

**On the Differences between Material Flow Cost Accounting and
Traditional Cost Accounting
— In Reply to the Questions and Misunderstandings on
Material Flow Cost Accounting**

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In the year 2000 the Material Flow Cost Accounting (MFCA) was introduced through a project sponsored by the Ministry of Economy, Trade and Industry of Japan (METI) as a tool of the environmental management accounting. Since then, its usefulness has been documented and MFCA has been in a process for a wider acceptance to Japanese companies. MFCA, whose origin of thought was developed in Germany, has been highlighted as a new approach in accounting, but at the same time scholars as well as practitioners in business have often raised such questions as what new it is or how useful it is in actual business, compared with the traditional cost accounting and the management accounting. In this article the author has selected and replied to some questions which seem to be important, and has further clarified misunderstandings which were caused by looking at MFCA from a viewpoint of the thought of traditional cost accounting, and has explained the differences between MFCA and the traditional cost accounting. Based on his experimental application of MFCA in several companies, the author has clarified what MFCA is and what real value it has.

Keywords: Environmental Management Accounting, Material Flow Cost Accounting, Cost Accounting, Waste.

I Foreword

As one of the millennium projects sponsored by the Ministry of Economy, Trade and Industry of Japan (METI), the “Research Study on Development and Promotion of Environmental Business, etc. (Environmental Accounting)”, from the fiscal year of 1999 for 3 years was conducted, and the results of the said research study was published in July 2002 in the “Work Book of Environmental Management Accounting Tools” issued by the METI.¹ In the process of works, 5 working groups in total

were set up, with the objective of developing a specific environmental business tool, one of which was the working group related to Material Flow Cost Accounting (MFCA). In this group, MFCA which was originally developed by IMU (Institut für Management und Umwelt, Augsberg, Germany) was actually introduced to a Japanese company for an experimental purpose to verify its usefulness, and the study was conducted for about 2 years since autumn of the year 2000.

In the process of making a research study, the questions were raised and discussed from a theoretical or technical point of view on the relations between MFCA and the traditional cost accounting by the companies having participated to the experimental adoption, the committee members, etc. In the past, the author tried to explain and reply to the questions raised about MFCA by word of mouth or through reports, etc. (METI (2002), Nakajima and Kokubu (2002)), as this accounting method was not fully recognized yet, but even such explanations or replies were made in an indirect way, and were inadequate to understand it completely as results.

In 2003, the Seminars on the environmental management accounting took place across Japan by the Japan Environmental Management Association for Industry (JEMAI: <http://www.jemai.or.jp/index-e.asp>) as a business project consigned by the METI.² The objective of this Seminar was to clarify and promote the three kinds of technique of the environmental management accounting including MFCA which was taken up in the recently published book called "Work Book of Environmental Management Accounting Tools". Through such opportunity as this Seminar, it is true that the name of the "Material Flow Cost Accounting (MFCA)" has become widely known among Japanese companies, but the name awareness does not necessarily mean adequate understanding of the content. Moreover, it was not rare that MFCA was mistakenly understood or explained. One such example is found in an underestimate that "the material flow cost accounting is the same in content as the traditional cost accounting or production management technique which have been in use in many companies, and is a tool having only a different name".

Even in the academic evaluation of MFCA, problems on its relevance in practical use were once pointed out. For example, there was an opportunity at the 61st Congress of Japan Accounting Association (Musashi University) to make a presentation on MFCA under the free subject program, and also in the same session one presentation on MFCA (Prof.

Nobuyuki Miyazaki, International Christian University), in which he raised several points on the relation between MFCA and the traditional cost accounting. Part of these points at issue was raised by him alone, but most of them covered the important points of question raised so far.

As shown in the above, needless to say, MFCA is a tool of the environmental management accounting in business practice as well as in the academic circle. However, from the standpoint of the author who has been involved in the introduction of MFCA and knows its usefulness and new potentiality, MFCA has not been fully understood yet, nor being appropriately evaluated. As MFCA is a tool of a management accounting, it is a fact that its usefulness will be demonstrated under a certain restricted condition or objective, and on the other hand, the magnitude of its usefulness and potentiality has been clearly shown in that all the four companies who participated in the experimental adoption of the project sponsored by the METI have been trying to extend the technique of MFCA to all their factories.³

When a new tool is proposed and came into wider use, such an above-mentioned misunderstanding or pointing out the misdirected problems are likely to occur as usually seen in the past, or can be ignored. However, the information and explanation on MFCA have not yet been given sufficiently enough to be able to reply to the questions and points at issue. In this paper, by way of answering to the points raised by Prof. Miyazaki, the author would like to clarify the questions and misunderstandings on MFCA in broader aspects.

