Workload | Activity cost (yuan) | Workload | Activity cost (yuan) |
| assembling           | 28.2               | 10000     | 282000    | 25000     | 705000   | 8000     | 225600   |
| Material procurement | 10                 | 1200      | 12000     | 4800      | 48000    | 14000    | 140000   |
| Material handling    | 60                 | 700       | 42000     | 3000      | 180000   | 6300     | 378000   |
| Start preparing      | 0.2                | 1000      | 200       | 4000      | 800      | 10000    | 2000     |
| Quality Control      | 21.05              | 4000      | 84200     | 8000      | 168400   | 8000     | 168400   |
| Product packaging    | 25                 | 400       | 10000     | 3000      | 75000    | 6600     | 165000   |
| Engineering treatment| 17.5               | 10000     | 175000    | 18000     | 315000   | 12000    | 210000   |
| Administration       | 4.3                | 30000     | 129000    | 80000     | 344000   | 8000     | 34400    |
| Total                | ——                 | 734400    | ——        | 1836200   | ——        | 1323400  |

#### 3.5.2 Cost pool allocation

The enterprise summarizes all the costs consumed by the activity center into the cost base, and then allocates the cost to the product according to the driver distribution rate, and obtains the cost per unit product, as shown in Table 6.
Table 6. Product unit cost calculation table

| Project               | Product | Product A | Product B | Product C |
|-----------------------|---------|-----------|-----------|-----------|
| Direct material (yuan)|         | 500000    | 1800000   | 8000      |
| Direct salary (yuan)  |         | 580000    | 1600000   | 160000    |
| Assembly (yuan)       |         | 282000    | 705000    | 225600    |
| Material purchase (yuan)|      | 120000   | 480000    | 140000    |
| Material handling (yuan)|    | 42000    | 180000    | 378000    |
| Start up preparation (yuan)| | 200     | 800       | 2000      |
| Quality control (yuan)|         | 84200     | 16800     | 168400    |
| Product packaging (yuan) |      | 10000    | 75000     | 165000    |
| Engineering treatment (yuan) | | 175000   | 315000    | 210000    |
| Management (yuan)     |         | 129000    | 344000    | 24400     |
| total                 |         | 1814400   | 52336200  | 1563400   |
| Output (piece)        |         | 10000     | 20000     | 4000      |
| Unit product cost (yuan)|       | 181.44    | 261.81    | 390.85    |

4. Comparison of Product Price results under two kinds of activity-based costing

Through the practical application of activity-based costing in the activity-based costing of three kinds of products, as shown in Table 7, it is obvious that activity-based costing obtains more accurate product information than the traditional costing method, which is helpful for the company to adjust its pricing strategy and further develop other effective business strategies. In addition, it can make the performance appraisal more objective and fair, and provide a better basis for the company to adjust the production structure and strengthen cost control.

Target selling price = Product cost * 125%  \hspace{1cm} (6)

Table 7 Comparison of selling prices under two costing methods

| Project product | Cost calculation method | Product cost (yuan) | Target selling price (yuan) | Actual market price (yuan) | Unit product profit / loss (yuan) |
|-----------------|-------------------------|---------------------|----------------------------|---------------------------|----------------------------------|
| Product A       | Traditional cost method | 209.00              | 258.75                     | 258.75                    | 0                                |
|                 | Activity based costing  | 181.44              | 226.80                     |                           | 31.95                            |
| Product B       | Traditional cost method | 302.00              | 377.50                     | 328.00                    | -49.5                            |
|                 | Activity based costing  | 261.81              | 327.26                     |                           | 0.74                             |
| Product C       | Traditional cost method | 126.00              | 157.50                     | 250.00                    | 92.5                             |
|                 | Activity based costing  | 390.85              | 488.56                     |                           | -238.56                          |

5. Using IE method to implement improvement

It can be clearly seen from the unit product cost table that the current product C has a slightly higher cost and is at a loss. Based on the analysis of the company's current situation, in response to the problems found in the implementation of the ABC, try to adopt IE to take corresponding measures to achieve the effect of continuous improvement. For example, through program analysis, reshape the production process of the enterprise, improve the site layout, and eliminate repetitive and unreasonable operations; through job analysis, simplify procedures and reduce time consumption; through action analysis, cancel invalid actions, and formulate a reasonable and waste-free sequence of actions. Through job
measurement, a scientific and reasonable working hour quota is established for each job to reduce invalid
time in production, and on-site improvements are made through 5S to eliminate waste.

