ワーキングペーパー

Calculation Structure of Gemba Kaizen Costing[1)]

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As a new costing theory, GKC (Gemba Kaizen Costing) also needs to present the cost concept and calculation structure. In GKC, after decomposing the manufacturing cost into real and non-real costs, real profit is calculated by subtracting the real cost as product cost from the sales amount. Gross profit is then calculated by subtracting non-real costs (non-value-added and Muda (waste) costs) from real profit. Operating income is calculated by subtracting selling, general, and administrative expenses from the gross profit. Through this calculation process, the Kaizen effect is calculated and presented in the income statement as cost reduction and opportunity loss. When Free capacity is used to increase production, it is calculated as an increase in sales.

Ⅰ Cost of Goods and Muda (Waste) Cost

This book defines Muda as an action that does not create customer value in corporate activities, with reference to Mr. Taiichi Ohno's "Muda Concept."

In production activities, management resources are expended along with various actions regardless of whether they generate customer value. While Muda (waste) is an action that does not create customer value, it consumes

1) 本稿は，上總康行・柊紫乃［2023］「現場改善会計論：改善効果の見える化」中央経済社の第5章（pp.127-167）の英訳版である。書籍は第１章から第６章で構成され，そのうち第5章は主としてGKCの計算構造について述べられている。海外の会計研究者との議論のため，当該章の英訳をワーキング・ペーパーとして公表する。

This paper is an English translation of Chapter 5 of "Gemba Kaizen Costing-Visualization of Kaizen Effect" by Kazusa Yasuyuki and Hiiragi Shino (Kazusa and Hiiragi 2023). The book consists of six chapters, of which Chapter 5 mainly describes the calculation structure of GKC. The English translation of this chapter is published as a working paper for the purpose of discussion with overseas accounting researchers.

management resources. The management resources expended for Muda are calculated as "Muda (waste) cost."

In cost accounting, the cost of production per unit, or product cost, is usually calculated. This product cost is recorded as the cost of sales that has been expended to earn revenue (sales) for the current period, and gross profit is calculated as the difference between the sales and cost of sales. On the other hand, manufacturing cost that does not contribute to profit is recorded as the ending inventory to be carried forward to the next period or later.

When computing for the product cost, it may appear that only the "good cost," which is expended to produce the finished product as a good that satisfies customer value, is being calculated. However, calculating the product cost is not that simple. In fact, product cost also includes "Muda cost," such as spoilage or impairment costs.

Prof. Michiharu Sakurai explains, "Spoilage means that the product did not become complete in the manufacturing process. A product resulting from manufacturing failure is called a defective, spoiled or reworked unit. If the spoilage is valued in monetary terms, then the ..... cost of the spoiled product minus the valuation of the spoiled product is the spoilage cost." Furthermore, "Impairment (shrinkage) refers to the loss of raw material input due to evaporation, dusting, gassing, smoking, etc. during processing. This amount is the impairment cost. It is generally almost worthless. Hence, unlike spoilage, it is not expressed as impaired goods" (Sakurai [2014] pp.177-178, In the quoted text, Gothic typeface was ignored. The same applies hereafter).

Spoilage or impairment cost is confirmed by "Genka-keisan kijun (Cost accounting standards, hereinafter abbreviated as "Standards")."

(a) Accounting processing of spoilage and impairment in process costing

In principle, spoilage cost is borne by the finished goods and works-in-progress of a period, and no special account title is set for it. The

impairment of raw materials produced by, for example, evaporation, dusting, gasification, and smoking during the process is equivalent to spoilage ("Standards" 27).

(b) Accounting processing of spoilage in job costing

Spoilage is accounted for in one of the following ways:

(1) The actual or estimated amount of spoilage is charged to the manufacture order of the product.

(2) Spoilage is assumed to be an indirect manufacturing cost charged to the department where it occurred. When calculating the predetermined burden rate of indirect costs, the scheduled amount includes spoilage ("Standards" 35).

Since spoilage cost is borne by the finished goods in process costing, Muda cost will also be borne by the finished goods in the current and next fiscal years. In other words, "Muda cost" will be borne by the finished goods in the current and next fiscal years. In job costing, it is either added to the manufacturing order or to indirect manufacturing costs and borne by the finished goods.

Thus, "Muda cost" is included in the finished goods in the current and subsequent periods, but "Standards" does not explicitly calculate Muda cost unless there is a particular anomaly. As a result, Muda cost is not shown in the income statement, which is brought to the attention of management. In this connection, Prof. Sakurai presents the following arguments:

Spoilage or impairment within the normal range is disregarded (i.e., ignoring the normal spoilage/impairment and charging it to the good), which is the method specified in "Standards" (27) . The method of disregarding spoilage or impairment may be simpler but ignoring them from the calculation is not useful for management as management control is not

visualized (Sakurai [2014] p.185).

Furthe, Prof. Sakurai highlighted that, "The disregard method is simple but not useful for management," and "The non-disregard method (spillage within the normal range is calculated separately and charged to the good) is desirable for visualizing management and consciously preventing environmental pollution. The non-disregard method is assumed to contribute to material flow cost accounting" (Sakurai [2014] p.72).

We agree with Prof. Sakurai's assertion in the basic recognition. However, from the perspective of Gemba Kaizen, there is no distinction between normal or abnormal spoilage and impairment. Spoilage or impairment is an equally important subject in Gemba Kaizen. Therefore, the "non-disregard method" should be adopted, and spoilage or impairment should not be charged to the goods, but rather, independently calculated as Muda cost.

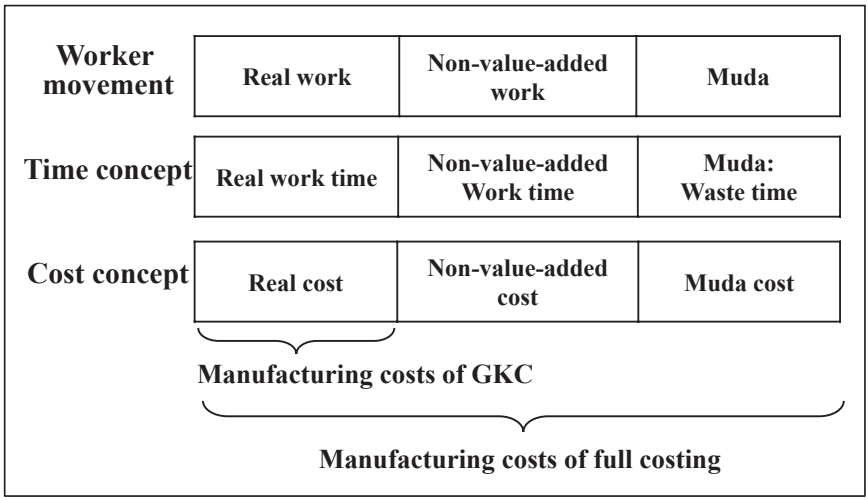
In Gemba Kaizen, Muda cost is gradually reduced from the product cost by accumulating and continuing small Kaizen efforts. While there can sometimes be surprisingly large cost reductions, this does not happen very frequently. GKC requires a calculation structure that allows the effects of Gemba Kaizen to be visualized as Muda cost reduction. Therefore, a non-disregard method to visualize Muda cost is essential. Furthermore, the visualized Muda cost must be shown on the income statement and the information must be "disclosed" and "shared" with management.

Ⅱ GKC's Cost Concept and Account Setting

1. Cost concept

In response to the "worker movement" (Ohno [1988] p.58) presented by Mr. Ohno, we specifically developed the time concept used in GKC. **Figure 5-1** shows the time and cost concepts used in GKC, corresponding to the following categories of "worker movement" proposed by Mr. Ohno: real work, non-value-added work, and Muda, respectively. These concepts are briefly described below.

Figure 5-1　GKC's time and cost concepts



Source: Author

（1）　Worker movement

In Gemba Kaizen, work sampling can be classified into real work, non-value-added work, and Muda. Although it may be difficult to properly perform work sampling at the beginning of Gemba Kaizen, its accuracy will improve as Kaizen progresses and distinguishing between real work, non-value-added work, and Muda work will become possible.

