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The Theoretical Necessity and Realistic Choice of the First-in-first-out Equivalent Units Method

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***Abstract*—Enterprise cost accounting is mainly horizontal distribution and vertical distribution, in which the vertical distribution is mainly used by the equivalent units weighted distribution method and the equivalent units first-in-first-out method, this paper through the comparative analysis of two vertical distribution methods, pointing out the theoretical defects of the weighted average equivalent units method and the reasons for sustainable implementation.**

Keywords—equivalent units allocation method; theoretical necessity; the implementation obstacle; realistic choices

I. INTRODUCTION

Cost accounting has two must work, namely horizontal allocation and vertical allocation. Horizontal distribution refers to the distribution of various types of production factors, vertical distribution refers to the allocation of aggregated production costs between finished products and unfinished products at the end of the month. Among them, the most advocated by vertical distribution is the weighted average method of equivalent yield (hereinafter referred to as the weighted average method).

As we all know, the weighted average method refers to the method that converts the end-of-month quantity of work-in-process into the quantity of qualified products according to the degree of completion or the degree of input, and then distributes the accumulated total production cost according to the number of finished products and the proportion of the equivalent yield of the work-in-process, and then calculates the cost of finished products and the cost of unfinished products at the end of the month. Although this method simplifies the accounting procedure, there are obvious problems in the accounting results: when there is a big difference between the cost composition of the previous period and that of the current period, the ending work-in-process is still distributed according to the weighted average distribution ratio of the previous period and the current period, so that the calculation of the end of the month in the product is clearly inaccurate. Chen Zhijun (1986) proposed to allocate production costs by first-in-first-out (FIFO), regardless of the professional title examination or teaching or practice, are still using the weighted average equivalent units method, what causes a more accurate method in theory for a long time not to be valued? Starting from the analysis of this "neglected" reality, this paper analyzes in depth the theoretical necessity of the vertical distribution of equivalent yield and the deep reasons for the obstacles to its implementation.

II. LITERATURE REVIEW

Some domestic scholars have studied the FIFO method for vertical allocation of production cost. Chen Zhijun (1986) not only discussed the feasibility and specific distribution method of vertical distribution of first-in-first-out, but also put forward the basis for the superiority of such allocation. Dong Xinmin (1992), Chen Zhenjian (1994), et al., based on Chen Zhijun's research, had no obvious innovation in either perspective, research field or research method. Li Hui's (2000) discussion on the cost valuation method for completed products, Lu Wenzhang's (2008) accounting for finished products and work-in-process cost, and Ye Linhui's (2011) discussion on the way of carrying forward the product cost of work-in-process at the beginning of the month, none of them went beyond the discussion based solely on accounting methods. Song Guifang (2012) researched on cost allocation of completed products and production. The research perspective was touched on the implementation analysis, and there was innovation in the field. However, the analysis of the reasons for the failure to fully implement and promote these years was still not comprehensive enough. Therefore, this paper tries to make an exploration in the application, in-depth study of its implementation of the advantages and disadvantages of factors.

III. COMPARISON OF TWO CALCULATION METHODS OF EQUIVALENT UNITS METHOD

A. Principle and Application of Weighted Average Equivalent Units Method

1) Fundamentals: The basic principle of the weighted average valuation of equivalent production units method is to simplify the calculation. It directly adds up the work-in-process at the beginning of the month reflecting the cost of the previous month and the product cost of the current month. After the average distribution rate is calculated according to the total equivalent production volume, the finished product and the unfinished product are allocated

according to the respective weighted production volume. The specific calculation formula is as follows:

Equivalent yield of end products = number of end products × l00% (1)

Equivalent yield of work-in-process = closing work-in-process quantity × feeding degree or completion degree (2)

Unit allocation rate of equivalent units = (opening work-in-process cost + production costs for this month) ÷ (Equivalent yield of end products + Equivalent yield of closing work-in-process) (3)

