Research on the Application of Activities-Based Cost Method in L Manufacturing Enterprise

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Abstract: The experimental object of this paper is two products on the same production line in the transformer workshop of L enterprise. This paper first analyzes the current situation and problems of product costing under the traditional cost method. Secondly, under the guidance of the activities-based cost method theory, the whole production process is divided into six job centers according to the production process of transformer products, the job motivation rate is calculated, and the product activity cost is attributed. Finally, the product costs under the two methods are compared and analyzed. This paper concludes that compared with the traditional cost method, the activities-based cost method improves the accuracy of product costs and facilitates the implementation of complete cost control. The research results are intended to provide guidance and direction for cost management reform for enterprises in the same industry.

Keywords: activities-based cost method; electrical manufacturing companies; job center; job motivation.

1 RESEARCH BACKGROUND

In recent years, China's rapid demand for electricity and the high-speed construction of power grids has boosted the market demand for transmission and substation equipment. The massive investment in power construction has brought opportunities and challenges to the transformer industry and also prompted the transformer industry to get rapid development. After the power grid enterprises adopt the way of public bidding to select suppliers, most enterprises fall into the trap of low prices to obtain orders and blindly reduce the offer. At this stage, most transformer manufacturing enterprises in China adopt the traditional costing method to calculate product costs, which leads to poor accuracy of cost information and cannot match the enterprise's pursuit of the lean production model. Therefore, introducing more advanced costing methods, that is, to improve the accuracy of product costs and the production of traceability costs.

Since its introduction, the activities-based cost method has been widely used in different industries, such as construction companies[10], water conservancy projects[9], machining companies[12], thermal power companies[11], etc. The activities-based cost method is a costing method that allocates overhead costs more accurately to products and is guided by the idea that “jobs consume resources and products consume jobs.” An overview of the basic principles of activities-based cost is shown in Figure 1:

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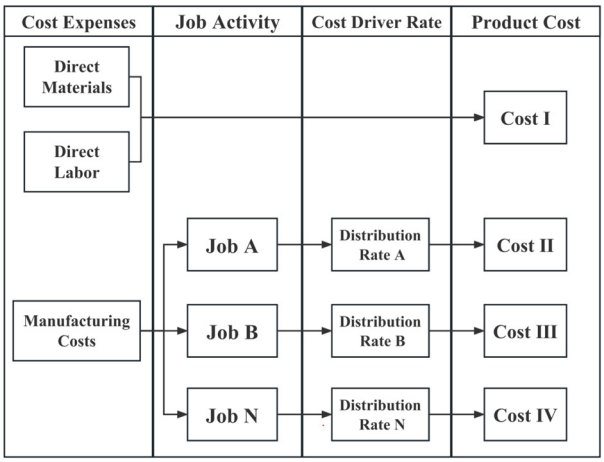

Figure 1: Basic rationale of the activity-based cost method.

The application of the activities-based cost method in the transformer manufacturing industry needs to be studied [6]. The experimental subjects in this paper are two kinds of products on the same production line in the transformer workshop of L enterprise. This paper will systematically sort out the production process of transformer products, reasonably plan the job center, and accurately calculate the product cost information. Continuously pursue the goal of lean manufacturing by improving existing costing methods[5].

2 CURRENT COST SITUATION OF L ENTERPRISE

2.1 Current State of Cost Accounting

The main products of L Company are various types of transformer equipment. At this stage, the company adopts the traditional costing method for product accounting, and the main criteria for measuring product costs involve direct materials, direct labor, and manufacturing costs. The object of study in this paper is two products on the same production line in the transformer workshop. The statistical scope of each type of cost is one production cycle, using the following two products produced by the company in October 2022.

Product A is an old product, put on the market for a long time, the technology content is low, and the production process is relatively simple.

Product B is a new product that has been put into the market for a shorter time, with higher technological content and a more complicated production process.

