IGES

International Symposium on Environmental Accounting 2003

Cutting Edge of Environmental Accounting for Corporate Management and Environmental Conservation

～Environmental Accounting in Japanese Corporate Management and Potentialities of Material Flow Cost Accounting～

January 31, 2003

Osaka International Convention Center, Osaka JAPAN

IGES Kansai

Proceedings of International Symposium
on Environmental Accounting 2003

Cutting Edge of Environmental Accounting for Corporate Management and Environmental Conservation

～Environmental Accounting in Japanese Corporate Management and Potentialities of Material Flow Cost Accounting～

Date & Time: January 31, 2003 (Friday) 10:30 - 17:00

Venue: Osaka International Convention Center (Nakanoshima, Kita-ku, Osaka JAPAN)

Organizer: Institute for Global Environmental Strategies (IGES)

Sponsors:
Ministry of the Environment of Japan, Hyogo Prefectural Government, Environmental Management Accounting Network - Asia Pacific (EMAN-AP), Japanese Institute of Certified Public Accountant (JICPA), Nihon Keizai Shimbun, Inc., Nikkei Ecology (Nikkei Business Publications, Inc.), The Osaka Chamber of Commerce and Industry, Asia-Pacific Network for Global Change Research (APN), International EMECS Center, Hyogo Environmental Advancement Association, the following eight organizations of the Advisory Board of IGES Kansai Research Center:
(Kansai Council, Global Environment Forum-KANSAI, Kansai Economic Federation, The Federation of Chamber of Commerce and Industry in Hyogo Prefecture, Hyogo Prefectural Federation of Societies of Commerce and Industry, The Hyogo Industrial Association, The Osaka Industrial Association, The New Industry Research Organization)

Co-sponsors:
Asahi & Co., Shin Nihon & Co., ChuoAoyama Audit Corporation, Deloitte Touche Tohmatsu

Panel Discussion

Poster Session

Outline

1. Theme:

Cutting Edge of Environmental Accounting for Corporate Management and Environmental Conservation ～Environmental Accounting in Japanese Corporate Management and Potentialities of Material Flow Cost Accounting～

2. Objectives:

"Sustainable corporate management" has become an important issue in realizing human beings co-existence with the environment. However, sustainability cannot be achieved by merely running slogan campaigns: it requires concrete systematic approaches. Environmental accounting is an indispensable business tool to integrate environmental conservation activities and corporate management. Environmental Accounting has been disseminated throughout Japanese corporate sector; however, there is much work to be done for corporate management to realize its full potential. In this context, Material Flow Cost Accounting has attracted global attention as a new tool of environmental management accounting that aims to realize profit-oriented business operation and sustainable environmental management simultaneously through improving eco-efficiency.

In this symposium, following opening remarks and a keynote presentation on "environmental accounting for corporate management and environmental conservation", presentations in the first session will provide an overview of the actual status and action assignments of environmental accounting for environmental disclosure being conducted in Japanese companies. The second session will focus on lectures on theoretical concepts and actual practices of environmental management accounting - presentations will be delivered by international experts on material flow cost accounting.

Following presentations on research findings of collaborative project conducted by Japanese companies and IGES Kansai Research Center, the panel session will explore the future agenda.

Overall, this symposium intends to propose a specific environmental management system that helps facilitate internal management for companies and the international business world.

3. Organizer etc.

Organizer: Institute for Global Environmental Strategies (IGES)

Sponsors: Ministry of the Environment of Japan, Hyogo Prefectural Government, Environmental Management Accounting Network - Asia Pacific (EMAN-AP), Japanese Institute of Certified Public Accountant (JICPA), Nihon Keizai Shimbun, Inc., Nikkei Ecology (Nikkei Business Publications, Inc.), The Osaka Chamber of Commerce and Industry, Asia-Pacific Network for Global Change Research (APN), International EMECS Center, Hyogo Environmental Advancement Association, the following eight organizations of the Advisory Board of IGES Kansai Research Center:

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4. Date & Time: January 31, 2003 (Friday) 10:30 - 17:00

5. Venue: Osaka International Convention Center (Grand Cube Osaka) 10th Floor (Nakanoshima, Kita-ku, Osaka JAPAN)

6. Attendance: 203 participants (including speakers)

7. Participation Fees (including distribution materials and lunch):
General: JPY 8,000- / Student: JPY 4,000-

8. Language: English and Japanese (with simultaneous translation)

9. Side Program: Poster Session

10. Program

Opening (10:30 -11:20)

Opening Remarks (10:30 - 10:50)