（2）　Time concept

The time required for real work among "worker movement" is known as real work time. The time required to send and receive product design information in Prof. Fujimoto's theory of design information transcription follows the same concept as "real work time." In addition to real work time, time is also required for non-value-added work and Muda time. These time concepts are respectively known as non-value-added work time and Muda time or collectively as non-real work time when they occur simultaneously.

（3） Cost concept

In general, “cost is the monetary amount of the consumption of goods or services (hereinafter referred to as ‘goods’) ascertained in a given benefit in management” (“Standards” 3). Therefore, the economic value of management resources consumed by real work implies real cost. Similarly, non-value-added cost and Muda cost are the economic values of management resources consumed in non-value-added work and Muda, respectively. In cases wherein these costs occur simultaneously, they are collectively referred to as non-real cost.

In GKC, only real cost is calculated as product cost among manufacturing costs. The remaining non-value-added and Muda costs are non-real costs. By contrast, in the commonly used full costing method, the cost of a good is calculated by adding the economic value of all management resources required for production. This evidently includes non-value-added and Muda costs, which are borne by the customer. The objective of Gemba Kaizen is to reduce not only Muda but also non-value-added activities to the utmost limit. Under ideal conditions, GKC and full costing product costs are identical.

2. Account setting

GKC does not necessarily need to implement a new cost accounting system. The cost accounting system currently in operation can be operated for GKC with minimal modifications. Specifically, when implementing GKC in an existing system, at a minimum, real, non-value-added, and Muda costs should be additionally set while using the conventional account title. **Table 5-1** shows the relationship between conventional and GKC cost accounts.

Table 5-1 Relationship between conventional and GKC cost accounts

GKC cost accounts / Conventional cost accounts	Real cost	Non-real cost	
		Non-value-added cost	Muda cost
Direct material costs	○	○	○
Direct labor costs	○	○	○
Other direct costs	○	○	○
Indirect manufacturing costs	×	○	○
Spoilage costs, etc.	×	×	○

Note: ○ : GKC cost is included in the account.
× : GKC cost is not included in the account.

Source: Author

Table 5-1 is briefly explained below.

① The traditional accounts of direct material costs, direct labor costs, and other direct costs can be used. Direct material costs include real costs achievable under current production conditions and methods, and non-real costs (non-value-added and Muda costs) that can be reduced by Gemba Kaizen. Direct material cost is theoretically calculated by multiplying the unit price of raw materials required to process a product by the quantity used, as indicated in the product design information; however, the actual direct material cost is often higher than the projected value. Direct labor cost also includes real costs achievable under current production conditions and methods, and non-real costs (non-value-added and Muda costs) that can be reduced by Gemba Kaizen. Direct labor cost is calculated by multiplying the direct labor hours required for the real work by the wage rate. Other direct costs include real and non-real costs.

Note that direct material cost, direct labor cost, and other direct costs include not only real costs but also non-real costs (non-value-added cost + Muda cost). Among the non-real costs included in these direct

manufacturing costs, Muda cost will be reduced first as Gemba Kaizen continues, followed by non-value-added cost, which will be gradually and steadily reduced. In addition, in order to reduce real costs, significant changes must be made in production conditions and methods.

② Indirect manufacturing cost includes indirect material costs, indirect labor costs, and other indirect costs. Strictly speaking, these indirect manufacturing costs do not include the cost of real work, only that of raw materials, labor, machinery, equipment, and energy used in non-value-added work and Muda. Indirect manufacturing cost only includes non-real costs (non-value-added cost + Muda cost), not real costs. Gemba Kaizen reduces non-value-added work and Muda, which in turn reduces non-value-added and Muda costs.

③ Spoilage cost, etc.: In conventional costing, account titles, such as spoilage, depletion, mill ends, and waiting time costs, are used as needed and are not intentionally set to capture Muda cost. However, in Gemba Kaizen, Muda is the top priority Kaizen target in the "worker movement." Thus, GKC sets up an account to capture and calculate Muda cost in order to provide Kaizen members and management with accounting information as results that contribute to Kaizen.

④ Opportunity loss: Opportunity loss is calculated as a difference by comparing direct labor cost and indirect manufacturing cost before and after Kaizen; thus, a special account need not be set up for it.

3. Allocation of indirect manufacturing costs

In GKC, the indirect manufacturing costs account is used to handle non-value-added costs. "Since manufacturing overhead is indirect in relation to the product, it must be allocated to the cost sheet of each instruction using some allocation basis" (Okamono [2000] p.207). The basis of allocation can

be classified according to the quantity of the allocation basis used:

（1） Single allocation basis
（2） Multiple allocation basis
　① Departmental allocation
　② Allocation by activity
　③ Allocation by expense

These classifications are briefly described below.

（1） Single allocation basis

A single allocation rate is used for the entire plant. This allocation rate is called the “blanket rate” or “plant-wide rate.” According to Okamoto (2000 p.208) , the allocated indirect manufacturing cost would be a “highly unreasonable amount” if calculated by product.

（2） Multiple allocation basis

① Departmental allocation

Various allocation rates are used for different departments within the plant. For example, “Machining and assembly departments work differently, and ..... in order to reflect these differences in the product-specific calculations, it is better to use the appropriate departmental rates for each department” (Okamoto [2000] p.208) . The allocation of indirect manufacturing costs by multiple departmental allocation rates has been a common practice in Japanese manufacturing companies.

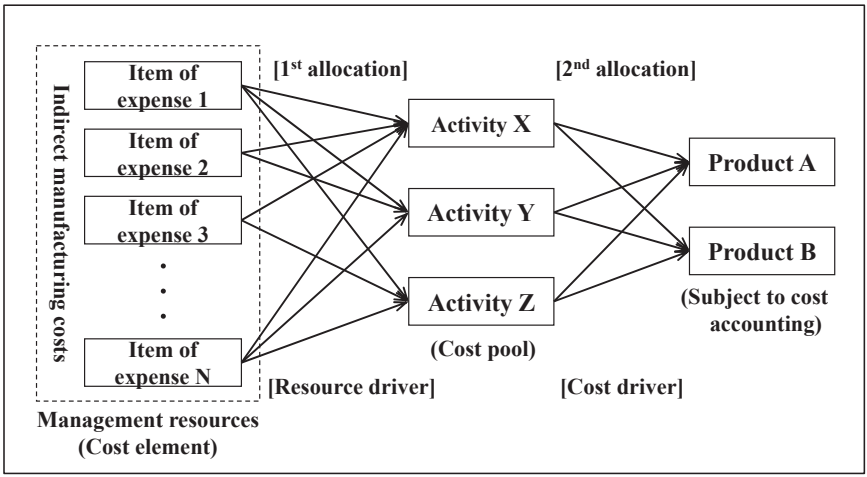
Indirect manufacturing cost is usually calculated by first totaling departmental costs, followed by a second totaling of departmental costs (allocation of auxiliary departmental costs) . In the 1st allocation, individual departmental expenses are charged to each department as incurred, and common departmental expenses are allocated to each department as incurred by the appropriate basis of allocation. In the 2nd allocation (allocation of auxiliary departmental costs) , auxiliary departmental costs are allocated

to the relevant department that provided the service on an appropriate basis (Okamoto [2000] pp.213-216).

② Allocation by activity

Assuming that there are different activities rather than different departments in the plant, multiple allocation rates are used for different activities. This is known as the so-called ABC (Activity-based costing) . ABC focuses on the activities that make up the production process. First, using this activity as a cost pool, the cost element is allocated by the resource driver (1st allocation) , then the activity cost is allocated to the product by the activity driver according to the activity's degree of consumption (2nd allocation) (Raffish and Turney [1991] p.53) . Activity driver is sometimes referred to as cost driver. Figure 5-2 shows a conceptual diagram of ABC.

Figure 5-2 Conceptual diagram of ABC



Source: Author

In ABC, an activity is recognized and the cost of the activity is allocated to the product using cost factors according to the activity's degree of

consumption. The more cost factors there are in ABC, the more one can expect an accurate allocation calculation; however, the number of cost factors is generally considered to be around 80 to 150 (Sakurai [1995] p.54).

