A Study of Integrated Cost Accounting System

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統合的原価管理の研究

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After the management of a company has drawn up a profit plan, it is extremely important that they work out a management strategy based on management information supplied from performance evaluation criteria when it is implementing the plan. Accordingly, I think I'll have standing it's important problems on this paper.

1. Introduction

In the United States, some new developments have been observed in the study of production system during the past several years. at present, however, many unsolved problems associated with the traditional production management accounting methods still remain. Under these circumstances, establishment of a new system suitable to the current business environment is being sought after.

Efforts now being made are based upon the recognition that productivity in the United States is considerably lower in comparison to other countries,particularly Japan. Imminent problems in the United States which triggered these efforts include.

(1) low productivity and subsequent decline in the market competitiveness;
(2) inability and impracticability of the quantitative approach (such as economics, statistics and OR) applied to the production management accounting; and
(3) vigorous market competition and the progress of automation of production line.

Above all,as R.Kaplan points out,problems related to the automation of production line (or FA, as it is commonly known) and the cost accounting system in FMS are most seriously discussed.

Early establishment of a new production management accounting system is needed for the following reasons:

(1) wide spread use of computer in processing accounting data
(2) rapid progress of technical innovation (such as computerized production) due to severe market competition and its effects on firms' cost composition
(3)liberalization of regulations necessary for the banking, transportation,service and other industries to develop their own cost computing system

Along with the automation of production line,issues critical to the cost analysis of FA are also being discussed. They are:

(1) lack of long-term measures to evaluate production records and efficiency:
(2) reconsideration of the conventional quantitative approch (such as EOQ model) and the application of ROI in evaluating production records; and
(3) testing new systems (such as TQC, QC circles, Just-In-Time method, MRP and OPT) conceived through case studies and proven to be effective in the actual production.

However, it is yet to be seen whether or not a new production management accounting system which fits the current economic and technological conditions can be established in the near future. In coping with this situation, when having to make a policy decision, firms'executive officers and factory managers should take into

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consideration not only accounting data but non-quantitative information as well. In order for a firm to survive competition and further its growth and development, it must ascertain its financial characteristics and prepare a business strategy accordingly.

Since the introduction of computer systems,the Decision Support System (DSS) has made rapid development in the field of production management accounting. Material Requirement Planning (MRP), developed in the U.S.A. is one method of production management accounting and some standard cost computing systems utilize this method. Toyota's production system, dveloped in Japan, is not a contradictory system to MRP, but rather a complementary system for the formulation of comprehensive business plans. The MRP data base is integrated with a production management accountig database and the new production system is integrated through the database with the production management accounting system, that is, the cost and profit management systems.

In this paper we will deal with the following topics:

(1) Toyota's production system with "smooths" daily Production
(2) Incorporation of MRP with Toyota's system
(3) Methods of cost management using the MRP database
(4) Evaluation of a company's profit growth management using the JIT business and MRP models.

2. Development of cost and profit management systems using the Toyota system

Let us consider the application of the Toyota system to cost and profit management systems from the point-of-view of a manager in the company. There are three types of production control accounting systems in use today: the Kaban system uses a single card,known as a kanban, to give withdrawal and production instructions. This system ensures that parts needed for later processes are delivered no earlier than necessary, and is therefore also sometimes referred to as the "Just-In-Time" system.

The Kanban system is simply described below. For example, assume a part Z is used in one of the later processes of assembly of a product.These parts are kept in containers near the position where the assembly is carried out and a card is attached to each of the containers. This card is the 'Kanban', which strictly means 'sign' in Japanese. when one of the containers becomes empty,a carrier arrives within a specified time and takes the empty container and the card away to where parts Z completed in preceding manufacturing stages are stored. he leaves the empty container and card at the store and takes another container full of parts Z and a new attached Kanban back to the point where they are assembled. The Kanban from the empty container is used as the production-ordering card for the preceding processes where part Z is manufactured.

This system can lead to problems with the inventories in the store of the parts prepared by previous processes. The number of parts in the store must be equal to the average demand for parts each replenishment cycle add to a safety factor of a certain number of shelf items. In order to minimize the number of parts in the inventory (output of preceding processes and the parts used in subsequent processes), the length of the cycle is kept short, to one or two hours, so that parts are withdrawn each day can be kept to a minimum. In other words,the lot sizes ordered by the kanbans from previous processes can be kept as small as possible.

Therefore the final products cannot be manufactured in large lots, but need to producce in smaller lots, averaged on a daily, or even hourly, basis. An example is shown in Table A. Four types of finished product, Z, Y, X, and W used to be produced in large lots, with 4,000 of type Z only produced one day, 4,000 of type Y only the next day, then 4,000 of types X and W respectively on the following 2 days. However, under the smoothed production system, 1,600 type Z, 1,200 type Y, 800 type X and 400 type W are produced every day. That is, the production of each of the products is

averaged for each day, so that the number of component parts used each day is held constant. This is one of the features of the Kanban system.