- Akio Morishima, Chair, Board of Directors, Institute for Global Environmental Strategies(IGES)/ President, Central Environmental Council, Japan
- Akihiro Amano, Director, IGES Kansai Research Center/ Director, IGES
- Nobutoshi Miyoshi, Director of Environment and Economy Division, Environment Policy Bureau, Ministry of the Environment

Keynote Speech (10:50 - 11:20)

"Environmental Accounting for Corporate Management and Environmental Conservation"
Katsuhiko Kokubu, Project Leader, IGES Kansai Research Center/ Professor, Graduate School of Business Administration, Kobe University

1st Session (11:20 - 12:00) Environmental Accounting for Environmental Disclosure

Presentations

1. "Efforts of Japanese Government - Focus on the Role of Ministry of the Environment -"
   Kenji Sawami, Assistant Director, Environment and Economy Division, Environmental Policy Bureau, Ministry of the Environment
2. "Efforts of the Japanese Institute of Certified Public Accountants (JICPA)"
   Eriko Nashioka, Research Fellow, IGES Kansai Research Center/ Certified Public Accountant/Member of the Environmental Accounting Expert Committee in the Management Research Study Group of the Japanese Institute of Certified Public Accountants

◇◇◇◇◇◇◇◇◇◇Lunch & Poster Session by co-sponsors (12:00 - 13:30) ◇◇◇◇◇◇◇◇◇◇

2nd Session (13:30 - 17:00) Environmental Management Accounting for Better Eco-Efficiency - Close Look at Material Flow Cost Accounting -

Introduction (13:30 - 13:50)

"Introducing Material Flow Cost Accounting for Better Utilizing Internal Environmental Management Information"
Michiyasu Nakajima, Associate Professor, Faculty of Commerce, Kansai University/Research Fellow, IGES

Presentations by Invited Speakers (13:50- 15:00)

1. "Development of Material Flow Cost Accounting in Germany"
   Bernd Wagner, Professor, University of Augsburg, Germany
2. "Using Process Maps and Other Tools to Improve the Use of Cost Flow Accounting - The North American Experience"
   Robert B. Pojasek, Adjunct Professor, Harvard University/ President, Pojasek & Associates, U.S.A.

◇◇◇◇◇◇◇◇◇◇Coffee Break & Poster Session (15:00 - 15:30) ◇◇◇◇◇◇◇◇◇◇

Panel Discussion (15:30 - 17:00)

"How will Material Flow Cost Accounting Contribute to Better Eco-Efficiency?"

Part 1: Case Studies of MFCA

1. Jun Okajima, Nippon Paint Co., Ltd.
2. Yoshitsugu Kokuryo, Shionogi & Co., Ltd.

Part 2: Panel Discussion

Coordinator: Professor Katsuhiko Kokubu
Panelists: Prof. Dr. Bernd Wagner, Dr. Robert B. Pojasek, Prof. Michiyasu Nakajima, Mr. Jun Okajima, Mr. Yoshitsugu Kokuryo

Profile of Speakers

Katsuhiko Kokubu

Professor, Graduate School of Business Administration, Kobe University, Japan
Project Leader, Business and the Environment Project, IGES Kansai Research Center

Completed Ph.D. at Osaka City University. Formally appointed as Associate Professor at Osaka City University, Visiting Scholar at London School of Economics (LSE) and Associate Professor at Kobe University. Has been involved with many governmental projects on environmental accounting. Serving as a member of the Committee of Ministry of the Environment, Ministry of Economy Trade and Industry, etc. Currently appointed as Steering Committee Member of Environmental Management Accounting Network-Asia Pacific(EMAN-AP), International Associate of the Centre for Social and Environmental Accounting Research at University of Glasgow, Director of Environmental Economics and Policy Association, Director of Corporate Social Accounting and Reporting Association. His main publications include " Material Flow Cost Accounting"(Nihon Keizai Shimbunsha, 2002), "The Environmental Management of IBM" (Toyokeizai Shinpo-sha, 2001) and "Environmental Accounting in the Process of Updating" (The Energy Conservation Center, 2003).

Kenji Sawami

Assistant Director, Environment and Economy Division, Environmental Policy Bureau, Ministry of the Environment

Certified Public Accountant. Graduated from Faculty of Economics, Keio University.
Through the Hokuriku Bank Ltd., Shin Nihon & Co.(audit corporation), Entered Ministry of the Environment in 2001. In charge ofencouraging voluntary environmental conservation activities in corporations (e.g. Environmental Accounting, Environmental Reporting, Environmental consideration in financial service sector).

