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Rapporteur's Summary

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Karl-Heinz Feuerherd
Professor, Kobe Yamate University

On January 31, 2003 the International Symposium on Environmental Accounting 2003 had been held at the International Convention Center in Osaka, Japan. The number of more than 200 participants indicates the high interest in this area of accounting, which attained special focus in recent years not only among specialists. Due to the effort of the Institute for Global Environmental Strategies (IGES) (<http://www.iges.or.jp>) located in Kanagawa prefecture and the staff of its Kansai Research Center the symposium became an inspiring event. The Ministry of the Environment of Japan and many other sponsors did contribute to a great extent to this success.

In his keynote speech K. Kokubu, professor at Kobe University and project leader at IGES Kansai Research Center stated the importance of environmental accounting not only for environmental conscious management itself, but for corporate management in general. Two initiatives of the Japanese government seem to have caused the change of behavior of Japanese enterprises. The guidelines of the Ministry of the Environment (MOE) on environmental accounting intend to increase the disclosure of information based on environmental accounting to third parties by means of environmental reports. In parallel the Ministry of Economy, Trade and Industry (METI) had launched an initiative, which did result in the development of various environmental management accounting tools. Among these tools *Material Flow Cost Accounting* (MFCA) is regarded as prospering method in future.

A survey performed by IGES Kansai Research Center has revealed the behavior of Japanese enterprises to emphasize the disclosure of environmental accounting information to external parties. This behavior is mainly influenced by the MOE guidelines. Nevertheless, corporate practices of environmental management accounting can be said to still contain much room for further development and refinement. Therefore Prof. Kokubu raised two important issues as task to be tackled by Japanese enterprises. First, there is the need to further refine the environmental accounting system, which is used to disclose information to external parties. And in this regard Japanese enterprises should take a lead concerning international practice. Second, environmental management accounting should get a firm footing in Japanese corporate practices. In this connection MFCA as a method is regarded to have a potential of development and application that should not be underestimated.

Session 1 Environmental Accounting for Environmental Disclosure

According to a survey conducted by the MOE at little less than 500 companies in Japan have published an environmental report and just under 600 companies were considering the introduction. According to the explanations given by K. Sawami of MOE the disclosure of information to third parties based on environmental accounting will steer activities to enhance the adoption of environmental conscious activities and procedures as well as promote the development of respective technologies. In this regard the MOE emphasizes its view that companies should use environmental accounting, environmental reporting and environmental performance indicators as integrated tool for disclosure of environmental information.

The MOE is expecting that companies have no choice but to disclose more detailed and reliable environmental

information, because this information will become the yardstick for external parties and stakeholders to judge of the environmental conscious management of corporations; a trend that has already become obvious in western industrialized countries. But judgment presupposes comparability and credibility of information disclosed in environmental reports, a condition that indicates the need for international harmonization.

In this connection it is the task of the Japanese Institute of Certified Public Accountants (JICPA) to guarantee the credibility of information, as E. Nashioka explained, who is at present research fellow at IGES Kansai Research Center. Driven by the activities of MOE there is an increasing need to further develop environmental accounting practices and provide more effective tools to better describe the state of environmental protection measures taken by corporations. There is still concern among practitioners of JICPA about environmental accounting as it is done at present. Worries like lack of information, different definitions and classifications are typical examples. Therefore, unification of diverse standards and the encouragement of creative activities in cutting edge areas are regarded as a first step to improve the present situation. But it will be not sufficient to only develop an accounting system that provides information in a more comprehensive way by amalgamating the current environmental guidelines. In addition it will be important to prepare the information in a proper way to be digestible by the target audience.

There is still no final decision on how environmental accounting statements should be disclosed. Disclosure can principally be done as separate statement or as information being integrated in environmental reports etc. To assure the credibility of primary information a pronouncement of corporate managers, the responsible persons in charge will be required. And a mechanism to guarantee the credibility of this information has to be established, which means to improve or establish an internal control system. Finally, the verification step will have to be done by a third party association to assure higher and more objective credibility. But still some hurdles must not be overseen. The new system will have to be established in parallel to the running business operations without hindering progress and prosperity, while there is a need to continuously review and refine a number of issues and items.

Session 2 Environmental Management Accounting for Better Eco-Efficiency - Close Look at Material Flow Cost Accounting -

With increasing need to strengthen the efforts of managing environmental issues of quite different dimension *Environmental Management Accounting* (EMA) attains focus as a tool, which is expected to provide corporate management the necessary information for sound decision-making, as M. Nakajima, associate professor at Kansai University pointed out. And he mentioned as a classical example for environmental sound decision-making the increase of profit while lowering the impact on the environment. A promising approach or tool for EMA is MFCA, which is based on material flow, or more precisely the physical phenomena of mass and energy flows to be observed in operations of company level. This tool is likely to allow better to understand flow and stock as well as the interrelation between both physical states. And the method can be said to be somewhat like a missing link to better relate two worlds, the world of physical phenomena and the world of values expressed in monetary units admeasured by human beings.