Prof. Yoshitaka Kobayashi (Keio University) introduced the reaction of Japanese practitioners to ABC as follows:

> As far as I have been able to contact, the reaction of Japanese practitioners to ABC can be divided into two main categories. One response is, "Why are you doing that?" and the other is, "Why are you doing that now?
>
> The former reaction seems to be that since allocations are always arbitrary, it would be more productive to engage in more important things (such as developing profitable products that the market demands and developing management accounting systems that respond to corporate globalization) rather than focusing attention on such things. On the other hand, the latter reaction is that the Company has been meticulously allocating funds for a long time, and it is hard to understand why this should be a problem now. (Kobayashi [1992] p.14)

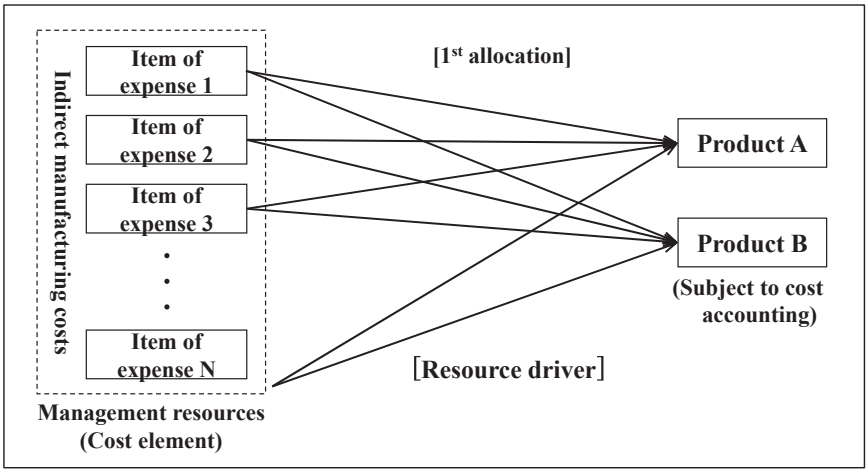
The practitioners responded by saying that "ABC is not worth adopting." The current ABC adoption rate in Japanese firms remains extremely low at approximately 10% (Kawano [2022] p.21).

Prof. Kobayashi argued that "some Japanese companies charge costs directly to the product as much as possible. For costs that cannot be charged directly, they choose a basis of allocation according to the situation and allocate them meticulously" (Kobayashi [1992] p.20) . Many practitioners in Japanese companies seem to understand that "basis of allocation = cost driver." At the same time, many Japanese firms had adopted departmental allocation on a multiple allocation basis rather than on a single allocation basis, and "detailed allocation had been in place for a long time."

③ Allocation by expenses

Which may not attract much attention, management resources (indirect manufacturing costs) are allocated by product without setting up cost pools such as departments or activities. It can be described as a method of allocating indirect manufacturing costs to the product only by 1st allocation. **Figure 5-3** shows a conceptual diagram of allocation by expenses on a multiple allocation basis.

Figure 5-3 Conceptual diagram of allocation by expenses on a multiple allocation basis



Source: Author

Figure 5-3 shows that indirect manufacturing costs are allocated by product, with appropriate allocation rates by expense item. If the causal relationship between management resources (cost elements) and their proportion consumed for the product is clear, the product cost can be accurately calculated as long as the allocation calculation is simple. In certain situations, some expenses may be grouped and allocated. This effectively means the combined use of departmental allocation or allocation by activity. This allocation method is recommended in GKC because it emphasizes that

management resources are consumed to produce products.

In relation to this allocation method, the "Full-and-Direct Costing" method proposed by Prof. Takahiro Fujimoto is examined. Prof. Fujimoto, together with Prof. Junjiro Shintaku, has long organized the consortium of manufacturing companies at the Monozukuri Management Research Centre (MMRC) during his tenure at the University of Tokyo. Together with the members and external participants, they also organized a manufacturing management accounting study group. Following the findings obtained with the study group, Prof. Fujimoto proposed "the Full-and-Direct Costing" method based on design information transfer theory. The main points are as follows:

> Based on design-based view of manufacturing, this paper regards a product and an artifact as a combination of design information and its medium. Price is related to customers' evaluation of design information, whereas cost (its productivity component) is related to the concept of "the amount and the time that the product occupies various media of productive resources." (Fujimoto [2012] p.1).

Many argue that direct costing should be called variable costing as it usually refers to costing in which only variable costs are taken as product costs (Kazusa [2017] p.225). Prof. Fujimoto argues that, regardless of the classification of variable or fixed cost, the system has been devised to treat what is conventionally regarded as a fixed cost as a variable cost. In the sense of allocating directly to the product without going through departments or activities, the "Full-and-Direct Costing" method was advocated.

Prof. Fujimoto's theory is highly compatible with our GKC indirect cost allocation method (i.e., allocation by expenses on a multiple allocation basis). GKC needs further verification in practice with regard to allocation by expenses on a multiple allocation basis. Thus, our study aims to complete

this verification in order to ensure a more adequate application of the GKC method.

4. GKC product cost

In response to real work, non-value-added work, and Muda as "worker movement" proposed by Mr. Ohno, we presented the time concept, cost concept, and account setting used in GKC, respectively. Here, the real, non-value-added, and Muda costs used in GKC can be summarized as follows:

[GKC product costs]

Product cost = Real cost
= Real direct material costs + Real direct labor costs
+ Real other direct costs
Non-real cost = Non-value-added costs + Muda costs
= Indirect manufacturing costs
+ Non-value-added direct material costs
+ Non-value-added direct labor costs
+ Non-value-added other direct costs
+ Muda costs

[Product costs for full costing]

Product cost = Direct material costs + Direct labor costs + Other direct costs
= Real costs + Non-real costs
= Real costs + Non-value-added costs + Muda costs

In the above equation, only real cost constitutes product cost in GKC. The breakdown includes real direct material costs, real direct labor costs, and real other direct costs. Costs other than real costs are "non-real costs," which include non-value-added and Muda costs. Non-value-added costs include indirect manufacturing costs as well as non-value-added direct material costs, non-value-added direct labor costs, non-value-added other direct costs, and

Muda costs. Muda costs include direct material costs, direct labor costs, and other direct costs, in addition to spoilage, impairment, mill ends, and waiting time costs.

Thus, in GKC, the consumption of all management resources required to produce a product is calculated as the sum of the real, non-value-added, and Muda costs. Only real cost is calculated as product cost, while non-real cost is not included in product cost; both are provided as cost information contributing to Gemba Kaizen. The sum of real and non-real costs is the same as the product cost in normal full costing.

In GKC, real cost is calculated as product cost; non value-added and Muda costs are considered as non-real costs and can be used for internal management together with opportunity losses. However, for external reporting purposes, such treatment is not permitted. Therefore, an "adjustment calculation" is required to transfer non-real costs (non-value-added and Muda costs) back to product cost and inventories in the accounts. This adjustment calculation is the same as that for transferring back the fixed costs expensed in the current year to product cost and inventories at the end of the year when direct costing is adopted.

In addition, real cost occurs in relation to real work, but its share of the product cost, which is the aggregate of all costs, is considerably smaller than what the reader might expect. Toyota Motor Co., Ltd (now Toyota Motor Corporation), stated that:

> Most costs are calculated together with ..... labor costs, material costs, etc., other than the "real cost of making things."
>
> Toyota Motor Co., Ltd says this is because "the true cost is about as small as the seeds of dried plums." It can be made from as little as dried plum seeds, but it is inflated to the size of a summer tangerine. Moreover, they are only scraping off the unevenness of the skin. There is no reason why we should be able to say that we have reduced costs with this (Japan Management Association [1978] p.19)

The real cost is so small that its size is figuratively about the same as that of a dried plum seed. Nevertheless, while having small real costs was "normal" at Toyota Motor Co., Ltd, we were surprised to learn that these costs were figuratively about the same size as dried plum seeds. With the exception of Toyota Motor Corporation and other companies that are thoroughly committed to Gemba Kaizen, it would be extremely difficult to suddenly get to the root of the matter and extract the "seeds" by means of Kaizen. The only way to achieve this is to gradually advance Kaizen through trial and error, beginning with the elimination of "Muda" then of "non-value-added work," and continuously and persistently scraping off the "bumps on the skin of the summer tangerine."