Eriko Nashioka

Research Fellow, IGES Kansai Research Center
Certified Public Accountant

Completed a master degree at Graduate School of Policy and Management (major in Environmental Management), Doshisha University in 1997. Entered the Osaka branch of Century Ota Showa & Co. (Shin Nihon & Co.) in 1991. Engages in consulting of accounting audit (the Commercial Law Act, the Securities & Exchange Law, investment promotion laws), environmental accounting and environmental reporting. Serves as a member of the Committee of Environmental Accounting of the Japanese Institute of Certified Public Accountants(JICPA), Ministry of the Environment, Ministry of Economy, Trade and Industry, etc. Her main publications include "Environmental Accounting and Environmental Report in Practice"(Chuokeizaisha, 2000), "Comprehensible Environmental Accounting"(Jitsugyononihonsha, 2000) and "Environmental Accounting in the Process of Updating" (The Energy Conservation Center, 2003).

Michiyasu Nakajima

Associate Professor, Faculty of Commerce, Kansai University, Japan
Visiting Research Fellow, IGES Kansai Research Center

Completed Master Degree (Management) at Osaka City University. Formally appointed as Associate Professor at Faculty of Economics, Kagawa University. Serving as a member of the Committee of Ministry of Economy Trade and Industry, etc. His main publications include "Material Flow Cost Accounting" (Nihon Keizai Shimbunsha, 2002).

Bernd Wagner

Professor, Management Center, University of Augsburg, Germany

Studied Business Administration and Organizational Psychology in Munich and Paris.
Foundation of the Management Training Center, University of Augsburg in 1974. Member of its Board since then, Director since 2000. Professor for Management and Organization Development at University of Sierra Leone, West Africa in 1982-84. Professor for Technology Transfer for the EU in China in 1986. Foundation of the Institute for Management and the Environment, imu, 1992. Foundation of the German Environmental Bankers Association in 1995. Many environmental awards by the Federal German Industrial Association and the German Environmental Minister etc. Main topics of interest: Corporate Environmental Management including Environmental Management Systems and Auditing, Environmental Indicators and Controlling, Mass and Energy Balances, Environmental and Material Flow Cost Accounting etc.

Robert B. Pojasek

President, Pojasek & Associates
Adjunct Professor, Harvard University, USA

Completed Ph.D. Chemistry at University of Massachusetts in 1974. Directed a management consulting practice for 30 years that focuses on helping organizations plan and implement programs for quality management, resource conservation, odor elimination, cleaner production, pollution prevention, safety improvement and sustainable development towards a ZERO goal. Developed the "Systems Approach" that uses a variety of process characterization, problem-solving, and decision-making tools to help organization teams improve efficiency and continuously improve their processes and/or services. His firm, Pojasek & Associates, is a sole proprietorship formed in 1998. Also provides commercial and in-house training on these approaches to both public and private sector clients. He has served on numerous industry and government advisory boards.

Jun Okajima

Manager, Finance & Accounting Department, Nippon Paint Co., Ltd.

Graduated from Kansai University in law. He joined Nippon Paint Co., Ltd. in the same year and doing finance, accounting and budgeting. In 1992 he moved to Nippon Paint (America) Corp in New York. He made consolidated accounting system and worked as a manager in charge of environmental accounting system and involved environmental report project from 1998. He has been responsible for Environmental Accounting, Investors Relations.

Yoshitsugu Kokuryo

General Manager, Environmental Management Unit, Shionogi & Co., Ltd

Completed Graduate School of Industrial Chemistry, Kobe University, 1973.
After working for Chemical Process R&D department, Shionogi Pharmaceutical Company, he has been present position since 2000.

Opening Remarks

Opening Remarks

Akio Morishima

Chair, Board of Directors, Institute for Global Environmental Strategies (IGES)
President, Central Environmental Council

On behalf of the Institute for Global Environmental Strategies (IGES), the organizer, I would like to express my sincere appreciation to you for your attendance at this symposium despite the cold weather. I am very pleased to see so many people gathered here today. I would especially like to express my gratitude to two lecturers from overseas for coming all the way to Japan to join us.

In 1995, the Japanese Prime Minister's Ad Hoc Commission recommended then Prime Minister Murayama to establish an international strategic policy research institute to realize sustainable development in the Asia-Pacific region. Based on this recommendation, a preparatory organization for the establishment of the Institute for Global Environmental Strategies (IGES) was set up in 1997. IGES was inaugurated with the signatures of 10 national governments in Asia, three international organizations including UNEP, and 13 research institutes, at the occasion of the 3rd Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3) in Kyoto. While financially supported by the Japanese government, the objective of IGES is to conduct research that could help Asian nations to promote sustainable development.