(1) Direct materials

Product direct materials include silicon steel sheet, copper wire, iron core, insulation materials, transformer oil, etc. The direct material costs of the two products are shown in Table 1:

Table 1: Breakdown of Direct Materials.

Raw Material Items	A	B
Silicon steel sheet	63504	21168
Copper wire	27216	9072
Iron core	36288	12096
Insulation material	31752	10584
Plate	13608	4536
Other materials	9072	3024
Total direct materials	181440	60480

(2) Direct labor

Product direct labor is the wages, allowances, and benefits of workers directly engaged in producing the product, which can now be charged to the corresponding product cost. The direct labor costs of products are shown in Table 2:

Table 2: Breakdown of Direct Labor.

Product Model	A	B
Quantity	6	5
Labor hours	240	96
Hourly wage	18	18
Direct labor costs	25920	8640

(3) Manufacturing costs

Manufacturing costs refer to the indirect costs incurred in production, such as depreciation, utilities, wages, benefits, etc. [2]. The analysis of product manufacturing costs is shown in Table 3:

Table 3: Breakdown of Manufacturing Costs.

Raw Material Items	Amount(¥)
Salaries and benefits	63504
Depreciation of plant	27216
Depreciation of machines	36288
Utilities	31752
Low-value consumables	13608
Others	9072
Total	181440

The manufacturing costs of two products are distributed according to direct labor hours, and the results are shown in Table 4:

Table 4: Product Cost Sheet.

Product Model	A	B
Direct materials (¥)	181440	60480
Direct labor (¥)	25920	8640
Manufacturing cost (¥)	38880	12960
Total cost (¥)	246240	82080
Capacity (Units)	6	5
Unit cost (¥)	41040	16416

2.2 Cost Management Issues

2.2.1 Cost Accuracy Deviates from Reality

Transformer products with different technological content, then the production process is other. Cost accounting relies only on direct labor hours and does not meet the reality. On the one hand, as enterprises develop new products, the actual manufacturing costs incurred for old products are much lower than for new developments in the case of more minor differences in raw materials used. Using only direct labor hours accounting ignores the fact that the manufacturing cost in the production of the enterprise has increased. On the other hand, using direct labor hours does not correlate the actual production process with the product cost. The accuracy of product costs cannot be guaranteed

2.2.2 Cost Responsibility Body is not Clear

Workers' awareness of product cost control could be more robust, and cost management only stays in the production stage. On the one hand, under the traditional cost method, product costs cannot be assigned to specific responsible subjects, which hinders the establishment of the company's cost efficiency control and responsibility system. On the other hand, when quality problems occur in products due to the single cost accounting standard, the body responsible for accidents is unclear. Tracing quality problems invariably wastes human and material resources.

3 APPLICATION OF ACTIVITIES-BASED COST METHOD

3.1 Specific Processes

Given the problem, the cost accuracy in cost management deviates from the actual product, and the cost responsibility entity needs to be clarified. After analyzing the feasibility of applying the activity-based cost method, this chapter proposes the specific application of the activity-based cost method in Company L.

3.1.1 Determine the Job Center and the Job Motivation

The implementation of an activity-based cost method must first determine the job[3]. The product manufacturing process flow is shown in Figure 2.

(1)The production workshop receives raw materials required for production, such as copper wire, steel, and silicon steel sheet, according to orders and product design drawings.

(2)Cross-cutting or longitudinal shearing operations to process silicon steel sheets and make laminated cores or rolled cores according to order requirements.

(3)Handle copper wire with paper rolls and guy wires, handle insulation barrels, and complete coil insulation windings.

(4)Weld the tank with steel and hardware and assemble the finished core, winding resistance coil, tank, and other parts into a whole.

(5)Inject transformer oil, complete the inductance value test, leakage inductance value test, and other tests, labeling to storage.