Ⅲ Gemba Kaizen effect and income statement

1. GKC income statement

In GKC, product cost is broken down into real and non-real costs, and real profit is calculated by first subtracting real cost from sales. Gross profit is then calculated by subtracting non-real cost (non-value-added and Muda costs) from real profit. Operating profit is calculated by deducting selling as well as general and administrative expenses from the gross profit.

Real cost includes real direct material costs, real direct labor costs, and real other direct costs directly related to real work that generates added value. Non-value-added cost includes indirect manufacturing costs such as "indirect material costs, indirect labor costs, depreciation, equipment maintenance costs, premises transport costs, energy costs, and plant management costs" related to non-value-added work, and other non-value-added costs included in direct material costs, direct labor costs, and other direct costs. Muda cost also includes "direct material costs, direct labor costs, and other direct costs" related to raw materials and labor, as well as "spoilage, depletion, mill ends, and waiting time costs."

Free capacity is created by Gemba Kaizen. There are four ways of utilizing the created Free capacity (see Figure 4-5 in the original Japanese book; Kazusa and Hiiargi [2023] p.109).

Variable Free capacity

①Reduction：Reduction of input management resources
→Cost reduction

②Storage：Warehousing → Inventory increase → Opportunity loss

Fixed Free capacity

③Application：Production increase
→ On demand → Increase sales
→No demand → Inventory increase → Opportunity loss
Management innovation → New business, etc.
→Increase sales

④Retention：Left unattended → Idle facilities, idle personnel, etc.
→Opportunity loss

Traditionally, the objective of Kaizen has been to aim for cost reduction by ①Reduction of input management resources, while conventional costing has been responsible for calculating these cost reductions. However, if we adopt a different utilization from the ①Reduction of input management resources, that is, ②Storage, ③Application, and ④Retention, a completely different Kaizen effect will emerge. This Kaizen effect can be measured as increased amounts of opportunity loss or sales. The GKC we advocate is a new accounting method that can comprehensively measure the four types of Kaizen effects.

Therefore, in contrast to conventional costing, the calculation method of GKC is explained in more detail, focusing on the calculation of the amount of cost reductions and opportunity losses as Kaizen effects.

The conventional costing and GKC income statements are illustrated in

Figures 5-4 and **5-5**, respectively. These income statements are presented in anticipation of the basic data from Gemba Kaizen and the resulting Kaizen data in [Example 7], which are explained in more detail in the next section.

Figure 5-4 will be easily understood by anyone who has studied basic bookkeeping or accounting. However, conventional costing rarely shows direct material costs, direct labor costs, and indirect manufacturing costs as a breakdown of the cost of sales. GKC is unique because it reflects the breakdown of the cost of sales. The 8,000,000 yen in sales minus the 5,800,000 yen in cost of sales results in a 2,200,000 yen gross profit. The 1,600,000 yen in selling, general, and administrative expenses are deducted from the gross profit to arrive at 600,000 yen in operating income.

Figure 5-4 Income statement for conventional costing (Before Kaizen)

Sales		Yen 8,000,000
Cost of sales		
Direct material costs	2,300,000	
Direct labor costs	2,000,000	
Indirect manufacturing costs	1,500,000	5,800,000
Gross profit		2,200,000
Selling expenses	800,000	
General and administrative expenses	800,000	1,600,000
Operating profit		Yen 600,000

Source: Author

The breakdown of real cost in the GKC income statement before Kaizen (**Figure 5-5**) should be shown as real direct material costs and real direct labor costs, but we have abbreviated them as direct material costs and direct labor costs. Similarly, the breakdown of non-real cost should be shown as non-real direct material costs and non-real direct labor costs, but we have abbreviated them as direct material costs and direct labor costs. The same notation is used in the GKC income statement presented below.

Figure 5-5 GKC income statement for conventional costing
(Before Kaizen)

Sales		Yen 8,000,000
Real cost		
Direct material costs	2,000,000	
Direct labor costs	1,600,000	3,600,000
Real profit		4,400,000
Non-real cost		
Direct material costs	300,000	
Direct labor costs	400,000	
Indirect manufacturing costs	1,500,000	2,200,000
Gross profit		2,200,000
Selling expenses	800,000	
General and administrative expenses	800,000	1,600,000
Operating profit		Yen 600,000

Source: Author

In the GKC income statement before Kaizen, 3,600,000 yen in real cost is first deducted from 8,000,000 yen in sales, and 4,400,000 yen in real profit is calculated. Next, 2,200,000 yen in non-real cost is deducted from the real profit to calculate the gross profit of 2,200,000 yen. Selling, general, and administrative expenses amounting to 1,600,000 yen are deducted from the gross profit, resulting in an operating profit of 600,000 yen.

In comparison, the gross profit of 2,200,000 and operating profit of 600,000 are the same for both income statements. The difference lies in the breakdown of the cost of sales. In the income statement based on conventional costing (**Figure 5-4**), the cost of sales includes 2,300,000 yen in direct material costs and 2,000,000 yen in direct labor costs. However, in the GKC income statement (**Figure 5-5**), it is broken down into real and non-real costs. It should be noted that the breakdown of non-real cost (i.e., 300,000 yen in non-real direct material costs and 400,000 yen in non-real direct labor costs) "visualizes" the existence of non-value-added and Muda costs arising

from non-value-added work and Muda in the production Gemba.

The calculation structure of the GKC income statement is summarized as follows:

Sales − Real cost = Real profit
Real profit − Non-real cost =Gross profit
Gross profit − (Selling expenses + General and administrative expenses)
= Operating profit

In the general income statement, cost of sales is deducted from sales to calculate gross profit, whereas in the GKC income statement, the details of the cost of sales are clearly stated as real and non-real costs. GKC has emphasized the opportunity loss to "visualize" the Kaizen effect as information for facilitating accounting communication with Kaizen members and management. This opportunity loss can be calculated by comparing the GKC income statements before and after Kaizen.

2. Calculating the Kaizen effect

As has been emphasized, management resources are input into the production system to form production capacity, which is increased by Gemba Kaizen. This increased production capacity is called Free capacity. There are two types of Free capacity: "variable Free capacity," which can be returned to the management resources invested, and "fixed Free capacity," which is retained as it is. In the case of variable Free capacity, the Kaizen effect can be calculated as a reduction in cost since surplus management inputs, typically raw materials, can be reduced. In the case of fixed Free capacity, it can be measured as an opportunity loss rather than a cost reduction if it is neglected. Especially in the case of fixed-paid human resources and machinery and equipment, Free capacity can be calculated as an opportunity loss; if the surplus is left unused, profits that would have been earned in the future are lost.

By comparing the cost figures in the GKC income statement before and after Kaizen, the Kaizen effect can be calculated as a cost reduction for variable costs and as an opportunity loss for fixed costs. **Figure 5-6** shows the comparative income statement before and after Kaizen using conventional costing, while **Figure 5-7** shows the GKC comparative income statement before and after Kaizen. Note that the assumptions and figures used in **Figures 5-6** and **5-7** are the same as those in **Figures 5-4** and **5-5**.

Figure 5-6 Comparative income statements before and after Kaizen using conventional cost accounting

	Before Kaizen	After Kaizen	Kaizen effect amount
Sales	Yen 8,000,000	Yen 8,000,000	Yen −
Cost of sales			
Direct material costs	2,300,000	2,000,000	300,000
Direct labor costs	2,000,000	2,000,000	0
Indirect manufacturing costs	1,500,000	1,500,000	0
Gross profit	2,200,000	2,500,000	300,000
Selling expenses	800,000	800,000	0
General and administrative expenses	800,000	800,000	0
Operating profit	Yen 600,000	Yen 900,000	Yen 300,000

Source: Author

In **Figure 5-6**, the income statement before Kaizen is exactly the same as that with conventional costing before Kaizen (**Figure 5-4**) . The 2,200,000 yen gross profit is calculated by deducting the 5,800,000 yen in cost of sales from the 8,000,000 yen in sales. The 1,600,000 yen in selling, general, and administrative expenses is deducted from the gross profit to arrive at an operating income of 600,000 yen.

In the income statement after Kaizen, the 5,500,000 yen in cost of sales is deducted from the 8,000,000 yen in sales, resulting in a gross profit of 2,500,000

yen. The 1,600,000 yen in selling, general, and administrative expenses is deducted from the gross profit to arrive at an operating income of 900,000 yen.