5.1. Using the method of program analysis to reduce cost and implement improvement

It is understood that the bolts and nuts needed for engine assembly produced by the auto parts
manufacturing company are purchased from the outside and put into storage after passing the inspection.
The current receiving and inspection process of the purchased parts of Company C is analyzed, as shown
in figure 1.

Figure 1. Procedure diagram of inspection and points of purchased parts (before improvement)

Figure 2. Process diagram of inspection and points of purchased parts (after improvement)
Through the analysis of figure 1, it is found that there are the following problems in the current layout: more time to process, wait and check. According to the statistical results, the receiving work of automobile engine connecting bolts and nuts includes 7 times of processing, 8 times of processing, 6 times of waiting, 3 times of inspection and 1 time of storage. It takes more time to process, wait and check, and it takes longer to transport. It can be seen from the figure that the parts box arrives at the part rack after many times of processing, the transportation distance is 57m, the transportation time is 32min, and the whole processing time is 122min. In view of the existing problems, this paper uses "5W1H" technology and "ECRS four principles" to analyze. Then the processes of receiving, checking and counting are combined to obtain the improved method of receiving the parts into the warehouse: unload the box from the delivery truck, then slide directly along the skateboard to the car, and then send it to the door. The operator opens the box directly on the trolley, takes out the delivery order, and then transports the delivery order and goods to the cashier. Wait a moment, open the box, take the parts out of the box and put them on the workbench; the inspector checks the quantity and quality according to the delivery order. After inspection, put the parts back into the carton and re-pack them. Finally, transport the parts to the warehouse and put them on the shelf. As shown in figure 2. As can be seen from the statistical table in figure 2, after the improvement, the number of operations is reduced from 7 to 4, the number of processing is reduced from 8 to 4, the waiting time is reduced from 6 to 2, the inspection is reduced from 3 to 1, and the transportation distance is reduced from 57 meters to 23.5 meters. The reception time was reduced from 122 minutes to 57 minutes. Through the improvement, the work efficiency is improved, and the labor cost and logistics transportation cost of product C are reduced.

5.2. Optimize the process arrangement through job analysis

Job analysis can be divided into man-machine job analysis, joint job analysis and two-handed job analysis. Below, we select specific bolt and nut assembly jobs for two-handed job analysis according to the above receiving, inspection and storage procedures of the bolts and nuts purchased by the company, as shown in Figure 3. With this reasonable arrangement of operators, operating objects, operating tools, to achieve a reasonable process structure, reduce labor intensity, reduce the overall working time of workers.

Because the bolt and the nut are in front of the operator, when holding the bolt with the left hand, the operator's body is to the left, the center of gravity is to the left, and the left hand is working; when taking the nut, the body is to the right, the center of gravity is to the right, and the right hand works again, so that the left hand and the right hand respectively produce the phenomenon of waiting and holding, the hands can not work at the same time, lose balance, and make the operator tired easily. In order to improve the above situation, according to the principle of action economy, put three boxes on the same line of
sight of the operator, let the operator see the bolt and nut at the same time, and let the left and right hands get the bolt and nut at the same time. The waiting phenomenon is reduced and the efficiency is significantly improved. The two-handed operation analysis diagram of the improved bolt and nut assembly operation is shown in figure 4. Obviously, this improvement not only reduces the number of movements of both hands, but also fully realizes the principle of symmetrical movements of both hands at the same time. Finally, it can reduce the working hours, reduce the labor cost, and then reduce the product cost.

6. **Research conclusion and inspiration**

The traditional Chinese cost management model pays more attention to the cost management related to product production and later production, and ignores the pre-production cost management of product development and design. It has become increasingly difficult to adapt to the needs of contemporary social and economic development. This greatly hinders the improvement of enterprises' competitiveness in the bulk commodity market. If modern enterprises want to better apply ABC, they must first fully understand ABC from the ideological level. Secondly, they must not only get involved in the application of ABC on the surface, but also regard the application of ABC as the routine of the cost control system. Companies can refer to the methods provided in this article, combine their own nature and experience, and combine them with industrial engineering methods and other cost control methods, so as to give full play to its application potential and value.

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