The foundation for every MFCA analysis is a mass balance or so-called eco-balance to visualize and understand the total impact of a company's activities on the environment as a whole. But it will be insufficient to only

record individual emissions by type and amount as a total figure. It is crucial to trace these emissions back to the origin of their creation, because emissions are nothing else but by-products generated by physical treatment of material in general and chemical synthesis reactions in particular. This type of in-depth analysis will help to enforce the precautionary principle by switching from end-of-pipe to front-of-pipe thinking encompassed with a predictable better financial performance of a company.

As Prof. Nakajima forecasts, the shift of thinking in the direction in terms of material flows, whereas stock is understood to be a flow with zero speed, will create the technique of "flow management". But the term of flow management still needs to be forged further, because flow management can focus on a single company, a branch of industry or a whole country. In any case the definition of flow represents primarily the movement of masses and energy carriers, while monetary flows are associated with these physical flows.

B. Wagner, professor at Augsburg University, Germany gave an overview of trends in *Material Flow Cost Accounting* in Germany. Obviously environmental management is pursuing different routes of development. In the beginning there was the classical approach of environmental protection by means of end-of-pipe measures based on technology. Prof. Wagner believes this thinking to still dominate the brain of corporate management especially of large enterprises.

During the nineties environmental management systems were introduced increasingly. But in the meantime euphoria has vanished. The European Environmental Management and Audit Scheme (EMAS) seems to have passed its culminating point while the ISO 14001 standard gains acceptance similar to its predecessor the ISO 9000 series on quality management. At present various procedures for environmental reporting have already been developed, which are mainly using environmental performance indicators (EPI). In addition different guidelines like the ISO 14031 standard and national ones are applied. These indicators based on I/O eco-balances are used for external reporting to stimulate environmental rating by third parties.

In this connection it will be one of the future tasks to develop a methodology that allows to distinguish between eco-efficient and eco-effective enterprises. A second task will be to let become environmental issues an obvious element in everyday decision-making in companies. The new type of manager must be able to recognize the chain of consequences caused by his decision not only from financial but also from environmental point of view. To be able to carry this heavy burden it will be essential to provide the management with information of a degree far higher in detail compared to environmental controlling practices for the time being. It will turn out to be crucial to have access to reliable data from every stage of the material flow to manage this task.

In principle this is not a new approach, because engineers have already been trained to optimize production processes, which did cause changes in material and energy flows. But now it will be a challenge for *Material Flow Analysis* and *Material Flow Management* to integrate the judgment in terms of technical function, cost and environmental impact. The projects performed by academia and corporations to tackle this task are distinguishing between macro and micro level depending on the focus of investigation. On macro level the supply chain, forward and backward logistics, the analysis of the total lifecycle as well as aspects of material cycles and reuse play an important role. On micro level production processes within the boundary of an enterprise are highlighted. Questions like material efficiency, material and energy losses in processes and

possibilities of substitution are raised.

At present these projects can be divided into two categories: environmental projects that are focusing on material flow and managerial projects, which are targeting monetary flows. Environmental oriented projects are mainly steered by environmental agencies or ministries for environment, whereas the other group is supported by business associations and ministries for trade and commerce. There have been launched several projects during the last five years that tried to avoid this single-eyed approach and use a binocular focus of investigation instead. But these projects run into the well known trap of *Environmental Cost Accounting* debate to only show the cost of pollution prevention measures, which amplified the signal of alert to find ways for cutting down environmental cost and lessen the efforts for environmental protection.

Another type of projects did try to model material flows by using software tools like "AUDIT" or "Umberto", by primarily modeling material and energy flows in terms of physical units and finally providing environmental indicators. These software tools are sometimes working as post-processors for data contained in ERP systems like SAP. Recently cost information is also included in these tools, but this is done not automatically, a fact that causes these tools to become more or less static and less flexible when conditions are changing or alternatives have to be evaluated.

But there are projects and efforts on corporate level, which are most promising in future, as Prof. Wagner said. These efforts have in common to try to use the standard management information systems, the *Enterprise Resource Planning* (ERP) systems, to extract the information on material flow in physical and monetary terms that is needed by managers on the spot. At present *Material Flow Cost Accounting* (MFCA) is developed in Germany from different aspects:

- Retrieval of information from existing or newly introduced ERP systems

- Restructuring of existing or newly introduced ERP systems to provide information in physical and monetary units

- Achievement of physical and monetary transparency on all stages of mass flow

It is a matter of fact that an increase of material efficiency will be rewarded by cost reduction, resource consumption, emissions and pollution. But Prof. Wagner expects that in the forthcoming years a tremendous work will have to be done to collect data from companies to achieve this goal.

R. Pojasek, adjunct professor at Harvard University's School of Public Health, president of Pojasek & Associates in Boston, USA was showing how process maps and other tools can be used to improve the use of flow cost accounting. The *Flow Cost Accounting Model* and its methodology have been tested extensively in different continents. The so-called *process mapping* consists of a hierarchical process to link resource, material and cost flows in a consistent fashion. The technique can be applied to any industries or service sector. In addition, accounting sheets are used to link supporting processes to the main process. The inventors claim that a resource accounting sheet tracks all the resources used in each process step by taking a 360-degree look at the work performed at that step. Resources used and lost in an operation can be assigned a cost on a spreadsheet that is linked to the resource accounting sheet. Furthermore, an activity accounting sheet examines all the functional activities that are needed to manage each work step, and a spreadsheet is linked to this sheet, too. A cost accounting sheet then can be prepared by combining the two spreadsheets. This so-called *Systems Approach* can be deployed using the *Flow Cost Accounting Model* structure. And in

a similar manner the described technique can be linked to existing management information systems like the SAP enterprise resources planning software.