Comparing the income statements before and after Kaizen, direct material costs decreased from 2,300,000 yen before Kaizen to 2,000,000 yen after Kaizen. Reflecting this calculation structure, the "Kaizen effect amount" is shown as a cost reduction of 300,000 yen. Reflecting this cost reduction of 300,000 yen, gross profit increased by 300,000 yen from 2,200,000 yen before Kaizen to 2,500,000 yen after Kaizen. Operating income also increased from 600,000 yen before Kaizen to 900,000 yen after Kaizen.

Thus, in the comparative income statements before and after Kaizen based on conventional cost accounting, the Kaizen effect was calculated as the amount of cost reduction, resulting in the calculation of gross profit and operating income. This is both a feature and a limitation of calculating the Kaizen effect by conventional costing. In conventional cost accounting, the Kaizen effect can only be calculated by the amount of cost reduction. In such case, the wise reader will immediately ask: Does Kaizen have any impact on, for example, direct labor costs and indirect manufacturing costs?

The answer to this question is illustrated in **Figure 5-7**, which shows a comparative income statement based on GKC before and after Kaizen.

Figures 5-7 GK comparative income statement before and after Kaizen

	Before Kaizen	After Kaizen	Kaizen effect amount
Sales	Yen 8,000,000	Yen 8,000,000	Yen −
Real cost			
Direct material costs	2,000,000	2,000,000	0
Direct labor costs	1,600,000	1,600,000	0
Real profit	4,400,000	4,400,000	0
Non-real cost			
Direct material costs	300,000	0	300,000
Direct labor costs	400,000	0	−
Opportunity loss	−	400,000	400,000
Indirect manufacturing costs	1,500,000	1,200,000	−
Opportunity loss	−	300,000	300,000
Gross profit	2,200,000	2,500,000	1,000,000
Selling expenses	800,000	800,000	0
General and administrative expenses	800,000	800,000	0
Operating profit	Yen 600,000	Yen 900,000	Yen1,000,000

Source: Author

Below is a brief description of the before and after Kaizen of the GKC comparative income statement (**Figures 5-7**).

① Sales of 8,000,000 yen are the same before and after Kaizen. The Kaizen effect does not appear for sales.

② Direct material costs and direct labor costs, which comprise real cost, are shown before and after Kaizen. They remain the same in both cases: 2,000,000 yen in direct material costs and 1,600,000 yen in direct labor costs. The Kaizen effect is not observed in this case. This is because direct material costs and direct labor costs include real and non-real

costs, of which real cost cannot be easily reduced without major changes in production conditions and methods.

③ Real profit, which is calculated by subtracting real cost from sales, is 4,400,000 yen, the same amount before and after Kaizen. This means that Gemba Kaizen was not implemented to significantly reduce real cost.

④ Direct material costs under non-real cost decreased from 300,000 yen before Kaizen to 0 yen after Kaizen, resulting in a reduction of 300,000 yen in direct material costs. Therefore, the Kaizen effect from Gemba Kaizen is calculated and displayed as 300,000 yen in the "Kaizen effect amount" column. The result of this calculation is the same 300,000 yen in cost reduction, as in the conventional costing method. If conventional costing is applied, the calculation ends here.

The 400,000 yen in non-real cost was included as a direct labor cost before Kaizen, but was reduced to 0 yen after Kaizen. However, because the worker was a regular employee with a fixed salary, the Kaizen effect was calculated as an opportunity loss of 400,000 yen instead of a cost reduction, and the amount is shown as 400,000 yen in the "Kaizen effect" column (the details of the calculation will be explained in the next section). The opportunity loss of 400,000 yen is the Kaizen effect that could not be calculated by the conventional costing method.

In GKC, if fixed Free capacity is left as it is as a result of Kaizen, it is calculated as an opportunity loss. Since direct labor costs are fixed costs, they are calculated as an opportunity loss and reported in the income statement.

⑤ Next, manufacturing indirect costs, which are non-real costs, decreased from 1,500,000 yen before Kaizen to 1,200,000 yen after Kaizen. The reason for this is that the Kaizen created Free capacity, which in turn generated an unused amount of 300,000 yen in indirect manufacturing

costs. GKC calculates this unutilized amount as an opportunity loss of 300,000 yen for indirect manufacturing costs, and the Kaizen effect is shown as 300,000 yen in the "Kaizen effect amount" column. This is what conventional cost accounting would calculate as an unfavorable capacity variance, meaning unused production capacity, of 300,000 yen. GKC emphasizes that the unutilized amount of manufacturing indirect costs as Free capacity created by Kaizen is not an "unfavorable" but a "favorable" variance. Moreover, because leaving Free capacity unutilized results in the loss of profit-making opportunities, it is called an opportunity loss. In order to "visualize" the Free capacity created by Kaizen, the Kaizen effect is calculated as an opportunity loss of 300,000 yen. This is the Kaizen effect of 300,000 yen, which has been ignored in conventional cost accounting.

⑥ There is no Kaizen effect for selling, general, and administrative expenses.

⑦ From the perspective of the entire company, operating income increased by 300,000 yen from 600,000 yen before Kaizen to 900,000 yen after Kaizen. This is because Kaizen reduced direct material costs by 300,000 yen. At first glance, the income statement after Kaizen might be misunderstood as reflecting only the cost reduction of 300,000 yen and not the opportunity loss of 700,000 yen in operating income. This is a not the most desirable outcome for those who have been actively engaged in Gemba Kaizen.

However, the Kaizen effect is not limited to the cost reduction of 300,000 yen. The Kaizen effect amount totals 1,000,000 yen, consisting of a cost reduction of 300,000 yen in direct material costs, an opportunity loss of 400,000 yen in direct labor costs, and an opportunity loss of 300,000 yen in indirect manufacturing costs. This is clearly shown in the "Kaizen effect" column of the GKC comparative income statement. The

GKC income statement shows not only the cost reduction of 300,000 yen, but also the opportunity loss of 400,000 yen in direct labor costs and 300,000 yen in indirect manufacturing costs as the Kaizen effect of GKC. Both Kaizen members and management will be easily convinced with such a GKC income statement since they can argue over opportunity losses. This is what we call the "visualization of the Kaizen effect."

3. Actual cost before Kaizen as basis cost

In the Kaizen comparative income statement (**Figure 5-7**), actual cost before Kaizen is treated as the "basis cost." The Kaizen effect is evaluated by comparing it with the actual cost after Kaizen. However, previous studies have argued that using actual cost as the "basis cost" is undesirable for cost control. For example, Prof. Kiyoshi Okamoto, who is a leading researcher in costing, asserted as follows: "If actual cost varies only with work efficiency or the quality of cost control by business managers, it would serve as useful data for cost control, but because it is the product of the synthesis of various cost elements, actual cost data cannot be used for cost control" (Okamoto [2000] p.379). According to this argument, actual cost cannot be used for cost control because it is the product of the totality of various cost elements.

The reason for emphasizing "basis cost" rather than standard cost is that cost control requires *some kind of cost* that can be compared with actual cost. One of the authors argues the following:

In cost control, the management cycle is repeated as follows: establishment of base cost -> measurement of actual cost -> cost comparison -> cost variance analysis -> corrective measures -> process control/quality control -> human resource management. Cost variance analysis becomes possible only when the basis cost is compared with the actual cost. Emphasizing this point, cost control is impossible without establishing a basis cost. Many argue that only standard costing, which uses standard costs, is effective for cost control. However, I believe that cost control is possible even if it is

not perfect, as long as there is a "basis" to compare the actual costs with. Therefore, I assume that standard costing is the most important. ……Three types of basis cost are shown: estimated cost, standard cost, and budgeted cost. (Kazusa [2017] p.327)

In cost control, "basis cost," which is compared with the actual cost, is considered important. While we do not deny the validity of the standard cost, we emphasize the basis cost because our goal is not "cost control" but "cost Kaizen" by means of eliminating waste. In this case, estimated cost, specifically actual cost before Kaizen, is more reasonable than standard cost. This also reflects the same concept as "different costs for different purposes."