Closing work-in-process cost = Unit cost of equivalent yield × Equivalent yield of closing work-in-process (4)

Total cost of end product = Unit cost of equivalent yield × Equivalent yield of end products (5)

2) Specific applications: Case 1: Assuming that the number of products of A company is 2,000 at the beginning of December, the cost of direct materials, direct labor and manufacturing are 30,000 yuan, 15,000 yuan and 13,000 yuan respectively. In this period, 10,000 pieces of production are invested, and 230,000 yuan are invested in direct materials, 160,000 yuan in direct labor and 110,000 yuan in manufacturing costs, respectively. 11,000 pieces are completed in this period and 1000 pieces are produced at the end of this period. Raw materials are invested once at the beginning of production, and the processing level of products is 50% at the beginning and end of production. The formula is calculated on the basis of the aforementioned weighted average equivalent yield method, and the specific cost allocation results are as follows in "Table I" below:

TABLE I. WEIGHTED AVERAGE EQUIVALENT UNITS ALLOCATION METHOD DISTRIBUTION TABLE UNIT: YUAN

Project	Direct materials	Direct labor	Manufacturing costs	Total	Yield
Opening work-in-process	30000.00	15000.00	13000.00	48000.00	2000
Input for the current period	230000.00	160000.00	110000.00	500000.00	10000
Accumulated this month	260000.00	175000.00	123000.00	548000.00	12000
End Products	238333.33	167391.30	117652.17	523376.80	11000
Closing work-in-process	21666.67	7608.70	5347.83	34623.20	1000
Unit cost of End products	21.67	15.22	10.70	47.60	

According to the calculation of "Table I", the finished product in the current period and the ending unfinished product unit cost will be the same, are 47.60, the distribution rate is the result of the weighted average distribution of the upper and lower two months, that is, at the end of this month, the product was actually put into production this month and was not completed this month. But with such a mixed weighted average distribution rate, although the procedures are relatively simplified, simple to operate, but can not really reflect the actual cost level of the current period, especially in the last two months when the cost discrepancy is large. If the cost level difference is small in different months, the defect of this method is not obvious, but if the cost level difference is large in different months, the product cost level last month will have a certain impact on the cost of the product at the end of the month when it is put into operation, this method has a greater deviation, therefore, The weighted average method is only suitable for use when the cost level is close to the upper and lower two periods.

B. The Principle and Application of First-in-first-out Equivalent Units Allocation Method

1) Fundamentals: The Basic Principle of First-in-First-out Equivalent yield allocation Method think: the first product to be put into production is completed first in this period, the order of completion of the product is the same as that of the first product to be put into production. The work-in-process transferred from early last month to next month must be completed first, followed by the completion of the new products put into production this month, because the initial work-in-process was put into production first this month and then into the production process at the beginning of this month. So at the beginning of the month, the work-in-process is bound to be completed first, the next completed is this month's new production of products, therefore, the initial work-in-process's costs do not need to be distributed in the ending work-in-process, it can be totally added in the finished product this month. The production cost of this month is only allocated between the products that are put into production and completed this month and the products that are put into production and unfinished at the end of this month, so the ending unfinished product must reflect the actual cost level of the month and will not be affected by last month's cost levels. The fifo's equivalent output shall not include the equivalent output of the unfinished product in the previous month to be fed or processed last month, including only the approximately production of actual feeding or processing this month. Equivalent output has nothing to do with the unfinished product cost at the beginning of the month, but only with the production cost of the month. Specific calculation should separate the product cost of the unfinished product at the beginning of the month and the production costs that will be put into operation this month: the production cost of this month needs to be allocated between the products that are put into production and completed this month and the products that are put into production but not completed at the end of this month, while the cost of work-in-process at the beginning of the month does not need to be allocated and all included in the completed product produced by unfinished product at the beginning of the month. A new calculation formula is obtained as follows:

Equivalent yield of opening work-in-process input this period = (1- the degree of completion or feeding of the opening work-in-process) × opening work-in-process quantity (6)

