New Thinking on Cost Analysis of Comparable Products

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Abstract—There are numerous factors that influence costs in practical work. Enterprises must explore cost reduction potentials, which must be grounded in comprehensive cost analysis. Understanding the patterns of cost changes and striving to reduce consumption are essential for improving economic benefits. Based on this, this paper discusses the cost analysis of comparable products, focusing on methods that are often difficult to master in cost analysis. The paper critically reviews conclusions in existing literature and textbooks, inferring that output changes only affect the cost reduction amount, but not the reduction rate. Additionally, the impact of changes in product mix on both the actual cost reduction amount and reduction rate is discussed. Furthermore, the variation in the reduction rate of individual products also influences the overall cost reduction amount. This paper organizes the relevant content in a clearer way, making it more accessible for scholars.

Keywords—comparable products cost analysis factor variation

I. INTRODUCTION

With the continuous development of big data and information technology, market competition is becoming increasingly fierce. If enterprises want to improve economic benefits, they must increase revenue and reduce costs. For enterprises that mainly sell products, the key to reducing costs is to reduce the cost of main business, and the sales cost of goods sold. The amount is determined by the cost of inventory goods. Therefore, cost control in the product generation process is very important. For enterprises, product cost is an important comprehensive economic indicator. Product production costs are affected by factors such as output, material unit consumption, material unit price, labor and manufacturing overhead unit consumption man-hours, labor and manufacturing overhead unit price, and product mix (Khan & Qureshi, 2021). If enterprises want to control and reduce product costs, they must compare the actual product production cost data with the planned data on the basis of cost accounting, calculate the total difference, and decompose and analyze the multiple factors affecting product costs, and further discover the factors with problems, so as to put forward targeted improvement measures (Bhimani & Langfield-Smith, 2020).

Products can be divided into comparable products and non-comparable products according to whether they are comparable or not. Comparable products refer to products that were normally produced in the previous year or recent years and continue to be produced in the current year, and have complete cost data for comparison. If a certain product produced in the previous year has undergone changes in its technical conditions, the raw materials consumed, or the structure of the product in the current year, as long as the main performance, specifications, and basic quality standards of the product remain unchanged, it is still a comparable product. The characteristic of comparable products is that because they were produced in the past, there are cost and technical data from previous years. Because they continue to be produced in the current year, there is also cost data for the current year. The planned output, actual output, and last year's actual unit cost and other items of cost data for each year can be found through the production task sheet and cost calculation sheet (Zhang & Zhao, 2022). After the enterprise determines the comparable products, it can conduct cost analysis of the comparable products according to relevant cost data. Cost analysis of comparable products is an important component of the cost analysis of all commodity products. The main purpose of the analysis is to assess the completion of the cost reduction task of comparable products, which is essentially to analyze the implementation of the planned reduction amount and the planned reduction rate (Kumar & Singh, 2023). When conducting the analysis, it is first necessary to calculate the planned reduction amount and reduction rate of the comparable products, then calculate the actual reduction amount and reduction rate of the comparable products, and then compare the two. If the actual reduction amount is greater than the planned reduction amount, it indicates that the enterprise has overfulfilled the planned reduction task; otherwise, it indicates that the planned reduction task has not been completed. Because the completion of the comparable product plan is affected by three factors: output, product mix, and unit cost, on the basis of calculating the total difference, it is also necessary to decompose and analyze the impact of changes in each factor on the completion of the planned reduction task, calculate the degree of impact of changes in each factor on the planned reduction amount and reduction rate of comparable products, and find out the sensitive factors (Li & Zhang, 2023). Through analysis, the achievements of the enterprise's cost reduction work can be checked, the problems existing in the production process of comparable products can be discovered, and data reference can be provided for enterprise production incentives and improvement of problems (Wang, 2025; Shan, 2017).

According to the foregoing, the completion of the comparable product plan reduction task is affected by three factors: output, product mix, and unit cost. When analyzing the actual impact of a certain factor on the planned cost reduction amount and reduction rate, it is necessary to calculate the difference under the condition that the other two factors are relatively fixed. This way, the degree of influence of this factor on the planned reduction rate and reduction amount can be seen, providing data support for the subsequent improvement and production decisions of comparable products of the enterprise.