The standard cost "must assume a base level for price, efficiency, and operations that constitutes the cost standard" (Okamoto [2000] p.386). "Standard" defines the ideal standard cost, realistic standard cost, and normal cost. Among them, ideal standard cost is defined as follows:

> Although ideal standard costs are sometimes used for cost control purposes, such standard costs are not the institutional standard costs referred to in this standard. Ideal standard cost is the lowest cost that represents the highest efficiency under the maximum technically achievable capacity utilization. It is the standard cost at an ideal level that does not allow for any allowance for impairment, spoilage, idle time, etc. in the consumption of goods. ("Standard" 4 Cost Concepts (1)2)

According to this provision, ideal standard cost is "the lowest cost that represents the highest efficiency under the maximum technically achievable operating rate", but it is "not the institutional standard cost." The standard cost considered acceptable by the "Standard" is the practical or normal standard cost. "Standard" states the following:

> Practical standard cost, which includes the margin rate of impairment,

spoilage, and idle time, is the standard cost that may be achieved under good efficiency to the extent that it is recognized to occur normally. It is determined on the assumption of scheduled capacity utilization and scheduled price in a relatively short period of time. It is often revised in accordance with changes in these conditions. Practical standard costs are not only the most suitable for cost control, but are also used for inventory value calculation and budgeting.

Normal cost is the cost that eliminates abnormal conditions in management, statistically equalizes past actual figures related to management activities over a relatively long period of time, and considers future trends. It is determined based on normal efficiency, normal capacity utilization, and normal prices. Normal cost is not only the most suitable for calculating inventory value when economic conditions are stable, but is also used as a cost standard. ("Standard" 4 Cost Concepts (1)2)

Practical and normal standard costs are emphasized as the "most suitable for cost control." It seems that "waste was tolerated" in order to avoid the large amount of unfavorable costs and capacity variances that arise when ideal standard costs are adopted, and to ensure the viability of standard costing as a system.

Prof. Michiharu Sakurai claims that the "Standard" "does not conform to modern accounting standards and cost theory" (Sakurai [2014] p.72). Regarding the establishment of the "Standard," Mr. Masanori Kuroki (Secretary of the Business Accounting Council) stated, "This standard is part of the Business Accounting Principles, which are a code of practice for corporate accounting. In particular, it specifies the costs. Therefore, it should be respected by all companies as well as business accounting principles. ....." (Kuroki [1962] pp.68-69). The published "Standard" is oriented less towards management accounting and more towards financial accounting (Kzausa [2017] p.53). In other words, the "Standard" stipulated standard costs in preference to external reporting and cost control purposes were secondary.

As for the "Standard" setting, its use in Gemba Kaizen, which focuses on real work and thoroughly eliminates Muda, may have been unforeseen.

According to Prof. Okamoto, "Practical standard cost is not only the most suitable for cost control at present when economic conditions are not necessarily stable, but is also used for profit control and inventory value determination. Therefore, practical standard cost is the most important among the three types of standard costs. When we speak of standard cost in the standard costing system, we usually mean this type of standard cost" (Okamoto [2000] p.388).

In other words, ideal standard cost is not suitable for "standard cost as an principle" but practical standard cost is because it is "the cost that includes the margin rate of impairment, spoilage, and idle time to the extent that they are recognized to occur normally."

However, since Muda is allowed in practical standard costing, the practical standard costing remains a problem from the Gemba Kaizen point of view. First, since Kaizen aims to thoroughly eliminate Muda and non-value-added work, the standard cost no longer functions as the "basis cost" when Gemba Kaizen is implemented beyond the practical standard cost. Second, as long as Muda is allowed in practical standard costing, the difference with the actual cost, which *includes Muda*, is only "a difference in degree."

Regarding actual cost, Okamoto (2000 p.379) explains that "since it is the product of the synthesis of various cost elements, the actual cost data cannot be used for cost control as it is." However, to varying degrees, the practical standard cost is also "the product of the synthesis of various cost elements" including Muda. If even the practical standard cost were to include Muda, it is not *uniformly* permitted to assert that the actual cost cannot be used for cost control.

Mr. Hirotoshi Shibuya, President of SHIBUYA CORPORATION (Headquarters: Kanazawa City, Ishikawa Prefecture, TSE Prime listed company), made the following assertions based on his many years of experience in cost management practice:

> It is true that there is a limit in eliminating the impossibility rate by comparing actual costs with each other, because actual costs include inefficiencies that occur by chance. However, ..., it has been our experience over the years that the actual cost used for cost control has already been calculated at a level where standard production procedures, work methods, etc. have already penetrated every corner of the Gemba and avoidable Muda and inefficiencies have already been eliminated. As a result, even if actual costs are compared with each other, they can function well as management normative values. Such an assumption behind the effectiveness of cost control by actual cost should not be overlooked. (Shibuya [2018] p.29)

This is a view worth acknowledging. In Gemba Kaizen, Kaizen plans are carefully prepared and implemented based on the IE (industrial engineering) method. The cycle of Kaizen PDCA: checking Kaizen effect, creating the next Kaizen, and implementing the next Kaizen is repeated. If such Gemba Kaizen is continuously implemented, Muda and non-value-added work will be thoroughly eliminated, and the negative effects resulting from the "total product of various elements" will almost be completely eliminated. Mr. Shibuya's assertion that "the normative management value can be fully functional" is very realistic.

The more Kaizen progresses, the more the actual cost is sharpened, and of the "worker movement" by Mr. Ohno, "Muda" will be eliminated and the remaining "non-value-added work" will be minimal. Moreover, thorough Kaizen will further reduce "non-value-added work" so that only "real work" remains. In GKC, the cost that occurs in the state of only real work is called "real cost," which is practically the same as the "ideal standard cost." Since the actual cost used to check the Kaizen effect is constantly approaching the real cost, even if the actual cost, specifically the non-real cost before Kaizen, is adopted as the "basis cost," it may function sufficiently as a normative

value. This is the reason why GKC calculates the amount of cost reduction after Kaizen by using the actual cost before Kaizen as the "basis cost."

Ⅳ GKC income statement

In GKC, real profit is calculated by subtracting real cost as product cost from sales after breaking down product cost into real and non-real costs. Gross profit is then calculated by subtracting non-real cost (non-value-added and Muda costs) from real profit. Operating income is calculated by subtracting selling, general, and administrative expenses from the gross profit.

The following is a simple example to illustrate how the Kaizen effect in the Gemba Kaizen described thus far is shown in the income statement as cost reduction and opportunity loss.

1. Basic and Kaizen data

GKC income statement can be prepared based on the basic and Kaizen data in [Example 7].

[Example 7] Basic data

Subject plant: Plant A

Item produced: X product

Shipping conditions : After production is completed, the entire quantity is immediately shipped to the customer. Therefore, there is no product inventory.

Prices, etc. : The purchase price of raw materials, wage rate, and amount of indirect manufacturing costs (fixed budget of 2 million yen) are the same before and after Kaizen.

At Factory A, five workers were producing X product. Before Kaizen, many spoilages occurred and the work was time-consuming. After analyzing

the work using a video camera and considering countermeasures, the work method was reviewed and a new jig was developed. After one month, the Kaizen effect has been successfully achieved. **Table 5-2** shows the Kaizen data for [Example 7]. Note that the data are kept simple for ease of computation.

Table 5-2 Kaizen data (monthly)

	Before Kaizen	After Kaizen
Unit sales price (yen)	8,000	8,000
Budgeted production (units/month)	1,000	1,250
Actual production (units/month)	1,000	1,000
Direct material costs (yen/unit)	2,300	2,000
Direct labor wage rate (yen/hour)	2,000	2,000
Direct labor hours (hours/month)	200	160
Direct labor (persons)*	5	5
Indirect manufacturing costs (yen/month)	1,500,000	1,500,000
Predetermined burden rate (yen/hour)	1,500	1,500
Selling expenses (yen/month)	800,000	800,000
General and administrative expenses (yen/month)	800,000	800,000

*All direct workers are regular employees and paid on a monthly basis.

Source: Author

The main points of the kaizen results are as follows:

① The direct material costs used was reduced by 300 yen per unit from 2,300 yen/unit to 2,000 yen/unit. This means that Kaizen reduced the non-real direct material costs of 300 yen/unit that had been incurred before Kaizen.