II What view has a production process in MFCA?

Before the author replies to the points at issue or questions, it will be necessary to explain to such people who have heard for the first time the name of MFCA what this accounting is. However, as there are already some materials available on what MFCA is (for example, Nakajima and Kokubu (2002)), the author will not make a detailed explanation here in this article. In this Section, for understanding the basic concept of the cost valuation in MFCA, the author will explain briefly the differences between MFCA and the traditional cost accounting on how to grasp a production process.

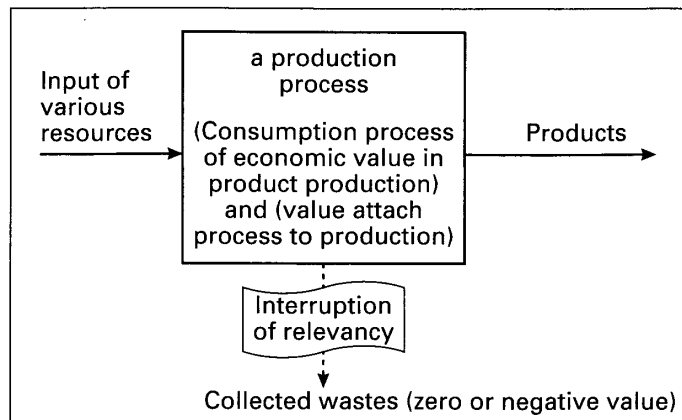


Fig. 1: View of Production Process in the Traditional Cost Accounting

Fig. 1 shows how to position a production process in the traditional cost accounting and how to value the cost of a product as the output of the production process. Compared with the view of a production process in MFCA as clearly shown in Fig. 2, it is considered that a production process in the traditional cost accounting is a consumption process of an economic value, in which the valuation of an attached value to a product by consumption is regarded as cost accounting, and, so far as a normal production is conducted, all the monetary values of inputted resources are to be calculated in the production cost of a product as an output of the corresponding production process.⁴ This means that a product should be burdened with all the costs of employed resources. Also in the structural picture which portrays recovery of the production cost by sales of the corresponding product and thus yields profit, the traditional cost accounting makes it a major objective to determine a production cost that should be recovered by sales of the corresponding product.

Therefore, it is not intended to determine a production cost of the wastes to be recovered by sales of the product. As shown in Fig. 1, generally to all appearances, wastes in a factory described in a dotted line exist as the ones which have accrued indirectly, being separated from the production process, and such wastes are put under control, being disrupted from the relation of occurring causes and places, although the wastes are stored separately as such in a waste warehouse. Wastes, being also disrupted from a consumption value which is attached from a product, based on the general recognition as wastes, are normally grasped and dealt with

as a totally different material from a product (causing loss), having a zero value or causing expenses for disposing of the wastes. Thus, wastes are not recognized at all in the traditional cost accounting, as these are regarded as a created product completely separated from places (production process) and various inputted resources (monetary value and physical volume), having no relation with a value chain.

In contrast, as shown in Fig. 2, in MFCA, wastes are not grasped as a process of value attachment with an aim to recover value of a product in a production process as seen in the traditional cost accounting, but, instead, all the outputs from a production process are to be equally valued.⁵ Products (quality goods) shown in Fig. 1 are grasped as positive products, while wastes or emissions (material loss)⁶ to be grasped by a production process are recognized as products (negative products) produced in the corresponding production process. In this respect, being "negative" of negative products denotes such products as being out of the objective of the corresponding production process or as having no marketability, but the important point is that, unlike the traditional cost accounting as shown in Fig. 1, a production process in MFCA is recognized as the one producing both quality products and waste products.

Under such perception, both positive products and "negative products" are as a rule equally valued in cost by MFCA as shown in Fig. 2.⁷ Each product is thus cost-valuated, based on what it is composed of, from the standpoint of inputted resources (by source).

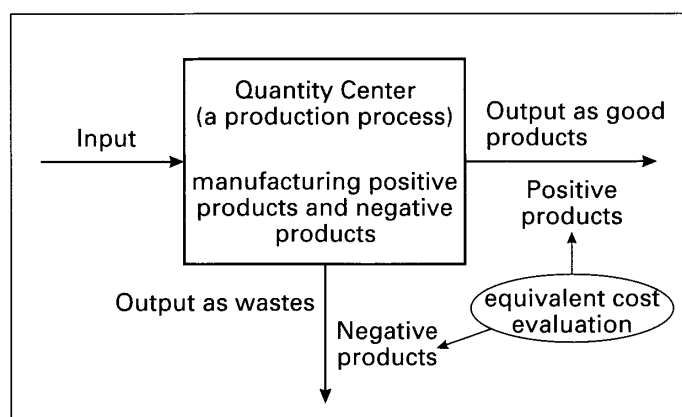


Fig. 2: View of Production Process in the Material Flow Cost Accounting (Refer to Nakajima and Kokube (2002), p. 68)