In the production of multiple varieties of comparable products, (1) when the variety structure and unit cost of comparable products remain unchanged, the increase in the total cost of comparable products due to changes in actual output means that the comprehensive reduction amount of comparable products calculated based on actual output will be greater than the reduction amount of comparable products calculated based on planned output, thereby over fulfilling the planned reduction task, otherwise vice versa; (2) when the actual output and unit cost remain unchanged, a larger planned reduction rate and a larger actual product mix than the planned product mix will lead to an increase in the cost reduction amount, which will greatly affect the cost reduction amount, otherwise vice versa; (3) when the actual output and actual product mix do not change, the increase in the actual reduction rate of each product due to the decrease in the actual unit cost of each product will increase the reduction amount of each product compared to the product reduction amount calculated based on the actual output and actual product mix, thereby overall affecting the actual cost reduction amount, over fulfilling the planned reduction task, otherwise vice versa (Wei, 2017).

II. PROBLEMS EXISTING IN THE COST ANALYSIS OF COMPARABLE PRODUCTS

In the current research on cost analysis of comparable products, although calculations and explanations are made on the planned cost reduction amount and reduction rate, the actual cost reduction amount and reduction rate, and whether the planned task is over fulfilled, etc., the derivation of the origin of relevant conclusions such as the quantitative change that "will only affect the cost reduction amount, but will not affect the cost reduction rate" is not performed, and some formulas are directly listed and applied in the teaching material, The conclusion is not combined with case studies, and there is no data support, which makes it difficult to understand its connotation, resulting in rote memorization and inability to integrate.

When analyzing the factors affecting the planned reduction amount and reduction rate of comparable product costs, it is mentioned that the change in product mix affects the reduction amount and reduction rate. When using the chain substitution method for factor analysis, the impact of the change from the planned product mix to the actual product mix on the actual reduction amount and reduction rate is not presented, which causes confusion for students.

III. THREE RELEVANT BASIS

Changes in output do not affect the planned reduction rate but affect the reduction amount. A company produces two kinds of comparable products, A and B. The planned output of product A is 120 pieces, the actual unit cost of the previous year was 10 yuan, and the planned unit cost of the current year is 9 yuan. The total actual cost of the previous year calculated according to the planned output and the actual unit cost of the previous year is 1200 yuan,

The total planned cost of the current year calculated according to the planned output and the planned unit cost of the current year is 1080 yuan, and the planned cost reduction amount is 120 yuan, and the planned cost reduction rate is 10%; the planned output of product B is 216 pieces, the actual unit cost of the previous year was 7 yuan, and the planned

unit cost of the current year is 6 yuan. The total actual cost of the previous year calculated according to the planned output and the actual unit cost of the previous year is 1512 yuan,

The total planned cost of the current year calculated according to the planned output and the planned unit cost of the current year is 1296 yuan, and the planned cost reduction amount is 216 yuan, and the planned cost reduction rate is 14.3%; the total planned reduction amount of the two products is 336, and the total planned reduction rate is 12.39%. According to the above data, there is the following analysis:

The change in product output only affects the amount of cost reduction, not the cost reduction rate. Under unchanged conditions, the impact of output changes on the amount of cost reduction is proportional; as output increases, the amount of cost reduction rises, and as output decreases, the amount of cost reduction falls. According to the data in the table, the planned reduction rate calculated based on the original planned output is = $[(120 \times 10 + 216 \times 7) - (120 \times 9 + 216 \times 7) - (120 \times 10 + 20 \times 10 \times 7) - (120 \times 10 + 20 \times 10 \times 7))$ 216×6] $\div (120 \times 10 + 216 \times 7) = 12.39\%$. If the planned output of product A increases by 20%, and the planned output of product B also increases by 20%, the planned cost reduction rate is: [(120×1.2×10 + 216×1.2×7) - (120×1.2×9 + $216 \times 1.2 \times 6$] ÷ (120×1.2×10 + 216×1.2×7). By factoring out the same 1.2 from both the numerator and denominator, and then canceling it, it can be seen that the result is equal to the original planned cost reduction rate. This shows that changes in output do not affect the reduction rate, but certainly impact the amount of reduction. The original reduction amount is $(120 \times 10 + 216 \times 7) - (120 \times 9 + 216 \times 6) = 336$ yuan, while the current reduction amount is (120×1.2×10 + 216×1.2×7) - $(120 \times 1.2 \times 9 + 216 \times 1.2 \times 6) = 403.2$ yuan. The actual reduction amount exceeds the planned reduction amount by 67.2 yuan, indicating that the task of calculating the reduction has been exceeded.