② The number of direct labor hours was reduced from 200 hours/month per worker to 160 hours/month, a reduction of 40 hours/month per worker. This means that Kaizen reduced 40 hours/month of non-value-added work per worker and wasted time among the work hours

performed by direct workers. Multiplying this reduced time by the wage rate, we can calculate the non-real cost of direct labor.

③ As a result of Kaizen, the budgeted production volume of 1,000 units/month before Kaizen increased to 1,250 units/month after Kaizen.

④ Indirect manufacturing costs are managed under a fixed budget. To simplify the discussion, a single basis of allocation (summary allocation rate) is used to allocate indirect manufacturing costs. The predetermined burden rate can be calculated as follows:

Predetermined burden rate = Fixed budget amount / Monthly work hours
= 1,500,000 yen / (25 days × 8 hours/day × 5 persons)
= 1,500,000 yen/hour

2. Calculation of Kaizen effect

Based on the above basic and Kaizen data, the Kaizen effect is first calculated in this section, then a GKC income statement is prepared in the next section. Note that the calculation of Kaizen effect by GKC is performed under very simple assumptions, so it may be a little unsatisfactory for researchers and practitioners who are familiar with cost accounting. Please excuse us for prioritizing the calculation logic.

[Before Kaizen]

Sales = @8,000 yen × 1,000 units = 8,000,000 yen

Cost of sales = Direct material costs + Direct labor costs + Direct manufacturing costs
= 2,300,000 yen + 2,000,000 yen + 1,500,000 yen
= 5,800,000 yen

Direct material costs = @2,300 yen × 1,000 units
= 2,300,000 yen

Direct labor costs = @2,000 yen/hour × 200 hours × 5 persons
= 2,000,000 yen
Indirect manufacturing costs = 1,500,000 yen

[**After Kaizen**]

Sales = @8,000 yen × 1,000 units = 8,000,000 yen
Cost of sales = 2,000,000 yen + 2,000,000 yen + 1,500,000 yen
= 5,500,000 yen
Direct material costs = @2,000 yen × 1,000 units
= 2,000,000 yen
Direct labor costs = @2,000 yen/hour × 200 hours × 5 persons
= 2,000,000 yen
Indirect manufacturing costs = 1,500,000 yen

[**Kaizen effect**]

Cost reduction = Direct labor costs before Kaizen – Direct labor costs after Kaizen
= 2,300,000 yen – 2,000,000 yen = 300,000 yen
Opportunity loss (Direct labor cost)
= Labor wage rate × Total Kaizen time
= @2,000yen/time × [(200 – 160) hours × 5 persons]
= 400,000 yen
Opportunity loss (Indirect manufacturing cost)
= Predetermined burden rate × Total Kaizen time
= @1,500 yen/time × [(200 – 160) hours × 5 persons]
= 300,000 yen

The following is a brief explanation. The cost reduction can be calculated relatively simply as 300,000 yen. Gemba Kaizen reduced the amount of materials used, which means a reduction in input management resources. If the reduced material is stored in the warehouse, an opportunity loss

occurs. Here, it is assumed that the same raw materials are used in the next manufacture order, so no materials are stored in the warehouse and no opportunity loss occurs. It is calculated as it is as a cost reduction. With respect to direct labor costs, direct laborers are paid a monthly fixed salary under their employment contract, so the salary paid is the same even with reduced work hours. Therefore, direct labor costs are not reduced. However, before Kaizen, it took five workers 200 hours to complete the work. However, this time was reduced to 160 hours, which means that the 40 hours of reduced work, or the time of one direct worker, was "Muda time." This phenomenon means that "invisible Muda" hidden in non-value-added work and Muda work has become visible. In GKC, the Kaizen effect is recognized as "opportunity loss" instead of cost reduction when direct workers are employed on a fixed salary. While "visible Muda" is relatively easy to detect, "invisible Muda" is not. GKC dares to challenge this point.

The noteworthy point of this Kaizen is that the time calculated as "unused hours = 40 hours/person × 5 persons = 200 hours/person" is the same as 200 hours/month of work for one person. Thus, Kaizen makes it possible for Factory A to finish the work in the same amount of time with only 4 direct workers instead of 5. Mr. Ohno referred to the removal of direct workers from the process for the amount of work time reduced by Kaizen as "Shojin-ka (Manpower saving)" (Ohno [1988] pp.67-68). This is one major point of Kaizen. Note that Toyota Motor Corporation currently seems to be using the term "Shojin (Manpower saving)" instead of "Shojin-ka (Manpower saving)" (Amezawa [2014] pp.143-144).

Regarding indirect manufacturing costs, the amount of unutilized indirect manufacturing costs reflects the decrease in work hours per direct manufacturing worker due to Kaizen. Before Kaizen, 200 work hours/month × 5 persons = 1,000 hours/month; after Kaizen, 160 hours/month × 5 persons = 800 hours/month. Based on this, the actual allocation of indirect manufacturing costs and the unused amount can be calculated as follows:

Fixed budget amount = 1,500,000 yen

Actual allocation amount

= Predetermined burden rate × Actual monthly work hours

= 1,500 yen/hour × 800 hours = 1,200,000 yen

Unused amount = Fixed budget amount – Actual allocation amount

= 1,500,000 yen – 1,200,000 yen = 300,000 yen

Indirect manufacturing costs arise from the consumption of management resources that are indirectly involved in production. Through their consumption, they form the production capacity in the production system. Kaizen will create Free capacity equivalent to 300,000 yen of unused indirect manufacturing costs. The Free capacity created is left unutilized and the opportunity loss to earn profit occurs. Therefore, the unused amount of 300,000 yen in indirect manufacturing costs is recognized as an opportunity loss.

The Kaizen effect amount due to GKC can be calculated in this way. **Table 5-3** shows the Kaizen effect statement for [Example 7].

Table 5-3 Kaizen effect statement for [Example 7] (Amount Unit: Yen)

	Before Kaizen	After Kaizen	Forecast: Incremental profit	Forecast: Additional order
Sales	8,000,000	8,000,000	2,000,000	10,000,000
Real cost	3,600,000	3,600,000	500,000	4,500,000
Direct material costs	2,000,000	2,000,000	500,000	2,500,000
Direct labor costs	1,600,000	1,600,000	0	2,000,000
Real profit	4,400,000	4,400,000	1,500,000	5,500,000
Non-real cost	2,200,000	1,900,000	0	1,500,000
Direct material costs	300,000	0	0	0
Direct labor costs	400,000	0	0	0
Opportunity loss	–	400,000	–	–
Indirect manufacturing costs	1,500,000	1,200,000	0	1,500,000
Opportunity loss	–	300,000	–	–
Gross profit	2,200,000	2,500,000	1,500,000	4,000,000

Selling expenses	800,000	800,000	0	800,000
General and administrative expenses	800,000	800,000	0	800,000
Operating profit	600,000	900,000	1,500,000	2,400,000
Cost reduction		300,000		300,000
Opportunity loss		700,000		
Direct material costs		400,000		
Indirect manufacturing costs		300,000		
Kaizen effect of factory		1,000,000		
Cost reduction		300,000	−	300,000
Opportunity loss		1,500,000	−	−
Incremental profit		−	−	1,500,000
Factory contribution			−	700,000
Sales contributions			−	800,000
Kaizen effect for the entire company		1,800,000	−	1,800,000

Source: Author

A brief explanation focusing on the "After Kaizen" column of the Kaizen effect statement is as follows. In the "After Kaizen" column, 3,600,000 yen in real cost is subtracted from 8,000,000 yen in sales to arrive at a real profit of 4,400,000 yen. The breakdown of real cost, 2,000,000 yen in direct material costs and 1,600,000 yen in direct labor costs, remains the same before and after Kaizen. No present Kaizen effect is observed. The reason is that direct material costs and direct labor costs include both real and non-real costs, of which real cost cannot be easily reduced without major changes in production conditions and methods.

Next, 1,900,000 yen in non-real cost is deducted from real profit to arrive at a gross profit of 2,500,000 yen. The breakdown of non-real cost shows that direct material costs are "0" yen. This indicates that Kaizen reduced the consumption of direct material costs, resulting in a cost reduction of 300,000 yen. The amount realized is shown as 300,000 yen in "Cost reduction" just below the "Operating income" account.