III Answers to questions and misunderstandings on MFCA

It was already mentioned that IMU of Germany developed the principal concept and the basic technique of MFCA and continued to make its experimental introduction. In Japan, experimental introduction of MFCA started, based on hearing at IMU and the discussion paper on MFCA issued by IMU which was used as a textbook. However, at the time of the experimental introduction of MFCA in Japan, its basic concept and technique were understood, but the specific problems encountered in the process of introduction were solved in Japan alone to proceed further for experimentation, which lead to development and evolution of the original Japanese version of MFCA.⁸ Therefore, MFCA of IMU and that of Japan have a common root, but its trunks (objects of introduction, methods, etc.) have grown differently at this point of time. Under such situation, in which both MFCA are same in the basic concept, the author will answer to the questions and misunderstandings on MFCA, based on the knowledge which he has in common and on his experiences in Japan.

As mentioned earlier, with reference to the points indicated by Prof. Miyazaki (2003), including some major questions on MFCA, the author does not intend to answer to the personal opinion expressed by Prof. Miyazaki, but instead will respond to the points which seem to be general and important.

Point 1: On the purposes of cost accounting in MFCA.

First of all this point raises a question whether or not MFCA is able to perform multiple functions (purposes) to be played roles by an institutional (traditional) cost accounting system.

However, regarding this point of whether or not an institutional cost accounting system itself performs (or is able to perform) multiple purposes, it has been widely discussed and studied in Japan as well as abroad, but remains to be solved. Therefore, it seems to be inappropriate to pose such a question from this point of view. Furthermore, as the saying of "different costs for different purposes", it has been pointed out⁹ that, to perform multiple purposes using only one cost accounting method which is an institutional cost accounting system, and it can be said that MFCA does not need to adapt to all the purposes. On the other hand, it goes without saying that, instead of regarding MFCA as one simple cost accounting method, since it

can be constructed as an environmental management accounting information system having detailed physical information as well as detailed monetary information as basic information (data base), an accomplished MFCA system is capable to address to various purposes.

Another question is that, as earlier explained, since MFCA values on an equal basis the cost of positive products which are of good quality and the cost of wastes which are negative products, the cost of a good quality product (so-called product cost) is valued lower by the amount allocated to the wastes, compared with the traditional cost accounting (all the expenses of inputted operating resources which are used for the corresponding production are included in a cost of a good quality product) as shown in Fig. 1. Therefore it has been pointed out that this lower valued product cost (cost of a good quality product) is neither suitable to a purpose of price decision-making, nor to a purpose of preparation of financial statements, nor to a purpose of yield management.

It is true that regarding suitability to the purpose of price decision-making or the purpose of preparation of financial statements, MFCA cannot be said to be appropriate, if only the cost of a good quality product is looked at, but it is rather easy to provide the product cost information as suitable to such purpose as in the traditional cost accounting, by making adjustment (addition) by the cost allocated to the wastes (material loss) using ERP (Enterprise Resource Planning).¹⁰ Also, regarding the yield management, a yield is generally defined to be a yield in the physical dimension, according to Accounting Research Office of Kobe University (1984). Furthermore, as the process cost accounting system denotes management based on the physical information such as a depleted volume in terms of process yield, it is considered that the physical information on such good quality products or wastes in MFCA will be utilized usefully. As shown in Fig. 3, the traditional cost accounting should be understood to be contained in MFCA.

Point 2: On the concept of cost in MFCA.

This point is related to the critical indication that a cost in MFCA does not satisfy the principle of matching costs with revenues for calculation of the so-called period profit/loss, and that a "cost normalcy" does not exist.

The primary purpose of MFCA lies in revealing the existing condition of resource productivity showing environmental impact and profitability, including the condition within a process (establishment of transparency