Equivalent yield of closing work-in-process = closing work-in-process quantity × closing work-in-process processing degree (or feeding degree) (7)

Equivalent ultimate production of product cost in current period = equivalent yield of opening work-in-process input this period + (current investment – closing work-in-process) + equivalent yield of closing work-in-process (8)

Cost distribution ratio of the product in current period = cost investment in current period ÷ equivalent ultimate yield of product cost in current period (9)

Cost of end products = [equivalent yield of opening work-in-process input this period + (current investment – closing work-in-process)] × cost distribution ratio of the product in current period + opening work-in-process cost (10)

Closing work-in-process cost = equivalent yield of closing work-in-process × cost distribution ratio of the product in current period (11)

The unit cost of the opening work-in-process completion category = (opening work-in-process cost + equivalent yield of opening work-in-process input this period × cost distribution ratio of the product in current period) ÷ opening work-in-process quantity (12)

The unit cost of product input and completed in current period = Cost distribution ratio of the product in current period (13)

2) Specific applications: Still take the information of the previous case one as an example, according to the first-in-first-out method formula ⑥-⑬ to calculate and allocate, the concrete results are as shown in "Table II":

TABLE II. ADVANCED FIRST-OUT ABOUT WHEN YIELD DISTRIBUTION METHOD CALCULATION UNIT: YUAN

Project	Direct materials	Direct labor	Manufacturing costs	Total	Yield
Opening work-in-process	30000.00	15000.00	13000.00	48000.00	2000
Input for the current period	230000.00	160000.00	110000.00	500000.00	10000
Total	260000.00	175000.00	123000.00	548000.00	12000
End Products	237000.00	152380.00	104761.90	494141.90	11000
Closing work-in-process	23000.00	22620.00	18238.10	63858.10	1000.00
Unit cost of the opening work-in-process completion category	15.00	15.12	11.74	41.86	
Unit cost of product input and completed in current period	23.00	15.24	10.48	48.72	

According to the calculation results of "Table II", the cost of unfinished product is 63858.10 yuan. It is nearly 30,000 yuan more than the weighted average allocation method in Table 1, which is 34623.20 yuan. This show: the ending work-in-process calculated in table 1 is severely low and the finished products are high, thus, the profit of case 1 reflected by weighted average distribution method in table 1 is also less. Obviously, the distribution of weighted average equivalent yield method does not objectively and fairly reflect the real cost level of the month.

C. Analysis of the Reasons for the Difference of Two Methods

What we need now is not to briefly describe the objective existence of this difference, but to analyze the causes through the phenomenon, and to reveal its theoretical requirements and the fundamental basis of realistic choice.

1) Results of different allocation rates: The calculation results of the two methods are different, this difference comes from the calculation method, and the calculation method comes from the basic principle, the core difference of the principle lies in what allocation rate is used to calculate the final product cost. And the weighted average method uses mixed allocation rate including the two months up and down to calculate closing work-in-process, first in first out, only use the monthly allocation rate to calculate the ending unfinished product. However, according to the principle of FIFO, the closing work-in-process can only be the products that are put into production at the current period and are not completed at the current period, which cannot be related to the cost of the previous period.

2) Two specific representations of calculating differences: First, the actual cost of the closing work-in-process is higher than the calculation results. With a weighted average equivalent yield distribution method, when the cost of raw materials, labor and manufacturing is rising constantly, because the finished product uses a mixed allocation rate that includes the previous month, at the time of allocation, in the distribution ratio, a part of the slightly lower cost of last month will be included, so that the ending product in process will be on the low side. However, the actual product cost of closing unfinished product which only reflects the cost level current month should be higher. Therefore, when the cost of factors of production rises, the final work-in-process obtained by weighted average method is low and inaccurate in product cost.