It is an advantage of this *Systems Approach* to go beyond the simple analysis of processes. It offers a systematic framework for facilitating process improvement opportunities discovered through the use of the *Flow Cost Accounting Model* or the hierarchical process mapping and accounting methods.

J. Okajima from Nippon Paint Co., Ltd. introduced a case study being part of IGES Kansai research project on *Material Flow Cost Accounting*. The key division staff learned about MFCA in December 2001. After a study tour to the factory selected for this trial project a project team was established consisting of members from environmental quality HQ, the accounting department, the manufacturing section, the center of engineering and the safety emergency section. This team became responsible to supervise the project.

In summer 2002 the project team began with preparations to investigate the introduction of a water-based paint production line at Osaka Factory of Nippon Paint as a non-fictive task to respond to actual needs of the market. Data collection needed two month.

Data have been collected from the following processes: stirring of starting materials (mixing process), equalizing of particle size (dispersion process), stirring by adding of additives (dissolution process), removal of impurities contained in finished product (filtration process) and filling of product into 18 litre cans (filling process).

To become an environment-conscious product this water-based paint consists of approx. 10 recipe components like water, pigment, additives and varnishes. As the production line is not only used to make one single type of product, it is essential to apply a cleaning operation after every batch production. The material recovered during the cleaning step is stored and used again as starting material for another batch with the same composition. Therefore it is crucial to avoid any leakage, which would cause a different concentration of ingredients required by the recipe.

As one result of this project it became clear that all measures having been taken so-far to recover used material achieved a remarkable reduction of overall material loss of 0.14 % or 5,000 Yen (approx. 42 US \$), which is a surprisingly low figure. If 30 lots are manufactured per year this amount sums up to 150,000 Yen (approx. 1,250 US \$).

Another focus of this MFCA project was the actual use of electric power. In the past the measurement of energy consumption of individual machines had not been taken into consideration. Therefore the problem was still unsolved how to relate these data being an environmental management information to *Material Flow Cost Accounting*. Simply speaking, it was possible to measure the energy consumption of every apparatus, but the problem did remain how to relate this data with energy loss figures. As a solution the investigation of the so-called power factor had been introduced, which is the ratio of effective energy that drives a machine compared to the apparent electric energy (expressed as voltage times current) expressed as per cent figure. Although the power ratio was 85 % in general, cases could be found showing a lower figure. As a reasonable approach to measures based on MFCA results the so-called loss factor will be used in future to relate it to energy cost.

Y. Kokuryo from Shionogi & Co., Ltd. introduced another case study of *Material Flow Cost Accounting* performed with the aid of IGES Kansai. The preparations to introduce MFCA started in summer 2002, and the project was carried out by the staff of the environmental management unit of Shionogi's head office and Kanegasaki Factory.

The product that had been chosen for investigation was a drug substance. The manufacturing chain did consist of three major stages: production of the drug substance, formulation process and packaging process. The production step did include operations like chemical synthesis, extraction, separation and drying. The formulation process did contain the operations palletizing and molding, whereas the packaging step did consist of the activities filling up and packaging in boxes.

Pharmaceutical companies in Japan are obliged to apply the "manufacturing and control standard code" in accordance with the "Good Manufacturing Practice (GMP)" of the Ministry of Health, Labor and Welfare. Mass balance information that already did exist for every production process had to be updated and completed by information of the master formula of the production process and checked precisely to fulfill the rule of mass conservation with respect to I/O material.

By running this project Shionogi learned how to find with the aid of MFCA to find a new "Kaizen" point. In other words, it was important to understand the origin of output and its cost evaluation. Furthermore, it was essential to trace the flow of material back to the source, i.e. purchase from suppliers, and get information on upstream operations as far as possible.

As result of this project a calculation method of material cost in chemical synthesis was proposed that does allocate a material's purchase price not on simple weight ratio but based of the concept of "composition" by reflecting the material loss on the supplier's side. As a second result MFCA opened the door to information on material loss cost rate, which was 24.3 % per total costs, 26.2 % per total material cost, and 14.4 % material cost caused by material loss by disposal per total material cost. From Shionogi's point of view MFCA did help to evaluate the yield rate and losses with financial measures, which allowed to put down the losses to their elements and origin. Based on this experience MFCA is expected to become a valuable tool to locate new "Kaizen" points.

From the different presentations, the results of case studies and the response of the auditory during the final panel discussion it can be concluded that *Material Flow Cost Accounting* is gaining increasing attention among academia, authorities and enterprises in Japan accompanied by the expectation to build a sound foundation to help to recover and secure the competitive strength of enterprises and economy of Japan in total.