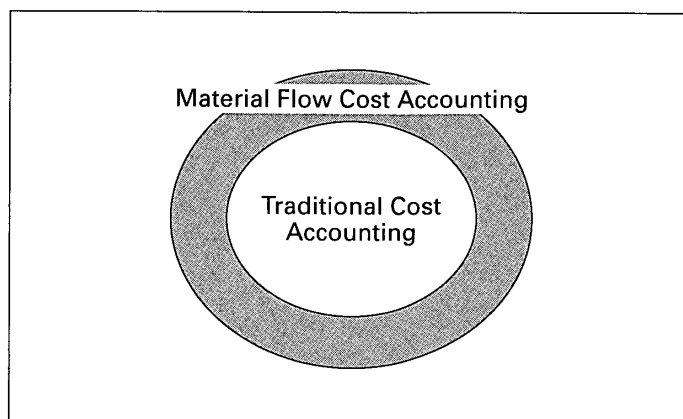


Fig. 3: Relation between Traditional Cost Accounting and Material Flow Cost Accounting (Nakajima and Kokubu (2002), p. 76)

within a process). Therefore, same as the traditional cost accounting so constructed as to have an organic relation with the financial accounting whose primary purpose lies in calculation of a period profit/loss, a presence or no presence of a standard for normalcy of a cost which should be merely included in the production cost and of the principle of matching costs with revenues cannot be said to be a problem for MFCA.

Instead of the relation of economic efforts and results in the principle of matching costs with revenues, MFCA grasps the input and output relation as a natural scientific relation of physical or chemical action and reaction. However, it has been pointed out that what these mean by is not clear.

Nevertheless, it should be considered that, as shown in Fig. 3, the traditional cost accounting is included in MFCA. With the premise of "a natural scientific relation of physical or chemical action and reaction" in MFCA, a method of allocating the production cost in the corresponding period to the cost of products in process and to the cost of finished products as a suitable cost accounting method in a period income statement can be said to be a traditional cost accounting. In other words, in a normal condition (normalcy of cost), there are no other outputs than finished products and products in process from a production process, and to these two kinds of products, the traditional cost accounting has the premise that the total production cost of the current period is allocated, while MFCA is to register and value physically things as they are. Therefore, it can be said that the information of MFCA is primary information showing an exact and detailed

productivity of resources.

Another question has been further pointed out (Miyazaki (2002) p. 3) that, against the assertion that it is possible to prepare the cost information suitable to the given purpose described as a reply in Point 1 by adjustment processing, such processing is time-consuming, un-rationally requiring "a compromise to the realities" as seen in the traditional cost accounting.

The problem of being time-consuming can be solved by introduction of ERP and a computer-soft. Adjustment processing is not a compromise to the realities, but signifies adaptation to each purpose. But, as the discussion on adaptability to purposes of this cost accounting is not intended in this paper, it will be discussed in another article. Furthermore, the fundamental issue of "what cost accounting means in an company" by way of experimental introduction of MFCA to an company will be further studied.

Point 3: On differences between MFCA and Standard Cost Accounting

As shown in Fig. 4, in the standard cost accounting, a standard cost is set up as a base to value the cost which has actually occurred, and its variance is to be managed. First, a standard cost is fixed to a product unit

① Variance Analysis: Amount of Standard Cost Variance Amount of Standard Cost Variance = (Actual Occurred Cost) – (Standard Cost)			
② Total Variance of Direct Material Cost: Development to Price Variance and Quantitative Variance Actual Direct Material Cost = Predetermined Price × Actual Consumption Quantity Standard Direct Material Cost = Standard Unit Price × Standard Consumption Volume			
③ Standard Cost Standard Cost = (Cost Standard) × (Actual Production Volume) Cost Standard = (Physical Standard) × (Price Standard) (Cost Standard means a cost per product unit.)			
④ Cost Standard			
	Efficiency Level	Price Level	Volume Level
Ideal Standard Cost	Ideal Efficiency	Ideal Price	Actual Production Capacity
Normal Cost	Normal Efficiency	Normal Price	Average Volume
Realistic Standard Cost	Achievable Efficiency	Current Price	Budget Volume

Fig. 4: Outline of Standard Cost System (Hiromoto (1997) pp. 269-275)

so that the variance between the standard cost and the actual cost in the product cost is calculated, and then the details of the variance in the variance analysis is to be developed and analyzed so as to be managed by factor (cause). For example, concerning direct cost of materials, as shown in ② of Fig. 4, the total cost variances of direct materials are to be broken down and developed into the price variance and the quantity variance.

However, this quantity variance analysis is obtained by multiplying the variance between the actual usage of consumption and the standard consumption by a standard unit cost, and is expressed and managed in a monetary value, but in reality it is expected that the quantity variance will be analyzed, which can be said to be an indirect approach in comparison with the method of MFCA. Furthermore, as mentioned in the following, a quantity variance varies with a fixed standard usage. In MFCA, a quantity variance corresponds to the quantity which did not produce quality products among the actual consumption, but theoretically is not the variance with the standard usage.¹¹

In this connection, as MFCA requires the same strictness in a standard cost of materials as in an ideal standard cost defined in the standard cost accounting, it has been pointed out whether or not MFCA is practically equal to the standard cost accounting.