Today's symposium is organized as a part of the activities of the "Business and the Environment" project at the IGES Kansai Research Center. During IGES' first phase from 1998 to 2001, the Kansai Research Center was not yet open and this project did not exist either. Projects during that period were performed in the main office of IGES at Hayama, Kanagawa Prefecture and dealt with issues such as global warming, forest conservation, urban environmental management and environmental education. In 2001, the Kitakyushu office was set up with the full support of Kitakyushu City, followed by the establishment of the Kansai Research Center, which is fully supported by Hyogo Prefecture. Research activities of the Kansai Research Center began in 2001. Since the Kansai Research Center is located in the area of major industrial cities of Osaka and Kobe, the focus of the Center is to conduct research on business activities which contribute toward sustainable development, with close cooperation of business companies in the area.

Today's symposium is organized as a part of the Center's research activities, focusing on environmental accounting. As confirmed at the World Summit for Sustainable Development (WSSD) held in 2002 in Johannesburg, partnership among all social sectors is essential to promote worldwide sustainable development. Business corporations, in particular, are expected to ensure sustainable development.

In the global community, the World Business Council of Sustainable Development (WBCSD) has provided opportunities to business leaders around the world to discuss how they should act to assure sustainable development. In view of global trends, IGES is trying to acquire the most advanced knowledge and apply it to solve the environmental issues. Today's symposium is organized with the hopes of sharing our research results in environmental business management.

The Director of IGES Kansai Research Center, Professor Akihiro Amano, will speak in more detail about the objective of the symposium. I would like to emphasize that the whole IGES places the utmost importance on relations between business companies and the environment and ask you for your further cooperation. Thank you.

Opening Remarks

Akihiro Amano
Director, IGES Kansai Research Center

I would like to welcome everyone here today--the eminent researchers who have come a long way from overseas to be with us, and the participants from organizations across Japan. It is a great honor for me to have an opportunity to give opening remarks at this international symposium that deals with environmental accounting with a special focus on material flow cost accounting.

As President Morishima just mentioned, IGES Kansai Research Center was established in April 2001 as an organization, although the office was actually opened in June of the same year. We started our first three-year project under the title of Business and the Environment.

The Kansai area is well endowed with social science researchers on environmental problems and policies, and industries in this area have accumulated rich experiences to mitigate industrial pollutions. This is the major reason that we chose the above theme for the starting research project. We believe the center is in a good position to build a kind of bottom-up model for environmental management in the 21st century with inputs from the communities and corporations in this region.

In fact, many researchers joining the IGES Kansai Research Center are from the business community or local government. In addition to the ordinary research activities, the center has also held international symposia and seminars over the past two years. In 2001, our inaugural year, we held an international symposium and a workshop that explored the theory and practical applications of environmental accounting.

For these events we invited distinguished scholars from abroad, including Mr. Roger Burritt, reader at the School of Business and Information Management at Australian National University, and Mr. Martin Bennett, senior lecturer at the University of Gloucestershire Business School. The latest theoretical developments in environmental accounting were discussed, and we all learned how environmental accounting was being applied in Australia, South Korea, the Philippines, Indonesia and Japan, and discussed the present situations and challenges.

In July 2002, the Second Tripartite Roundtable on Environmental Industry - China, Korea and Japan was held, and as a consecutive event, we hosted an international symposium with the theme of 'Industry and the Environment: Quest for a Market System Leading to Sustainable Development'. We invited Dr. William H. Glanville, Vice-President and Chief Operating Officer of the International Institute for Sustainable Development (IISD) as well as participants from the Second Tripartite Roundtable to discuss approaches to mitigating environmental degradation through partnership of private sectors and public organizations, an idea that has gained much importance in the World Summit on Sustainable Development (WSSD).

One of the basic views of the Kansai Research Center is in line with that of the WSSD, in that we are looking for the methods to build such social structures that will spontaneously reduce environmental degradation due to economic activities by means of partnership between private sectors and public organizations. How

can we integrate business activities with environmental conservation? This is a big challenge, and to address such an important, long-term issue, it is vital for fuller discussions to take place that involve governments, the business community, scholars, consultants, and the public.

Today's international symposium focuses on a promising tool for corporate management designed to achieve these ends, and we have asked the participation of world's leading researchers and practitioners in this field along with government officials. It is my hope that we can develop fruitful discussions among those with diverse viewpoints to make further progress in this area.

I believe this will be a superb opportunity for everyone at the symposium here to discuss to the end of the day, and think deeply about the relationship between reducing environmental degradation and the role of corporate management through the "window" of environmental accounting, particularly material flow cost accounting.