The features of the production instruction number system is that parts and materials are procured according to the orders received from the customer and them a production instruction number is attached to the products being manufactured. For example, if the production instruction number for one order of a certain product X is #110, the same number 110 is also entered on the order forms for parts A, B and C used to manufacture X.

This system has a major weakness, however, if there is a change in the basic manufacturing plan for product X. For example, problems occur when using 50 parts A, originally purchased for the manufacture of production instruction number #110, in products with production instruction number #111. In this case, the parts are the same part A, but the production instruction number attached the parts is different, so that it becomes impossible to manage the delivery deadlines for part A.

The MRP system also employs a production instruction number (for example #110) related to the order of the product X in the same way as the production instruction number system. However, unlike the production instruction number system, MRP does not employ a simple number display, but uses parts tables for each production stage to calculate the number of parts required for each stage.

In this case, the parts at each level are marked with number (eg. #1000), which differs from the production instruction number of product X. This eliminates the effort associated with the production instruction number system of converting differing production instruction numbers for various orders of the same product to the same part number. Consequently, this system is able to respond flexibly to changes in the basic production plan to handle the delivery deadline management of all parts at every stage of manufacture. when using the production instruction number system, cost management is carried out by adding the cost of all the component parts as these are also marked with production instruction number of the finished product. However,when using the MRP system, the production instruction number is separated from the component parts used at each level,so that the costs are calculated at each stage of manufacture. This method allow to determine the standard prices from a standard bill of materials and gives a grasp of the predicted costs.

3. New developments in cost management systems using the MRP database

We will now consider how the MRP database can be applied to cost management and describe the new types of cost management system.

(1) Cost piled-up system

This is a database for the piling-up calculation of the standard costs and latest costs of parts or a product. It uses a "master file for components" and "master file for product composition" (parts table) for the direct materials costs and out-sourced manufacturing costs, and a "master file for (manufacturing) processes" and "master file for working sections" to determine the direct labor costs and indirect manufacturing costs.

The cost pile-up calculation starts from the part at the extreme bottom level of the part table and works level by level up the table. when using multi-level parts tables, a single part may appear on sevsral of the levels of the table, but the unit cost for the part can be computed in a single calculation using the part's low-level code, know as LLC for short.

(2) The master file for working sections contains wage rate data and indirect manufacturing cost rate distribution data. the master file for processes contains the stndard operation time for each process and code data for the operations associated with the process. The labor and indirect manufacturing costs of part Z are calculated from this data for each of the process which the part undergoes, as shown below.

labor costs

$$= \sum_{i=1}^{n} (\text{standard time} \times \text{wage rate for the operation})$$

Indirect costs

$$= \sum_{i=1}^{n} (\text{standard time} \times \text{indirect cost rate of the operation})$$

(3) product cost calculation

The production flow for the completion of product Z is shown in Figure 2. part V is a steel part which is cut and ground to produce part Y. part V is a steel part which is cut and ground to produce the finished part W. part X is produced by assembling parts Y and W together and then the finished product Z is made by assembling parts X and Y together.

Figure 3 shows the technical design data, which comprises of parts cost data and parts composition data (product tree). The costs of part W have already been completed from the materials, labor and indirect manufacturing costs. Figure 4 shows process data for the machined part Y and assemblies X and Z. the costs of the product Z calculated from the database shown in Figures 3 and 4 are presented in the calculated costs table, Table B.

(4) Decision Support System based on cost comparison

When the part number is input into the computer, the single-level parts list is used to look up the standard and latest values of the materials, labor and indirect manufacturing costs. Refer to Table C.

It can readily be seen from the table that for the materials cost alone,there is a difference of 160 between the standard and latest costs. This indicates that the price of the component parts has risen 160 since the standard cost was determined. In the calculated cost table, the piled-up cost is shown as both 'This Level Costs' and 'Total Costs'. However,in this example all the parts are assembled to produce a double door set,so that the process costs are 'This Level Costs' and the cost of all the parts is added to the 'This Level Costs' to give the 'Total Costs' of the double door set.

Unlike the production instruction number system, it can be seen that the production instruction number of a part is not attached to the order forms for all the component parts when using the MRP production management control system.

Consequently, the cost calculation for a product manufactured under MRP is carried out by a 'piling-up' calculation through the levels of a multi-level parts list.

To take an example, the cost of sub-subordinate parts are calculated and accumlated into the cost of the subordinate parts which they make up, and then the costs of these parts are complied into the cost of the parent part which they constitute. This method of making piling-up cost calculations using multi-level parts tables has the merit that it can determine both the standard and latest costs of a product.