To begin with, MFCA seeks to strictly grasp the volume of materials of all inputted and outputted substances within a process, as represented in a mass balance. MFCA is different in that it does not fix a cost standard as in the standard cost accounting, but directly looks at the volume of materials. Moreover, the objective of such grasping is not for fixing a standard, but for scientifically and accurately grasping the actual condition to be entered clearly.

Certainly, since the material loss (waste or emission) is grasped in MFCA, in which, based on its volume, the cost is valued and ideally the material loss is aimed to reach zero, the total amount of such cost is recognized as the amount of loss (waste). If the total amount of such cost is equal to a variance between the standard cost in the standard cost accounting and the actual cost, then it may seem alike. As shown in ③ of Fig. 4, the cost standard in the standard cost is equal to the physical standard multiplied by the price standard, and as shown in ④ of Fig. 4, the cost standards of three levels of ideal, normal and achievable volumes are said to be able to be fixed. An ideal cost standard means to set up as a standard

the very ideal condition to be fixed based on a scientific analysis. It has been pointed out that the variance between this ideal standard and the actual one may be equal to the material loss, especially related to materials.

In MFCA, unless inputted materials 100% produce quality products as a result of production, material loss which should be entered as material loss exists. Therefore, from a standard cost accounting viewpoint, to make this material loss zero can be interpreted as if it would be an "ideal" objective in MFCA. However, although this "ideal" in standard cost accounting is already known to be impossible, such interpretation as "if an ultimate dream is assumed to become realized" is included. Irrespective of such interpretation, MFCA intends to provide information from a viewpoint of resource productivity. Based on an improvement plan on how to reduce the material loss contained in the flow of wastes and emissions, in spite of the raw materials which are able to constitute quality products, a cost benefit analysis should be conducted for judgment and execution, which is the objective of introduction of MFCA, and at the same time the volume (monetary amount) of reduction to be fixed (or expected) is also its objective.

Furthermore, it has been pointed out that a standard cost accounting not disregarding normal shrinkage cost may be identical with MFCA. When, to say nothing of abnormal shrinkage (spoilage), normal shrinkage (spoilage) without being included into a product cost is grasped, it is necessary to define what shrinkage or spoilage stands for. For instance, it has been explained as "accrual of defective products in a job process or loss of materials".¹² And as a treating method of shrinkage or spoilage in the cost accounting, there are generally two explanations, i.e. the one of allocating the production cost to both finished products and products in process at end of fiscal year, disregarding accrual of shrinkage or spoilage and another one of allocating the production cost to both finished products and products in process at end of fiscal year, not disregarding accrual of shrinkage or spoilage. However, in such case, cost attribute of shrinkage or spoilage and a treatment method based on presence of such cost attribute and also easiness of this treatment method have been disputed.

Another aspect of the problem is that, when attention is paid to loss of materials, the content of the problem differs largely if the loss is grasped in reality only for direct materials or if the loss is grasped for all materials as in MFCA. In the opinion of the author, generally, loss of only direct materials is grasped in practical business and it is very seldom that normal

shrinkage or spoilage is grasped in the cost accounting, except, however, that quantitative information on shrinkage or spoilage under a normal or standard production condition may be obtained for production control.

Therefore, if the existing information on production control with regard to the material loss which is a part of materials being unable to produce quality products is fully covered, it may give an impression that grasping is made sufficiently. However, for example the material loss information, as shown in Fig. 5, is not grasped at all. The material loss is first differentiated into a recycle part and a final waste part as a material loss means, for instance, a part of materials which is not outputted as quality products in the one-time processing process. Both of them are composed of the materials making up products (quality products) and the materials necessary for production, but not making up the components of products. Therefore, MFCA grasps the material flow, beyond treatment of shrinkage or spoilage depending on the presence or no presence of cost attributes. Furthermore, as the recycle part which is generally not regarded as normal shrinkage is also once grasped as material loss in MFCA, a go-through rate¹³ in a strict sense of the word can be obtained.

If the normal shrinkage (spoilage) is theoretically grasped and its cost is valued as in MFCA, then the cost accounting not disregarding normal shrinkage cost, etc. and MFCA may resemble each other. However, the reason why it is necessary to separate and grasp the normal shrinkage (spoilage) is not sufficiently explained for practical business, and furthermore such explanation is considered to be unnecessary. Therefore, it seems to be extremely rare that a company executes the cost accounting which does not disregard normal shrinkage costs, etc.