As you know, we have speakers here today from Germany, the United States, and Japan-from three leading countries that are at the forefront of environmental accounting including material flow cost accounting. I would like to end my remarks by expressing the hope that we will be able to contribute to building a new social structure in which corporations can make further progressive strides in these fields. Thank you very much.

Opening Remarks

Nobutoshi Miyoshi
Director of Environmental and Economy Division
Environmental Policy Bureau
Ministry of the Environment

I would like to say a few congratulatory words on the occasion of the opening of the International Symposium on Environmental Accounting 2003. First of all, let me take this opportunity to express my appreciation for your understanding and continued cooperation for the promotion of governmental environmental policies. While we seek understanding and cooperation from the corporate sector, professionals from various academic backgrounds, consumers and people from other fields, the Ministry of the Environment is committed to building a sustainable society where the environment and economy are well integrated. This is a big challenge for us.

The Environment and Economy Division focuses especially on promoting the green economy. Our policies to achieve this goal include:

- promotion of economic measures to incorporate environmental consideration into a market mechanism,
- provision of support to facilitate a company's voluntary environmental protection activities such as environmental reporting and environmental accounting, today's topic,
- and the promotion of concepts of green purchasing and eco-labels to raise people's awareness of environmentally-conscious products.

In this respect, I think my division is more closely related with companies than other divisions of the Ministry of the Environment.

In Japan, the number of companies that disclose their environmental information and adopt environmental reporting and environmental accounting systems has been increasing every year. Environmental reporting and environmental accounting are considered to serve as environmental communication tools between companies and the society. According to our survey conducted in fiscal year 2001, approximately 600 companies produced environmental reports and approximately 500 companies adopted environmental accounting. These results have made us reconfirm the increasing social demand for companies to disclose their environmental information.

We have recently publicized a draft of the Basic Plan for Establishing the Recycling-based Society in order to seek public opinion. One of our aims presented in the plan is to have 50% of all listed companies in Japan publish their environmental reports and adopt an environmental accounting system by 2010. Some of the opinions we have received to this point say that a higher goal should be set. It would be very helpful if today's participants could also give us their opinions and suggestions.

Environmental accounting, a tool to integrate environmental and financial information, provides companies and other organizations with two functions: an internal function for their management and an external function for their communication with society. The Ministry has presented a comprehensive guideline for environmental accounting that can serve both internally and externally with the hope that the guideline could be used widely.

Environmental accounting has been conventionally developed among Japanese companies whose objectives place an importance on social responsibilities and communication. The external function of environmental accounting fits well with the objectives of such companies. On the other hand, Material Flow Cost Accounting, the major subject for today's symposium, aims to be used by companies for their internal management. We hope that such an internal effort will further expand externally so that companies can gain social credibility and meet social demands, thus making an ideal development of environmental accounting that integrates internal and external functions.

From this point of view and from the number of participants we have here today, I think the theme of the symposium is timed well and it is clear that companies have a great interest in integrating the environment into their business management. As one involved in environmental policy making, this is very encouraging to me.

Our division has provided many guidelines for environmental reporting and environmental accounting. This may sound like an advertisement of our activities, but these guidelines can serve as standards for companies in making use of environmental reporting and environmental accounting systems. We are now engaged in revising these guidelines. Environmental performance indicators are one of the items under revision, for which we are seeking public opinion. As our hope is to complete a guideline that can be of direct use for those addressing environmental issues, we welcome your opinions.

We have also built a database of environmental reports based on companies' voluntary registration with the hope of connecting companies and the public. This database has been open to the public on the Ministry of the Environment's website as of last September. Since any company can register, we would like to encourage your participation as well.

Another effort we are making is to set up a framework that allows a third party to review companies' environmental reports in order to further promote environmental reporting and improve comparability and credibility. I think we may be able to implement the framework on a trial basis at the beginning of the next fiscal year. According to our schedule, we are working to make the concept more concrete.

To involve the whole corporate community in environmental conservation activities, we are also revising "Environmental Activities Evaluation Program - Eco Action 21 - ". This program provides a simple method with which small and medium-sized companies can easily join environmental protection activities. After a trial period, we are considering the introduction of a certification system. We hope this program will serve as an incentive not only for small and medium-sized companies wishing to be voluntarily involved in environmental activities, but also for large-scale companies that are already currently promoting the greening of the supply chain.

As mentioned above, we are presenting various policies and measures. These tools however can only be effective when companies utilize them in their actual activities, so we hope you will further actively engage in environmental conservation.