Second, the actual cost of the closing work-in-process is lower than the calculation results. Similarly, if with the

weighted average equivalent yield distribution method, when the cost of raw materials, labor and manufacturing in the current month is declining, because of the use of a mixed distribution rate of up to two months in vertical distribution, some of last month's slightly lower costs will be included in the final product in which the end of the calculation is high. The cost calculation of the corresponding finished product will be lower. Therefore, when the cost of production factors decreases in the current month, the ending work-in-process obtained with the weighted averaging method will be higher than the actual product.

IV. CONCLUSION

Through the previous analysis, we have clearly seen the differences between the two calculation methods and the reasons for the differences, and then analyze the theoretical necessity of the two methods and the impact factors of the actual choice.

A. Theoretical Necessity

From the theoretical research level, based on academic rigor and the correctness of knowledge, this paper argues that fifo equivalent units method should be used in the allocation of production costs between finished products and unfinished products, which is the inevitable theoretical requirements, the specific reasons are as follows:

1) The inevitable requirement of real cost calculation: According to the fifo method, the actual cost level of the same product in different periods can be seen. This enables us to track the real reason for the difference between the actual cost and planned (standard) cost of finished products in the current period from the perspective of product cost structure: whether it is affected by the work-in-process cost at the beginning of the period, or by the changes in production technology and production organization or prices in the current period. And then we can targeted formulate measures to reduce production cost, effectively control the cost.

2) The necessary requirement of real profit calculation: According to first in first out method to calculate the product cost, can reflect the real profits of the enterprise after the current product sales, which is beneficial to maintain the country's fiscal revenue. It is also conducive to the assessment and management of sub-companies by group enterprises, to prevent defects on cost calculation method, the false phenomenon of product cost calculation, which will make the country suffer the loss of enterprise income tax, the group headquarters can not accurately assess the true profits of subordinate companies.

3) The inevitable requirement of true cost assessment: If the enterprise use the weighted average equivalent output method to calculate the product cost, in all kinds of production elements price rises, the cost calculation result will lower than the first-in, first-out method. When it is necessary to assess the cost completion, to transfer (defer) a portion of the cost of work-in-process with a higher cost level to the end product, may make it easier for the enterprise to complete the assessment task of completed products, but in fact is not real. Instead, they cheat the performance appraisal of cost control

4) Necessary requirements for the consistency between physical flow and cost flow: From the continuity of production process, under complex multi-step continuous production conditions, the products produced in the previous step will be carried over to the next step. If the cost value carried over is inconsistent with the value of the physical flow, it will affect all links until the final cost accounting is divorced from reality, not only conducive to the terminal product sales accounting, also go against export business accounting of excess semi-finished products.

B. Realistic Choice

Realistic choice refers to the choice made in the vertical distribution of costs when enterprises are faced with the actual macro and micro situations based on the interests of enterprises and the convenience of accounting personnel.

1) The realistic choice of corporate tax avoidance: Over the years, the decline in the value of the currency and the proper inflation have been an indisputable fact, the main factors of production such as raw materials, labor costs and manufacturing costs are rising. At this point, if the first-in, first-out method is used, the closing work-in-process cost be distributed with the higher distribution rate of the current period, and the result must be higher. Then the total production cost minus the higher end work-in-process, the resulting finished product is correspondingly lower so that the profits of enterprises will be more. Due to the idea of tax avoidance, enterprises will not actively choose fifo method to accounting, although they know that this method is accurate and true.

2) Realistic options for simplifying accounting: Since the weighted average equivalent production method does not allocate the production cost in the three parts of the finished product that was opening work-in-process in current period, the finished product input in current period and the unfinished product input in the current period. Also, there is no need to deliberately use the current allocation rate in the calculation of the closing work-in-process, which can greatly simplify the workload of the cost calculation, but also for the enterprise to save tax. As for the errors in cost assessment, we can take into account the standard cost in advance, so that the fairness of the assessment will not be affected. Thus, the enterprise staff is certainly willing to use the weighted average method.

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