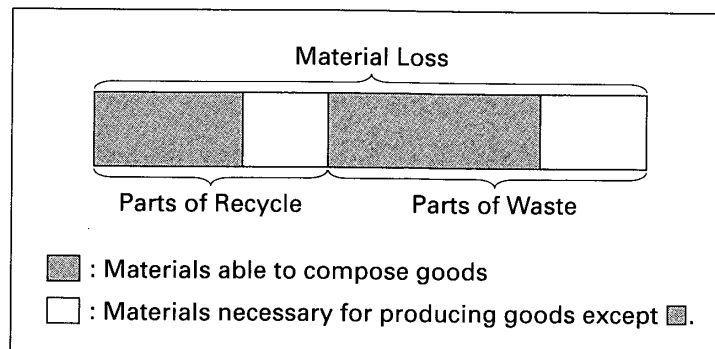


Fig. 5: Composition of Material Loss

Even though the cost accounting which does not disregard normal shrinkage costs, etc. comes closer to (resembles) MFCA, MFCA does not need at all to adopt a cost accounting which disregards normal shrinkage costs, etc. As seen above, it is possible to make a comparison with the traditional cost accounting, but it can be said that it is impossible to include MFCA into the traditional cost accounting.

In this article the author is unable to address to all the questions. Accordingly it will be described below briefly the differences in process of calculation between the standard cost accounting and MFCA.

- ① The standard cost accounting pays attention to the computation and treatment of variances in a product cost, while MFCA regards variances between the inputted volume and the output of quality products as the material loss.
- ② In respect of material cost, a method of grasping consumption volumes varies direct material or indirect material in the standard cost accounting, while materials are all grasped accurately, based on mass balance in MFCA.
- ③ Standard cost is calculated, based on the actual production volume, while a product cost is developed, based on the input volume and the output volume (quality products and material loss) in MFCA.
- ④ In the standard cost accounting, setting a cost standard means setting a standard cost which is a base for control. But, as clearly shown in Fig. 4, this cost standard is integrated with a monetary value so as to make a price standard a calculation factor. On the contrary, in the MFCA, a flow chart to be prepared at the end of the adoption of MFCA is a chart based on the monetary units (costs inscribed), and at this occasion, the volume of materials and costs are for the first time integrated. The integration with costs in MFCA indicates a magnitude of material loss in the monetary value, and the object of control is the volume of materials.

If a brief explanation on the above-mentioned ④ is added, when we look at the relation equation of "Volume of Materials \times Volume of Materials = Volume of Materials" and the relation equation of "Volume of Materials \times Monetary Value = Monetary Value", both of these equations may be mistakenly understood, at first sight, as a physical control information¹⁴ because the volume of materials constitutes a factor. However, if the

monetary value is multiplied in the latter equation, then it becomes information of a monetary value. Therefore, it should be considered that the nature of physical information is lost completely. On the contrary, if the two different kinds of information in "Volume of Materials \times Monetary Value" are presented in parallel for control, then understanding and judgment with addition of the physical information as well are possible. Simply by looking at the monetary value as the result of this equation, it cannot be said that this information is only the physical control information.

Point 4: On the method of wastes (discharges) cost accounting

It has been pointed out that there must be theoretical problems in allocation calculation, etc. at the time of valuating costs of material loss (wastes or discharges) in the same way as in the costing of co-products or by-products in the cost accounting.

On this point, as shown in Fig. 2, the costs of quality products and material loss is premised on an equal basis in MFCA, which makes it possible to invoke the method of the traditional cost accounting. However, for example the material cost in the material loss is computed, based on the volume of inputted materials which are contained in each of quality products and material loss, and even though the quality of inputted materials has become entirely different from the ones at the time of input, the material cost is grasped, based only on the physical volume, in which lies a problem. In other words, if an input material (A: solid) is contained in quality products and material loss due to processing of a production process, the inputted material (solid) is for instance, contained in the form of the solid B for the quality product and in the form of the gas C for the material loss by chemical changes, then the physical amount of both B and C as the inputted material A is grasped and entered for record according to MFCA, and the cost valuation is done by the physical volume and the purchase prices of the inputted material A. However, the rights and wrongs of valuing as the inputted material A, B and C which are entirely different from the inputted material A has become an issue at dispute for computation of MFCA at the production process particularly involving chemical changes.

This issue should not be concerned to the rights or wrongs of usefulness of MFCA, but should be considered as a suggestion of the need to develop some useful calculation method. As an example of one solution for this problem, the case study done for Shionogi & Co., Ltd. is suggestive

(IGES Kansai Research Center (2003)).

As IGES Kansai Research Center will publish a report, an explanation is made here briefly as follows: In case that in MFCA the inputted material S used in a pharmaceutical production process is contained as X in the quality goods and occurs as Y in the emissions, each cost of X and Y is computed by multiplying each weight of X and Y by the purchase prices of the input material S. However, for instance, if Y is carbon dioxide and most of the amount of the purchase price of S is paid to X, it seems to be not recommendable to make the cost valuation, based simply on the weight. Therefore, in case of Shionogi & Co., Ltd., it has been decided that the cost valuation of quality products and emissions is not be the weights, but is valued, taking into consideration the production method producing the purchased materials and the costs at the supplier.