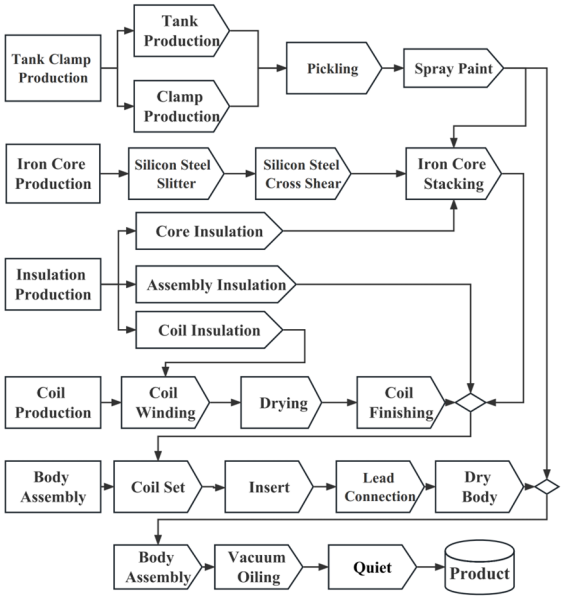

Figure 2: Flow of the products manufacturing process.

After the production process analysis, the following operations are determined: order operation, drawing design, steel plate preparation, shearing and punching technology, machining, welding operation, winding operation, oil tanker operation, machine equipment maintenance, workshop operation, and assembly operation drying operation, drying in the shade, packaging and quality testing.

According to the actual manufacturing process, homogeneous work is integrated to establish a job costing center and analyze the cost drivers[4]. As shown in Table 5:

(1)Planning Operations Center(POC): including signing orders, product drawing design, production material distribution, etc. The different batches require different planning operations. Therefore, the planning operation center uses the ordering lot as the operation motive.

(2)Primary Jobs Center(PJC): including steel plate processing, core pre-processing treatment, insulation plate punching, shearing, and other primary processing of materials. The consumption of raw materials varies from product to product. Therefore, the primary operation center uses raw material consumption as the operation motive.

(3)Depth Operations Center(DOC): including soldering operation, iron powder core grinding and assembly, iron core hot pressing and stacking, oil tank making, etc. This job records the machine and equipment's working hours through the machine's numerical control system. Therefore, the deep work center uses machine work hours as the motivation for the operation.

(4)Reprocessing Operations Center(ROC): including coil winding, drying operation, coloring treatment, etc. This part is carried out manually. Therefore, the post-processing operation center uses manual work hours as the motivation for the operation.

(5)Product Assembly Center(PAC): including final assembly and packaging operations. Therefore, the product assembly center uses the number of assemblies as an operational driver.

(6) Quality Control Operation Center(QCOC): including quality testing of semi-finished products, quality testing of finished products and quality sampling, etc. Each inspection operation records the inspection time and the type of product inspected. Therefore, the QA operation center uses the number of inspections to motivate processes.

Table 5: Job Center and Job Motivation.

Job Center	Job Motivation
POC	Order batch
PJC	Raw material consumption
DOC	Machine hours
ROC	Labor hours
PAC	Number of assemblies
QCOC	Number of tests

3.1.2 Confirmation of Consumed Resources

Under the idea of an activities-based cost method, jobs consume different resources. To analyze the resource drivers, you must identify the input resources' business activities and specifics[8].

(1) Employee Compensation Allocation

The number of people in each operation center is as follows, and the related expenses are assigned to the operation centers according to the job responsibilities, as shown in Table 6:

Table 6: Employee Compensation Allocation Table.

Job Center	No. of people	Amount
POC	8	2022
PJC	12	3110

DOC	13	3421
ROC	11	2800
PAC	10	2644
QCOC	6	1555
Total	60	15552

(2) Plant Depreciation Allocation

Through the workshop design drawings, confirm the workshop area of each job center. The specific allocation is shown in Table 7:

Table 7: Employee Compensation Allocation Table.

Job Center	Workshop Area	Amount
POC	345	885
PJC	735	1886
DOC	751	1926
ROC	640	1642
PAC	647	1660
QCOC	519	1332
Total	3637	9331

(3) Allocation of machine depreciation

Depreciation expenses are allocated by where the equipment is stored. The specific allocation is shown in Table 8:

Table 8: Allocation of Machine Depreciation Expenses.