On this basis, if a is the planned reduction rate a=(x-y)+x, it can be deduced that $x-y=x\times a$, according to: Comparable product cost planned reduction rate = Comparable product cost planned reduction amount/ Σ (Planned output×Last year's actual unit cost), when the planned cost reduction rate and Σ (Planned output × Last year's actual unit cost) are known, the Comparable product cost planned reduction amount can be calculated, that is Σ (Comparable product planned output × Last year's actual unit cost) – Σ (Comparable product planned output × Planned unit cost).

Assume that a company produces two comparable products, Product A and Product B: Let the planned output of Product A be Q11, the actual output be Q21, the actual unit cost of last year be C11, the actual unit cost of this year be C21, the planned unit cost of this year be C31, the planned reduction amount be N11, the actual reduction amount be N21, the planned reduction rate be R11, the actual reduction rate be R21, the planned product structure be M11, and the actual product structure be M21; Let the planned output of Product B be Q12, the actual output be Q22, the actual unit cost of last year be C12, the actual unit cost of this year be C22, the planned unit cost of this year be C32, the planned reduction amount be N12, the actual reduction amount be N22, the planned reduction rate be R12, the actual reduction rate be R22, the planned product structure be M12, and the actual product structure be M22; then:

(1) Product structure: Product structure refers to the proportion of the quantity of each product in the total quantity of all products. Since the physical quantity of each product cannot be simply added, when performing comparable product cost analysis, the proportion of the cost of a product to the cost of all products is generally used as the product structure for analysis. The formula is as follows:

M11=Product A planned product structure =Q11 \times C11 \div (Q11 \times C11+Q12 \times C12)

M12=Product B planned product structure =Q12 \times C12 \div (Q11 \times C11+Q12 \times C12)

M21=Product A actual product structure=Q21×C11 \div (Q21×C11+Q22×C12)

M22=Product B actual product structure=Q22×C12÷

(Q21×C11+Q22×C12)

(2) Related formulas:

N11=Product A comparable product cost planned reduction amount =Q11 \times C11 - Q11 \times C31

N21=Actual Cost Reduction of Comparable Products=Q21×C11-Q21×C31

 $\label{eq:R21=Actual Cost Reduction Rate of Comparable} Products=N21/(Q21\times C11)$

IV. EXAMPLE ILLUSTRATION

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Table 1. Planned reduction.	reduction rate, an	d planned	product mix	data table for	products A and B.

Product	Production Volume (Pieces)	Unit Cost (Thousands of Yuan)			Total (Productio	Cost by on Volume	Planned Reduct Reduct	Planned Product Variety Structure	
Name	This Year's Plan	Last Year's Actual Average	This Year's Plan	This Year's Actual Average	Planned Amount Actual Order	Planned Based on Planned Order	Planned Reduction Amount	Planned Reduction Rate (%)	Planned Product Variety Structure
Product A	32	700	690	685	22400	22080	320	1.4286	0.4534
Product B	30	900	850	835	27000	25500	1500	5.5556	0.5466
		Total			49400	47580	1820	3.68	1

Table 2. Actual reduction, reduction rate, and actual product mix data table for products A and B

Product	Production Volume (Pieces)	Unit Cost (Thousands of Yuan)			Total Produc	Actual tion Cost	Actual Reduc and Redu	Actual Variety Structure	
Name	This Year's Actual	Last Year Actual Actual Average	This Year's Plan	This Year's Actual Average	In fact Actual Order	Real cost Actual Order	Actual Reduction Amount	Actual Reduction Rate(%)	Actual Variety Structure
Product A	30	700	690	685	21000	20550	450	2.1429	0.4
Product B	35	900	850	835	31500	29225	2275	7.2222	0.6
		Total			52500	49775	2725	5.19	1