It is considered that it is necessary to develop an appropriate valuation method in accordance with production methods and quality of products as seen in the above case. However, in case of Shionogi & Co., Ltd., it was easy to understand the production methods and the costs of the purchased materials of the supplier, but for such case as the materials are purchased simply by weight, a calculation method according to the rule of MFCA may be more appropriate. Nevertheless, instead of blindly complying with the rule, depending on the above-mentioned production method or on the quality, etc. of quality products, wastes and emissions, a better valuation method and a solution of such problems will be developed to make formulas, based on case studies. Furthermore, to enable a cost valuation more adapted to the production environment, it will be necessary to make a study of MFCA extended to life cycle assessment and supply chain management.

Point 5: On such case as occurs frequently and cannot be computed

This is a critical comment on the valuation method accommodating quality change of input materials due to chemical changes, etc., as earlier explained in the Point 4, and it has been already discussed on the quality changes. But, combined with this criticism, there is another important criticism on how to grasp and value "weightless energy (thermal energy, electricity, etc.)" in MFCA, and there is an explanation on this point below.

IMU (Strobel, M and Redmann, C. (2001), P.1, Note 3 and Strobel, M. and Redmann, C (2002), P.67, Note 2) explains that the material in MFCA

contains energy. However, any specific case study has not been published yet from IMU, and judging from the opinion exchanged with IMU on the method of MFCA concerning energy, IMU might be still in a stage of theoretical conception for the method.

As IMU explained to the author that the material contained energy, the author examined an original method to develop energy into MFCA at an introduction experiment in Japan which the author directed. In the discussion on MFCA with the introduction companies, attention was drawn to the originality to include energy into the materials and the usefulness of energy flow analysis and reduction of energy loss. Preparation of a flow chart of the materials as a basis of MFCA and its analysis itself took most of the time and cost prepared for the project. In addition, although the information on transfer of materials (shapes change like intermediate products) such as from bringing-in of materials, etc. to processing and shipping of the finished products are followed to some extent as production control information. However, usually energy-related information is grossly grasped in a unit such as a factory or building, etc., and this information was not determined and recorded, as seen in the inputted volume or consumption by location from one process to the next process as done in MFCA. Therefore, it was difficult to readily develop MFCA, including energy in the materials. From such reason, a detailed research study on energy has been left as a problem to be solved, but the information obtained was only inscribed on a flow chart, using an allocation calculation within the measured scope and with the obtained accuracy.

IV Conclusions

It is important to seek significance of MFCA in the relation with the traditional cost accounting or financial accounting. As shown in Fig. 3, however, MFCA contains in it a traditional cost accounting, and the current discussion on MFCA has been progressively developing its theory including a part of the environmental management which is not a category of the traditional cost accounting. This discussion is not appropriate, because it can be likened to try to put a large thing into a small container. But, as Prof. Miyazaki pointed out, supposing that the place of an institutional cost accounting system is taken by MFCA, there must be some institutional problems to be solved. On the other hand, since MFCA is a big concept

and at the same time is variable, a clue to find a solution for the problems will be found, as already explained in this paper. It can be said that the biggest issue is not a problem peculiar to MFCA, but a construction of a cost accounting and production control information system useful to a company, which has been still up to now a problem to be solved. Since with the expansion and improvement of information systems such as ERP, the concept and methods of MFCA has been supplicated, stepwise solutions to the unsolved problems can be proposed. For example, the traditional cost accounting has premised the abacus calculation, although it uses a handy calculator or a computer, too, but the freedom (casting-off) from the abacus calculation will be able to make a construction of a new cost management. With regard to this new development, it will be verified through the case study and the publication of the result of such study will be made in another article.

This article has not answered perfectly all the questions, but it could explained the major misunderstandings and the critically indicated points, based on the latest, presently available information. Such problems as has shown only a partial solution will be solved by future development of MFCA.

(Associate Professor of Cost Accounting)

Notes

- 1 As a result of this research study and as a report of the Committee having conducted the project, this report was first published from Japan Environmental Management Association for Industry (JEMAI) in 2002, and then published by the Ministry of Economy, Trade and Industry (METI) with an aim to specifically promote the environmental management accounting. The author was a member of this project committee and Chairman of the working group of MFCA.
- 2 The news article on this Seminar held at the site of Tokyo was published in the Nikkei Sangyo Shimbun (dated February 6, 2003), and the news article at the site of Osaka was in the Kankyo Shimbun (dated March 5, 2003).
- 3 Four companies are Nitto Denko Corporation, Tanabe Seiyaku Co., Ltd., Takiron Co., Ltd. and Cannon Inc. "Development inside an company" means that, as the object of the introduction project into Japan is one kind (group) of product — one production line and when introduction of MFCA is made to only one production line, it is a partial introduction of the project. Therefore, it has been under review that MFCA is to be widely

applied to the other production lines or to the whole factories, or all the factories of a company.