The advantages of using this new cost management system can be summarized as follows.

(1) Monthly balances are facilitated by the standard cost calculation.

(2) The system helps determine cost management objectives.

Cost fluctuations are apparent from the differences between standard cost and latest cost, and these figures provide a valuable aid to cost management of each part.

(3) The system is an aid in meeting the target prices set at the cost planning stage, as it readily provides estimated costs (latest costs) due to design changes,equipment installation and changes between in-house and subcontracted manufacture at the product planning stage.

(4) The system aids the business department in determining the sale price of products by providing latest cost figures to carry out profit and loss calculations for ordered products.

4. Conclusion: My profit growth management method

After the management of a company has drawn up a profit plan, it is extremely important that they work out a management

strategy based on management information supplied from performance evaluation criteria when implementing the plan. In many ways the clearest way of determining the relative value of management is the relation between market share and the ratio of profit to capital. In the case of a closed corporation other factors, including the administrative capabilities of the management, the power of the management to protect the corporate against the competition, credit-worthiness of the management, and the personal assets of the management are particularly important. In the case of the management of a non-closed corporation other factors also apply in addition to these, such as political, social and economic factors affecting the company and the general environment. It is also very important that the management has the right personality to permit it to act rationally to protect the company in the face of rapid depression and other economic uncertainties.

The following methods are available for the quantitave evaluation of the management:

1) analysis of the flow of funds from fund statements
2) the static liquidity determined from the level of the liquidity ratio, and the dynamic liquidity determined from the asset turnover period, debt turnover period and the ratio of current income to current expenses
3) profitability level determined from the ratio of profit to capital

These indeces are very important for the individual, concrete appraisal of a company.

In particular, the following four items before and after tax must be investigated when condisering the profitability (item 3) above:

a) the standard ratio of ordinary profit to total capital
b) the standard ratio of operating profit to operating capital
c) the standard ratio of current profit to net worth
d) the standard ratio of current profit to capital stock

For example, if the capital interest and financial expenses are approximately 10% of ordinary profit rate to total capital and operating profit rate to operating capital, and the risk is 3%, each profit rate should be 13% after tax. Before tax, assuming that the tax rate is 50% for capital interest and financial expenses, 23% profit should be gained in each case. Since 20% of gross capital of Japanese industries is owed capital, capital interest on owed capital is 10%. Thus, the standard profit rate to gross capital is required to be, 5% after tax,and 7% before tax, assuming that tax rate is 50%.

The standard current profit rate to owed capital is 25% after tax, and 35% before tax, respectively. the standard profit rate to the capital is, if the capital proportion is 15%, 33% after tax, and 46% before tax, respectively.

The figures from theorical calculations shown above may be extremely high. in determining companies' criteria for profit increase management, it is important to carry out management control in accordance with relative values and absolute financial values.

References

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(4) Hall,R.W., Driving the Productivity Machine: Production planning and Control in Japan, APICS, 1981.

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[Table A] Comparison between traditional and Smoothed Production system

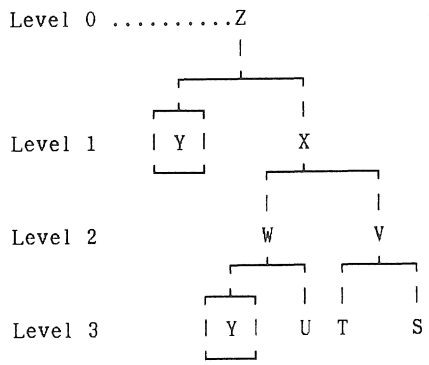
1. Traditional Production System

Item		Number of Production/Day				
Type	Numb.	1	2	3	4	5
Z	1,600	4,000				4,000
Y	1,200		4,000			
X	800			4,000		
W	400				4,000	
Total	4,000	4,000	4,000	4,000	4,000	4,000

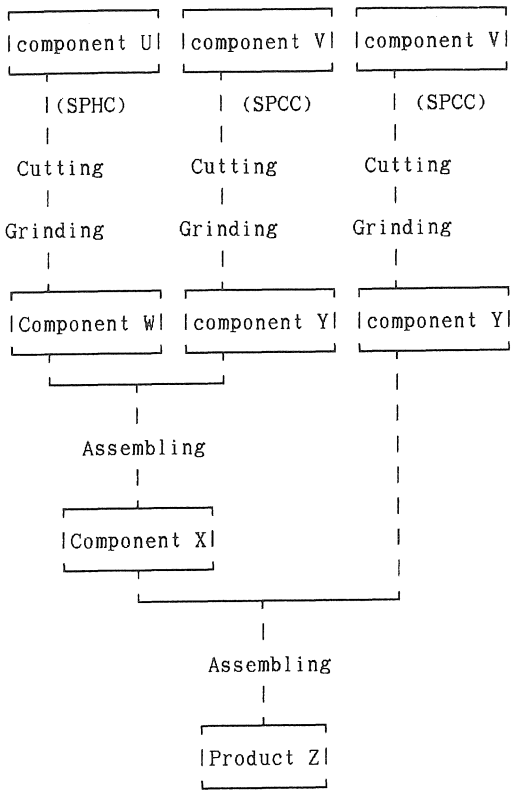
2. Smoothed Production System(per day)