The overall impact is analyzed as follows:

$$\begin{split} \text{N_total} &= \text{Planned reduction amount of comparable} \\ \text{product cost} &= (\text{Q11} \times \text{C11} + \text{Q12} \times \text{C12}) - (\text{Q11} \times \text{C31} + \text{Q12} \times \text{C32}) = (32 \times 700 + 30 \times 900) - (32 \times 690 + 30 \times 850) \\ &= 1820 \end{split}$$

 $\begin{array}{l} R_total = Planned \ reduction \ rate \ of \ comparable \ product \\ cost = N_total \ / \ (Q11 \times C11 + Q12 \times C12) = 1820 \ / \ (32 \times 700 \\ + \ 30 \times 900) = 3.68\% \end{array}$

N_actual = Actual reduction amount of comparable product cost = $(Q21 \times C11 + Q22 \times C12) - (Q21 \times C21 + Q22 \times C22) = (30 \times 700 + 35 \times 900) - (30 \times 685 + 35 \times 835) = 2725$

 $\label{eq:R_actual} \begin{array}{l} R_actual = Actual \ reduction \ rate \ of \ comparable \ product \\ cost = N_actual \ / \ (Q21 \times C11 + Q22 \times C12) = 2735 \ / \ (30 \times C12) \\ \end{array}$

 $700 + 35 \times 900) = 5.19\%$

Total variance amount = $N_actual-N_total$ = Actual reduction amount of comparable product cost-Planned reduction amount of comparable product cost = 2725-1820= 905

Total variance rate = $R_actual - R_total = 5.19\% - 3.68\% = 1.51\%$

Impact of various factors on the reduction amount: The chain substitution method analyzes the impact of changes in various factors on the amount and rate of cost changes, mainly influenced by three factors. First, let's look at the impact of changes in production volume on the reduction amount and rate (Zheng, 2019).

A. According to Planned Production Volume, Planned Variety Structure, and Planned Unit Cost for the Current Year

Cost reduction amount: Σ [Σ (Planned output × Unit cost of last year) × (Product planned product structure) × Product planned reduction rate] = (Q11×C11+Q12×C12) × M11 × N11 + (Q11×C11+Q12×C12) × M12 × N12 = (32×700+30×900) × 0.4534×1.4286%+(32×700+30×900) × 0.5466 × 5.5556\% = 319.98+1500.12=1820.1 (1)

The above formula can be simplified as [Σ (Planned Output × Last Year's Actual Unit Cost)] × Planned Cost Reduction Rate = (Q11 × C11 + Q12 × C12) × R = (32 × 700 + 30 × 900) × 3.684% = 1820.1

Cost Reduction Rate = 1820.1 / 49400 = 3.684%

B. Based on Actual Output, Planned Product Structure, and This Year's Planned Unit Cost

Cost Reduction Amount: Σ [Σ (Actual Output × Last Year's Unit Cost) × (Certain Product Planned Product Structure) × Certain Product Planned Reduction Rate] = (Q21 × C11 + Q22 × C12) × M11 × N11 + (Q21 × C11 + Q22 × C12) × M12 × N12 = (30 × 700 + 35 × 900) × 0.4534 × 1.4286% + (30 × 700 + 35 × 900) × 0.5466 × 5.5556% = 340.06 + 1594.26 = 1934.32 (2)

The above formula can be simplified as [Σ (Actual Output × Last Year's Actual Unit Cost)] × Planned Cost Reduction = (Q21 × C11 + Q22 × C12) × R = (30 × 700 + 35 × 900) × 3.684% = 1934.32

Cost Reduction Rate = 1934.32 / 52500 = 3.684%

Impact of Output Variation on Actual Cost Reduction Amount and Rate:

Impact on Cost Reduction Amount: (2)-(1) = 1934.32-1820.1 = 114.22

Impact on Cost Reduction Rate: 3.684% - 3.684% = 0

C. Based on Actual Output, Actual Variety Structure, and This Year's Planned Unit Cost

 $\begin{array}{ll} \mbox{Cost reduction amount: } \Sigma \left[\Sigma (\mbox{Actual output } \times \mbox{Unit cost of last year}) \times (\mbox{Actual product structure of a product}) \times \mbox{Planned reduction rate of a product} \right] = (\mbox{Q21} \times \mbox{C11} + \mbox{Q22} \times \mbox{C11}) \times \mbox{M21} \times \mbox{M11} + (\mbox{Q21} \times \mbox{C11} + \mbox{Q22} \times \mbox{C12}) \times \mbox{M22} \times \mbox{M12} = (\mbox{30} \times \mbox{700} + \mbox{35} \times \mbox{900}) \times \mbox{0.4} \times \mbox{1.4286\%} + (\mbox{30} \times \mbox{700} + \mbox{35} \times \mbox{900}) \times \mbox{0.6} \times \mbox{5.5556\%} = \mbox{300} + \mbox{1750.01} = \mbox{2050.01} \end{tabular}$

The above formula can be simplified as Σ (Actual output × Actual unit cost of last year)— Σ (Actual output×Planned unit cost of this year) = Q21×C11+Q22×C12-(Q21×C31+Q22×C32) = (30×700+35×900)-(30×690+35×850) = 2050

Cost reduction rate: 2050.01/52500=3.905%

Impact of product mix changes on actual cost reduction amount and reduction rate:

Impact on cost reduction amount: (3)–(2)=2050.01–1934.32=115.69

Impact on cost reduction rate: 3.905%-3.684%=0.221%

D. According to Actual Output, Actual Product Mix, and Actual Unit Cost of This Year

 $(30 \times 700 + 35 \times 900) \times 0.4 \times 2.1429\% + (30 \times 700 + 35 \times 900) \times 0.6 \times 7.2222\% = 450 + 2275 = 2725$ (4)

The above formula can be simplified as Σ (Actual output × Actual unit cost of last year)— Σ (Actual output × Actual unit cost of this year) = Q21×C11+Q22×C12— (Q21×C21+Q22×C22) = (30 × 700 + 35 × 900)— (30×685+35×835) = 2725

Cost reduction rate: 2725/52500 = 5.19%

The Impact of Unit Cost Changes on Actual Cost Reduction Amount and Reduction Rate:

Impact on the change amount: (4)–(3) = 2725–2050.01 = 674.9

Impact on the change rate: 5.19% - 3.905% = 1.285%

The impact of various factors on the actual reduction amount and reduction rate is shown in the table below:

Table 3.	Impact of	f changes	in	various	factors	on	actual	reduct	ion	amount	5
			and	d raduct	ion rata						

Factor Change	Impact on Reduction Amount	Impact on Reduction Rate
Change in Production Volume	114.22	0
Change in Product Variety Structure	115.69	0.221%
Changes in unit cost	674.9	1.285%
Total	905	1.506%

It can be seen from the above table that, through the changes from various factors planning to actual, the main reason why the comparable product planned reduction task was overfulfilled in this case is that the actual unit costs of the two comparable products, A and B, were lower than the actual unit costs of the previous year and the planned unit costs of this year. The unit costs of comparable products were better controlled, resulting in the actual reduction rates of the two comparable products, A and B, being higher than the planned reduction rates, which made the comparable products overfulfill the planned reduction task by 674.9 yuan.

V. CONCLUSION

In summary, it can be seen from the analysis that in the analysis of the implementation of the comparable product cost plan, if the actual reduction is greater than the planned reduction, it indicates that the enterprise has completed and over-completed the planned reduction task of comparable products, with high execution efficiency. Conversely, it indicates that the planned reduction task has not been completed, with low execution rate, and further analysis is needed for the uncompleted situation. Since there are three factors affecting the actual completion of the comparable product planned reduction task, namely output, product mix, and unit cost, by substituting the actual output, actual product mix, and actual unit cost for the planned product, planned product mix, and planned unit cost one by one, the differences in the completion of the actual reduction task and the planned reduction task due to the three factors can be seen separately. Then, targeted measures can be taken to highly complete the planned completion task of highly comparable products.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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