Job Center	Amount
POC	1160
PJC	2308
DOC	2855
ROC	1749
PAC	2355
QCOC	978
Total	11405

(4) Distribution of Water and Electricity Charges

Utility bills are paid with proof of payment. The specific allocation is shown in Table 9:

Table 9: Summary of Utility Bills.

Job Center	Water	Electricity	Amount
POC	91	220	311
PJC	504	1178	1682
DOC	476	1117	1593
ROC	273	626	899
PAC	196	467	663
QCOC	168	384	552
Total	1708	3994	5702

(5) Allocation of Low-Value Consumables

The specific accounting is made according to the workshop receiving table. The particular allocation is shown in Table 10:

Table 10: Low-Value Consumables Cost Allocation Table.

Job Center	Amount
POC	137
PJC	222
DOC	183
ROC	132
PAC	214
QCOC	149
Total	1037

(6) Other Cost Allocation.

The specific allocation is shown in Table 11:

Table 11: Other Cost Allocation Table.

Job Center	Repair Costs	Office Costs	Handling Fee	Amount
POC	352	526	878	1756
PJC	683	409	274	1366
DOC	652	391	262	1305
ROC	449	301	749	1499
PAC	125	500	625	1250
QCOC	819	327	491	1637
Total	3080	2454	3279	8813

Manufacturing costs are grouped in Table 12:

Table 12: Manufacturing Costs Table.

Job Center	Amount
POC	6271
PJC	10574
DOC	11283
ROC	8721
PAC	8786
QCOC	6203
Total	51840

3.1.3 Job Cost Allocation

According to product consumption, the activity motivation rate should be calculated first. Activity motivation rate refers to the reduction in the number of resources caused by a particular activity driver, and the calculation of activity motivation rate is shown in Equation 1:

$$r = R / D \tag{1}$$

Where: r denotes the cost driver rate, R denotes the job center cost, and D denotes the total cost driver amount for each job center.

Viewing production records and interviewing workers, the cost drivers consumed by different products in the job center are counted. The order batch is two times, one each for A and B. The raw materials consumed were 5545 kg, A was 3340 kg, and B was 2205 kg. The machine hours are 1056 h, A is 634 h, and B is 422 h. Labor hours were 864 hours, A was 475 hours, and B was 389 hours. The number of assemblies is 44 times, 26 times for A, and 18 times for B. The number of tests was 62, 34 for A and 28 for B. The calculation results are shown in Table 13:

Table 13: Cost Driver Allocation Table.

Job Center	Cost Driver Volume	Costs	Distribution Rate
POC	2	6271	3135.50
PJC	5545	10574	1.91
DOC	1056	11283	10.68
ROC	864	8721	10.09
PAC	44	8786	199.68
QCOC	62	6203	100.05

The actual cost of the cost object is obtained by calculating the job motivation rate and the amount of job motivation occupied by each product, as shown in Equation 2:

$$C = r * d \tag{2}$$

Where: C represents the cost of each product, r represents the cost driver rate, and d represents the cost drivers for each operation center for that product. The calculation results are shown in Table 14:

Table 14: Product Activities-Based Cost Table.

Job Center	Distribution Rate	Product A Cost	Product B Cost
POC	3135.50	3136	3136
PJC	1.91	6379	4189
DOC	10.68	6772	4508
ROC	10.09	4794	3926
PAC	199.68	5200	3600
QCOC	100.05	3400	2800
Total		29681	22159

3.1.4 Product Costing

Under the activities-based cost method, the manufacturing costs of both products have been attributed based on jobs. There is no difference between the direct materials and direct labor obtained under the activities-based and traditional costing methods. The specific data are shown in Table 15:

Table 15: Product Activities-Based Cost Table.