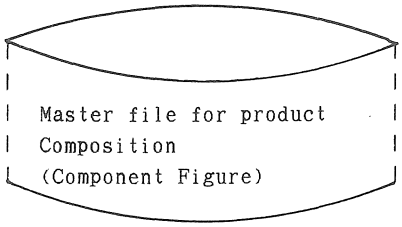
Item		Nunber of Production/Day		
Type	Numb.	1	2	3
Z	1,600	1,600	1,600	1,600
Y	1,200	1,200	1,200	1,200
X	800	800	800	800
W	400	400	400	400
Total	4,000	4,000	4,000	4,000

[Figure 1] LLC of component B



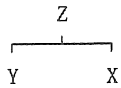
[Figure 2] Flow of Production Processes for Product Z





[Data contained]

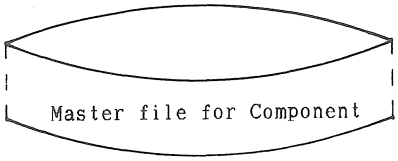
(1) Product Tree



(2) Quantity

Z-Y2
Z-X1
X-Y1
X-W1
Y-V1

[Figure 3] Data on Design Engineering

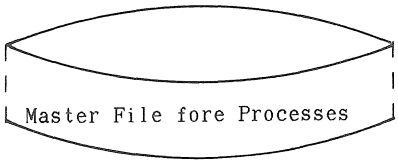


[Data Contained]

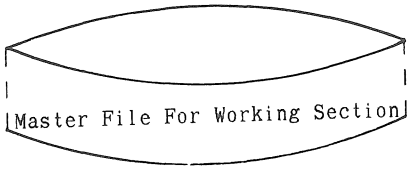
Cost Breakdown of Components

	Material cost	Labour Cost	Indirect manufacturing cost
Component v	@¥1,000	-	-
Component W	@¥1,000	¥150	¥150

[Figure 4] Data on Manufacture Engineering



[Data Contain]



Component	Process No.	Description of Process	Standard Hours	Working Section No.
Z	1,000	Component Y & X	2 HR	1001
X	2,000	Component Y & W	1 HR	2001
Y	3,000	Cutting	1 HR	2002
	4,000	Grinding	0.5 HR	2002

Component	Working Section No.	Wage Rate	Ratio of Indirect Cost
Z	1001	¥ 50	¥ 70
X	2001	¥100	¥180
Y	2002	¥ 90	¥200
		¥ 45	¥100

[Table B] Cost Accounting Table for Product Z

Component No.	Item	Material Cost	Labor Cost	Indirect Manufacturing Cost	Total
Component V	Total	¥ 1,000	¥ -	¥ -	¥1,000
Component Y	Component V	1,000	-	-	1,000
	Process 3,000		90	200	290
	Process 4,000		45	100	145
	Total	1,000	135	300	1,435

Component W	Total	1,000	150	150	1,300
Component X	Component Y	1,000	135	300	1,435
	Component W	1,000	150	150	1,300
	Process 2,000		100	180	180
	Total	2,000	385	630	3,015
Product Z	Component X	2,000	385	630	3,015
	COmponent Y	2,000	270	600	2,870
	Process 1,000		100	140	240
	Total	4,000	755	1,370	6,125

[Table C] Comparison between Standard Cost and Latest Cost Quoted from p.137, Fujimoto(1980).

Cost Accounting Table

Component No.	Name of Product	Unit	Material Cost	Labor Cost	Overhead	Total
AA-01	Double Door Set	Set	1,240.65	751.50	1,608.65	3,600.65 Total Cost
			.00	46.00	69.00	115.00 This Level
Subordinate Component	Quantity		Latest Cost			
AA-02	Rigth Door	1 Set				
AA-03	Left Door	1 set	610.02 (1)	342.00	748.00	1,700.02
AA-08	Center Post	1 Set	569.22	342.00	748.00	1,659.22
AA-13	Hinges	6 each	43.31	21.50	43.50	108.31
AA-14	Screws	31 each	15.00	.00	.00	15.00
			3.10 (2)	.00 (3)	.00	3.10 (4)
			.00	46.00	69.00	115.00 This Level
			1,400.65	751.50	1,608.50	3,760.65 TotalCost
					(5)	

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