In conclusion, I would like to express my appreciation to the Institute for Global Environmental Strategies, the organizer of this symposium, and any other persons concerned. I hope that this symposium will be meaningful to all the participants. Thank you.

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Overview of Presentations and Panel Discussion

Overview of Presentations and Panel Discussion

CONTENT

1. Environmental Accounting for Corporate Management and Environmental Protection

Katsuhiko Kokubu

Environmental accounting has two functions: external disclosure (external environmental accounting) and internal management (environmental management accounting). Both types of environmental accounting are indispensable not only for environmental management but also for corporate management itself.

Environmental accounting in Japan has developed rapidly during recent years. This development was triggered by the initiatives by the government. Of these initiatives, those of Ministry of the Environment (MOE) and Ministry of Economy, Trade and Industry (METI) are considered to play a more important role in Japanese companies. The MOE environmental accounting guidelines stress the external disclosure of environmental accounting information by environmental reports. On the other hand, the METI initiative has developed various environmental management accounting tools including material flow cost accounting.

Based on some surveys of IGES Kansai Research Center, Japanese companies put much more stress on external disclosure purpose of environmental accounting. Their disclosure practices have been strongly influenced by the MOE guidelines. However, corporate practices of environmental management accounting in Japanese companies have not been well developed yet. Therefore, two important issues for Japanese companies can be pointed out. First, they should sophisticate their external environmental accounting system and lead international practices. Second, environmental management accounting should be well introduced into Japanese corporate practices. For this purpose we believe material flow cost accounting has huge potentialities.

(For full text, please refer to page 30.)

2. Efforts of Japanese Government - Focus on the Role of Ministry of the Environment -

Kenji Sawami

1. Roles of environmental accounting in policy making

i. Transition of environmental issues in Japan

Environmental issues in Japan can be roughly divided into three groups: (a) those in the high growth period when industries served as a source of pollution; (b) those in the stable growth period when pollution surfaced as a result of urban-centered life; and (c) those in the present period since global environmental issues have been recognized.

ii. Roles of environmental accounting in policy making

One of the most effective measures to cope with these environmental issues is the optimal policy mix. Since disclosure of environmental information is the key to promote environmental-friendly activities, companies should closely connect the following three elements, so as to use them as an integrated tool for environmental information disclosure: (1) environmental accounting; (2) environmental report; and (3) environmental performance indicators.

2. Measures taken by the government and other organizations

i. Current prevalence of environmental accounting in Japan

The number of companies introducing corporate environmental accounting is constantly increasing in Japan. According to the survey by the Ministry of the Environment, 491 companies introduced an environmental accounting system (367 of them have announced their introduction.) and 580 companies were considering the introduction of such a system in the last fiscal year.

ii. Governmental policy to promote environmental accounting

The increased introduction of environmental accounting by companies attributes to the active promotion by the government as shown in the Basic Environmental Plan and Three-Year Program for Promoting Regulatory Reform (Revised). In addition to the Ministry of the Environment, various ministries and agencies are engaging in projects to promote the introduction of environmental accounting.

iii. Environmental accounting guidelines

The Ministry of the Environment has published the environmental accounting guidelines based on the opinions of many business people and experts. The Ministry regularly holds workshops for companies and enjoys a cooperative relationship with the Japanese Institute of Certified Public Accountants. Furthermore, the Ministry has published guidebooks containing the results of some relevant researches with the aim of promoting an understanding of environmental accounting and making the system more user-friendly.

3. Issues to be considered in the future

i. Transition in corporate sustainable development management

Circumstances surrounding corporate sustainable development management is going through a major transition. It is expected that companies will be urged to further disclose environmental information and will be evaluated based on the disclosed information. Considering this, the demand for environmental accounting that relates financial information to environmental information is likely to increase significantly.

ii. An issue to be considered in the governmental policy

Environmental accounting, one of the most important measures to pursuit of environmental conservation and economic growth in tandem, is needed to be spread more widely. Particularly, when environmental accounting information is disclosed in environmental reports, their comparability and credibility must be improved.

iii. Harmonization with international trend

In order to harmonize with international trends, it is necessary to review methods mainly designed for internal functions, which have been considered at expert meetings of UN Sustainable Development Department, while contributing to the regional promotion of environmental accounting using the Environmental Accounting Network - Asia Pacific.

(For full text, please refer to page 38.)