As the year 2002 project of the IGES Kansai Research Center (http://www.iges.or.jp/iges_kansai/english/index.html), MFCA was experimentally carried out, and its results were published in the year 2003 International Symposium of Environmental Accounting held on January 31, 2003. (The relevant explanatory paper is on display in the IGES Kansai Research Center (2003).) The collaborating companies for experimental introduction of MFCA by this Center are the 2 companies, namely Nippon Paint Co., Ltd. and Shionogi & Co., Ltd., and these companies are considering application of MFCA to their other factories owing to their understanding of its usefulness.

- 4 From "Chapter 3. Nature of Cost" in the "Cost Accounting Standards" in Japan.
- 5 It says "to value equally", but caution must be taken that there are the following differences between the traditional cost accounting and MFCA; In the traditional cost accounting, based on the input of the resources into the production of the product, the inputted resources (e.g. materials) make the product valuable, and the product is valued by the value of the inputted resources, while in MFCA, based on the physical composition of the output (product or material loss), the cost is valued by using the unit prices of the materials being the sources of its materials. Therefore, in MFCA, with the premise of the physical existence, only the unit prices are multiplied, as occasion arises, and regarding the materials, a valuing process as done particularly in the traditional cost accounting is not intervened. However, in case when the material loss is valued not only by the material cost, but also by including the system cost of the so-called conversion cost, it will be necessary to make a calculation of allocation, etc. as in the same way as in the traditional cost accounting, and this part can be said to be the same valuing method.
- 6 "Wastes or emissions (discharges)" mentioned here, we generally regarded the physical substances except quality products which are coming out from the production process as wastes. It should not be easily named as "(final) wastes", because companies make various devices actually taken in the factory as recycle, re-use, etc. Under such the present circumstances, it is often inappropriate to enter simply as "wastes" the physical substances which occur from the production process, except quality goods. Therefore, although it is considered to be appropriate that wastes are essentially included in "emissions (discharges)", the emissions which cannot become quality goods after one-time use of the virgin materials (re-cycled products or re-used products) are entered as "wastes", because these emissions are as useless as the final wastes, judging from the view point of production efficiency. Also, in this sense of the word, wastes are described as material loss in MFCA, and specifically are grasped in sharp discrimination as the emissions which have not become quality products at one time and the final wastes out of the such disqualified products.
- 7 "As a rule" means calculation of the corresponding material costs of positive and negative products in MFCA, based on the weight ratio of inputted virgin materials. However, for example, as published by IGES Kansai Research Center (2003), if the production method of purchased raw materials, cost components, etc. are clearly known, in a man-

ufacturing industry involving chemical changes as in the pharmaceutical industry, an allocation simply by a weight ratio is inappropriate, and it is necessary to choose a suitable method.

- 8 Needless to say, mutual exchange of information and sharing of knowledge and experiences with Prof. Dr. B. Wagner and Dr. M. Strobel, who are the organizers of IMU and the developers of the material flow cost accounting are going on. (HP of IMU: <http://www.imu-augsburg.de>)
- 9 For example, see pp. 13-21, Hiromoto (1997).
- 10 In this respect, it is not only a theoretical explanation, but, for example, Tanabe Seiyaku Co., Ltd has been trying to adopt MFCA as a corporate, institutional cost accounting system, and has been examining a system construction suitable to the objectives of both financial accounting and management accounting, by making an adjustment calculation treatment on ERP. (Nakajima and Kokubu (2002) p. 159-162).
- 11 In this respect, regarding how to determine or set up the flow to quality products of materials and the flow to the material loss at the actual introduction of MFCA into an company and from the necessity to utilize the materials (documentation, data and so on) which are available at the company as much as possible in order to reduce the introduction cost, a ratio to be used for the allocation calculation is sometimes used, by using standard values (theoretical values) which are fixed by the company. For details, refer to Nakajima and Kokubu, pp. 102-107.
- 12 Refer to Hiromoto (1997), pp. 199-200.
- 13 It denotes the ratio of the inputted materials becoming a product in the shortest time not through the stage of recycling or repairing.
- 14 The physical volume control information stands for the meaning of controlling the physical volume, not of controlling by the physical volume.

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