Product Model	A	B
Direct materials (¥)	181440	60480
Direct labor (¥)	25920	8640
Manufacturing cost (¥)	29681	22159
Total cost (¥)	237041	91279
Capacity (Units)	6	5
Unit cost (¥)	39507	18256

3.2 Contrast Analysis

3.2.1 Cost Differences Comparison

Under both methods, direct materials and direct labor are the same and do not affect the product cost. The comparison of manufacturing costs in different ways is shown in Table 16 and Figure 3. From the comparison results, the price apportioned to transformer A is under-recorded by ¥1,533, and the cost of transformer B is over-recorded by ¥1,840.

Table 16: Comparison of Manufacturing Costs under Different Methods.

Product Model	A	B
Traditional Cost Method	6480	2592
Activities-Based Cost Method	4947	4432
Variance Amount	-1533	1840

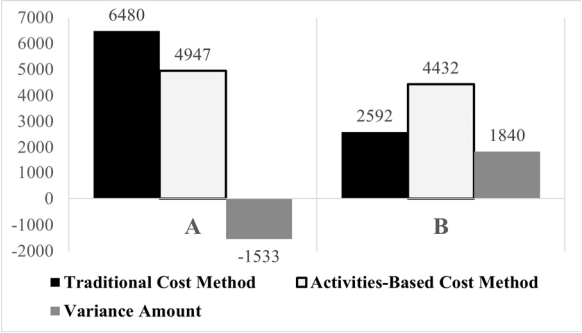

Figure 3: Comparison of Manufacturing Costs under Different Methods.

3.2.2 Cost Differences Analysis

The different ways of allocating manufacturing costs under other accounting methods result in significant differences in product costs[1].

Direct labor hours under the traditional cost method are the standard for allocating manufacturing costs. The approach ignores the process and technical content of the product[7]. The increased level of automation in the business has led to higher overhead costs. Under the traditional cost method, overhead costs are apportioned by direct labor, and manufacturing costs are forced to be apportioned to older products. Therefore, under the traditional cost method, the manufacturing costs of products with simple production processes and low technology content are overestimated; the manufacturing costs of products with complex production processes and high technology content are underestimated. This result is also consistent with production reality.

On the other hand, the activities-based cost method allocates indirect costs according to job motives, breaking the unreasonable allocation method, improving the accuracy of cost accounting to a certain extent, and reflecting the actual price of products more realistically.

4 ADVANTAGES OF THE ACTIVITIES-BASED COST METHOD

4.1 Improved Accuracy of Product Costs

To adapt to the improvement of the company's production process, Company L intends to introduce more technologically advanced and energy-efficient products in the coming years. From the comparative study of products A and B earlier in this paper, we have concluded that

the traditional costing method underestimates the cost of products with higher technological content and overestimates the price of products with lower specialized content.

The application of the activities-based cost method, on the one hand, reduces the distortion of product costs by the traditional costing method and, on the other hand, makes the allocation basis more relevant to the allocated costs and improves the accuracy of product costing. Therefore, L company must accelerate the broad application of activities-based cost method in different workshops, divide the jobs more accurately, and make more future exploration.

4.2 Good for Implementing Cost Control

The operation cost method divides the production process into several operations. The division of labor in each department is clear, and the responsibility is clear, which helps L company manage each department. It is convenient to find the responsible department when there is a product quality problem. It is also helpful to urge each department to be accountable for their work seriously, which helps form an efficient and orderly working system.

5 CONCLUSIONS

This paper analyzes the problems of the current costing system of L enterprises and presents the benefits of applying the activities-based cost method. This paper selects two products with different technological contents in a transformer production plant as experimental objects. Although they are representative, determining operation centers and motives also consumes much time, and the allocation method needs to fit better with the operation way of real transformers. Therefore, this paper only provides a basic model for applying the activities-based cost method in transformer manufacturing enterprises. Promoting activities-based cost method in enterprises requires overall planning and design. Thus, implementing the activities-based cost method in the transformer industry still has a long way to go.

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