3. Efforts of the Japanese Institute of Certified Public Accountants (JICPA) -Toward the Establishment of an Environmental Accounting System (Interim Report)-

Eriko Nashioka

1. Activities about environmental issues on JICPA

JICPA originally formed in 1949 as an association, and reorganized under the Certified Public Accountants Law in 1966 and is the sole organization for the CPA profession in Japan. Qualified persons who wish to practice with the title of CPA must register with JICPA and join its membership. JICPA members consist of CPAs, Foreign CPAs qualified by passing special examination, audit firms, and Junior CPAs as associated members, about 18,000 people.

With the objectives of the CPA profession as a whole to maintain a high level of ethical integrity and to improve and enhance high quality professional services, JICPA continues to be involved in various activities including: Enhancement of members' service opportunity, including harmonization of services and cooperation with other qualified professions.

For its part, JICPA set about investigating environmental auditing and accounting by establishing in 1993 an Environmental Auditing Subcommittee under the Management Research Committee (established in 1987), followed by an Environmental Auditing Research Group in 1995. In 1998, the research structure was bolstered by dividing this group to form an Environmental Accounting Working Group and an Environmental Auditing Working Group. GHG Emission Trading Working Group was formed in 2002. Since then, several research reports have been published (see the reference). JICPA has also been involved in a number of collaborative projects, such as a joint research group formed in cooperation with the Ministry of the Environment.

2. Environmental accounting statements initiative

Environmental accounting is still at the developmental stage, the approach adopted to date has been to look to innovation by individual corporations. Such activity should be encouraged all the more in the future, and there is a particularly important role for diverse action by corporations in fields as yet untouched by environmental accounting.

Given that almost 500 corporations have already adopted environmental accounting, we have reached the point where standards should be progressively adopted starting with those areas where standardization is feasible. In particular, if environmental accounting is to provide core data for the evaluation of environmental management, the methods used to calculate the figures should be, to some extent, standardized in order to increase the utility of this information.

Environmental accounting data are presently generally disclosed in the form of a couple of pages of information in environmental reports. For such data to be capable of being used to evaluate environmental management of corporations, however, it is necessary to establish a more comprehensive system of environmental accounting that and goes beyond the environmental accounting data presently required under existing environmental accounting guidelines. Environmental accounting in the future should thus consist not simply of a collection of data expressed as a page of tables, but include an integrated system of accounts comprising a variety of tables of monetary and physical data. The data for disclosure should, as far as possible, be interlinked and each table systematically interconnected. The system of accounts we propose should also include supplementary schedules setting out the bases of calculations and giving a detailed breakdown of the principal figures contained.

Building a society where the level of environmental management of corporations can be accurately evaluated by the markets requires that environmental accounting takes large responsibility of providing core data necessary for such evaluations.

Environmental accounting needs to function as a tool to enable corporations to fulfill their duty of accountability regarding their environmental protection activities. Environmental accounting data should therefore incorporate sufficient information to enable the assessment of the level of environmental management of corporations. Environmental accounting should cover not only those aspects environmental management that a corporation has adopted, but include the basic data

required to evaluate environmental management. By analyzing environmental accounting data, it is necessary to determine the level of environmental management of a corporation.

By processing the various kinds of environmental accounting data described above, the user would be able to calculate a corporation's environmental efficiency index along with numerous other indices and use this information for evaluation purposes.

3. Forward the evaluation of corporate sustainable management

An accurate assessment of level of environmental management requires certain basic information. Environmental problems faced today are diverse and their relationships to corporate activities are complex. A proper social consensus concerning how much emphasis should be given to what kinds of problems when evaluating corporations has thus yet to be reached. It is consequently conceivable for different evaluation agencies to hold different positions concerning the appropriate method of evaluation. It is necessary, however, to define and standardize the method of calculation of the data that form the basis for evaluation. This is because it is impossible for evaluations to be accurate, even where the same method of evaluation is used, unless the underlying data meet common standards. Common standards on the preparation of basic data must therefore be adopted, though diverse methods may be used for its evaluation. Furthermore, information provided by corporations is of little use unless it actually conforms to these standards. Given these considerations, the following two conditions must be met in order to enable the accurate evaluation of environmental management.

Firstly, standards that is considered to be fair and proper concerning the basic data for evaluating environmental management must be established. And secondly, the reliability of the information to be evaluated must be guaranteed.

If access to highly reliable information can thus be ensured, the level of environmental management may be evaluated more easily. This will as a result, for example, put higher rated corporations in a better position to raise funds on the markets. The accurate evaluation in this way of a corporation's contribution to the protection of the environment should thus act as an incentive to pursue environmental management. If the outcomes of the actions by corporations to protect the environment can thus be accurately ascertained, preferential treatment can be offered-both on a program and policy basis-to corporations corresponding to these outcomes. And if access to data enabling the accurate assessment of the level environmental management of corporations can be ensured, it should result in both incentives in the markets and policy-based incentives.