Similarly, direct labor costs, which is a breakdown of non-real costs, is "0" yen. Kaizen should reduce direct labor costs by 400,000 yen due to the decrease in direct labor hours. However, since the direct workers are employed on a monthly salary basis, it is calculated that the human resources equivalent to the cost reduction of 400,000 yen is left unutilized, resulting in an opportunity loss of the same amount. Reflecting this, an "opportunity loss" of 400,000 yen is shown as a breakdown of direct labor costs.

Under non-real cost, indirect manufacturing costs were 1,500,000 yen before Kaizen but decreased to 1,200,000 yen after Kaizen. Kaizen created Free capacity, which resulted in 300,000 yen in unused indirect manufacturing costs. GKC calculates this unused amount as an "opportunity loss" of 300,000 yen in manufacturing indirect costs.

Furthermore, since the Kaizen effect was not assumed for selling, general, and administrative expenses, the amounts before and after Kaizen are the same. The Kaizen effect can be observed when Kaizen is applied not only to the production division but also to the sales and administrative divisions.

Finally, in the "After Kaizen effect" column, the 900,000 yen operating income is calculated by subtracting 800,000 yen in selling expenses and 800,000 yen in general administrative expenses from the gross profit of 2,500,000 yen. The Kaizen effect is calculated as 300,000 yen because Kaizen operating income before Kaizen was 600,000 yen. Since the operating income in the income statement based on ordinary cost accounting was also 900,000 yen, to that extent, both of them are the same amount. However, referring to the "After Kaizen" calculation, we can confirm that the opportunity losses of 400,000 yen in direct labor costs and 300,000 yen in indirect manufacturing costs are shown as the Kaizen effect amount.

Thus, the Kaizen effect observed in the factory's production process is shown as 1,000,000 yen, which is the total of the 300,000 yen in cost reduction and 700,000 yen in opportunity loss. In the ordinary profit-and-loss calculation, only the cost reduction of 300,000 yen is calculated, but in GKC, the Kaizen effect amount is 1,000,000 yen, including opportunity loss.

Furthermore, at the bottom of the "After Kaizen" column, the 1,800,000 yen "Kaizen effect for the entire company" is shown, which consists of a 300,000 yen cost reduction and 1,500,000 yen opportunity loss. The cost reduction amount is the 300,000 yen in direct material costs, while the opportunity loss amount is the 1,500,000 yen in gross profit calculated in the "Forecast: Incremental profit" column. This gross profit is the incremental profit that may be earned as a result of effectively utilizing the Free capacity created by Kaizen.

Operating income can be calculated by subtracting selling, general, and administrative expenses from Kaizen's gross profit in the "Before Kaizen," "After Kaizen," and "Forecast: Additional order" columns in **Table 5-3**. Operating income is 600,000 yen before Kaizen, 900,000 yen after Kaizen, and 2,400,000 yen if there are additional orders. This illustrates how much profit can be earned if the Free capacity created by Kaizen is effectively utilized by receiving additional orders.

Thus, introducing the opportunity loss concept enables not only a "visualization of the Kaizen effect" but also a "visualization of Kaizen," which has been difficult to achieve in conventional cost accounting.

3. Calculation of Kaizen effect considering additional orders

Kaizen increases the monthly production capacity by 250 units, resulting in a monthly production capacity of 1,250 units. Suppose that management and the sales force learn of this and rush to place additional orders. Thanks to their efforts, they receive an order for 250 additional units. Free capacity has been completely eliminated. The incremental profit on the additional order is calculated as follows:

[**Additional orders**]
Sales = @8,000 yen × 250 pieces = 2,000,000 yen
Cost of sales: 500,000 yen
Breakdown: Direct material costs
= @2,000 yen × 250 pieces = 500,000 yen

Direct labor costs = 0 yen

Indirect manufacturing costs = 0 yen

Incremental profit = Marginal profit × Additional sales volume

= (Sales – Variable cost) × Additional sales volume

= (@8,000 yen – @2,000 yen) × 250 pieces = 1,500,000 yen

The "Forecast: Incremental Profit" column in **Table 5-3** shows the incremental profit calculated when additional orders become available. It shows the results if management and the sales force successfully obtain additional orders, and if the Free capacity created by Kaizen is actively utilized. As an overview, the additional order of 250 units will increase sales by 2,000,000 yen, but will result in a small expenditure of 500,000 yen in direct manufacturing costs. The subtraction of 1,500,000 yen is the incremental profit. The Free capacity created by Kaizen can be utilized to earn a large amount of profit. **Figure 5-8** shows the GKC income statement (after Kaizen/forecast of additional orders).

Figures 5-8 GKC income statement (after Kaizen / forecast of additional orders)

	Before Kaizen	Forecast: Additional order	Kaizen effect
Sales	Yen 8,000,000	Yen 10,000,000	Yen 2,000,000
Real cost			
Direct material costs	2,000,000	2,500,000	–
Direct labor costs	1,600,000	2,000,000	–
Real profit	4,400,000	5,500,000	1,100,000
Non-real cost			
Direct material costs	300,000	0	300,000
Direct labor costs	400,000	0	400,000
Opportunity loss	–	0	0
Indirect manufacturing costs	1,500,000	1,500,000	0
Opportunity loss	–	0	0
Gross profit	2,200,000	4,000,000	1,800,000
Selling expenses	800,000	800,000	0
General and administrative expenses	800,000	800,000	0
Operating profit	Yen 600,000	Yen 2,400,000	Yen 1,800,000

Source: Author

If the additional order is realized, a 5,500,000 yen real profit is calculated by subtracting 4,500,000 yen in real cost from 10,000,000 yen in sales. In addition, the 1,500,000 yen in non-real cost is subtracted from the real profit to arrive at a gross profit of 4,000,000 yen. An operating income of 2,400,000 yen is calculated by subtracting 800,000 yen in selling expenses and 800,000 yen in general and administrative expenses from the gross profit. Thus, if additional orders are received to fully utilize the Free capacity created by Kaizen, an operating income of 2,400,000 yen can be earned.

The final Kaizen effect amount of 1,800,000 yen can be calculated from the before Kaizen and additional order forecast columns of the GKC income statement (**Figure 5-8**) . The breakdown is as follows: cost reduction of 300,000 yen in direct material costs, utilization of opportunity loss of 400,000 yen in direct labor costs, utilization of opportunity loss of 300,000 yen in indirect manufacturing costs, and 800,000 yen in incremental profit from the efforts of management and the sales force. Of this amount, the incremental profit of 800,000 yen, which is the result of the efforts of management and the sales force, is included in the real profit of 1,100,000 yen in the "Kaizen effect" column.

As for the 800,000 yen incremental profit, the manufacturing section that implemented Kaizen may have also contributed to the profit, so it is desirable to determine the distribution of the amount of contribution through discussions among the parties concerned.

It should be noted here again that in the case of additional orders to eliminate Free capacity, only direct material costs (variable costs) are incurred, and no new costs are incurred with respect to direct labor costs and indirect manufacturing costs, which are fixed. Mr. Ohno of Toyota Motor Corporation stated the following about this:

Opinions differ on the economic advantages of maintaining extra production capacity. In brief, excess capacity utilizes workers and machines that are otherwise idle, incurring no new expense. In other words, they

cost nothing.……At Toyota, we go one step further and try to extract improvements from excess capacity. This is because, with greater production capacity, we don't need to fear new costs. (Ohno [1988] pp.56-57)

This is an astute observation and the following confirms it: The "Forecast: Incremental profit" column in **Table 5-3** calculates the Kaizen effect of the additional orders. In this column, a real cost of 500,000 yen is deducted from the 2,000,000 yen in sales for the additional order, resulting in a real profit of 1,500,000 yen. Since there are no additional direct labor and indirect manufacturing costs, real profit is directly recorded as a gross profit of 1,500,000 yen. This gross profit of 1,500,000 yen is the incremental profit from the cooperative play between Gemba Kaizen and the additional orders. If management and the sales force had not scrambled to obtain additional orders, the Free capacity created by Kaizen would have been left untapped, disappointing the Kaizen team members.

GKC can visualize the Kaizen effect by calculating and displaying its amount, which consists of cost reduction and opportunity loss, on the GKC income statement. Moreover, it can communicate the impact of Gemba Kaizen on the company's profit to the management team.

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