Note: This report include my private opinion based on deliverance of JICPA.

"Environmental Reports Assurance Guidelines (draft)" (interim report), *JICPA Journal* November 2001

"Current Situation and Issues of Environmental Reports Assurance" (interim report), Summary published in *JICPA Journal* December 2002

(For full text, please refer to page 42.)

4. Development of Environmental Management Information in the Material Flow Cost Accounting Practices

Michiyasu Nakajima

In a company, Environmental Management Accounting (EMA) attracts attention with a promotion of environmental management today. Management accounting is the tool which offers useful accounting information when managers do decision making in company, and this information is management accounting information. Therefore, EMA is a tool offering useful accounting information to do appropriate decision making when managers do environmental management, and such information is EMA information.

Then what kind of management will be recognized as environmental management?

For example, it may be defined as the management that seems to improve company profit while reducing environmental impact with environmental management or the management to aim at maximization of company profit with minimum environment impact. It may be said that EMA to provide accounting information to be useful for this environmental management is a tool

offering useful information to lead company to achieve improvement of profit and reduction of environment impact at the same time.

Then what will a concrete EMA tool be?

If one of concrete and useful EMA tool is given, it can be a Material Flow Cost Accounting (MFCA). MFCA is one of useful EMA tools developed in the flow management to understand flow and stock of material in a meaning of physical substance in a company.

A mass balance and eco-balance are made to understand an environmental impact of a company as the whole. However, it is necessary to analyze a process in a company produced emissions from namely material, because the emissions which give environment impact is produced by a process in a company. Instead of conventional measures for a result as an end-of-the-pipe, it is more important that a cause is got rid of.

In this viewpoint, a flow (stock is included) of materials in a company, or between companies is understood, and the management to be going to make use it can be defined as the flow management. But there are variations regarding the definition of the flow management. For example it depends that the range is company unit or the whole society, and the elements are just only materials or including energy. Therefore the thought of flow management has expansibility and possibility.

Emissions (mainly, wastes) of a company (mainly, waste) are focused from the flow management thought, and the concrete EMA tool, by which a waste is reduced, in other words environment impact is decreased and manufacturing cost is reduced, is devised. One of the useful EMA tool is MFCA developed Prof. B. Wagner (IMU, Germany). This is carried as the EMA tool which is useful in some environmental handbooks issued by the German Ministry of the Environment. Moreover, Systems Approach developed by Prof. R. Pojasek is influential, and it is introduced as a waste reduction tool of US-EPA (Environmental Protection Agency).

Two these tools have common points. In both of tools, a flow of materials in a company is understood, a flow of emissions (wastes) is made transparent for the amount of materials, and a cost is evaluated, then these information are made use for resources productivity improvement. Also they are introduced into a company concretely, and lead to good results.

Through presentations about two these tools, we will understand how MFCA or Systems Approach is really applied in German and North American companies, and how they function as an EMA tool in practice.

Furthermore, in a panel discussion, MFCA trial project by IGES will be explained. In trial project, two Japanese companies (Nippon Paint and Shionogi & Co., Ltd.) participate, and Japanese MFCA is developed. About this result, we will be able to see an evaluation of MFCA as environmental management tool from a viewpoint of company.

At this symposium, it is one purpose to understand MFCA in Germany and Japan, Systems Approach in North America. Moreover we do not only understand that they have relevance and possibility as EMA, but also we need to have more purposes to find what is international environmental management supported by EMA and, to discuss the perspectives in order to realize it.

(For full text, please refer to page 48.)

5. Trends of Material Flow Cost Accounting in Germany

Bernd Wagner

Environmental Management in Germany presently shows various lines of development. Starting point and still continuing is the classical environmental protection approach, technology oriented, end of pipe. This still covers probably the most dominant range of activities of the environmental officers, especially in bigger companies, securing the functioning of the end of pipe technologies for waste, waste water and emissions treatment, securing compliance.

In the 90ies the introduction of Environmental Management Systems became a widely spread standard. Even though after a first wave of enthusiasm bureaucratic experiences led to some disappointments. Today the European Environmental Management and Audit Scheme (EMAS) is staggering , the number of participating companies even dropping, while its sister, the ISO 14001 Environmental Management Norm, is taking over

and continuously develops to be the international accepted standard, comparable to the acceptance of the analogues Quality Standards ISO 9000 ff.

With the introduction of Environmental Management Systems various environmental reporting procedures developed, including methodological questions of environmental performance measurement (EPA), mostly focusing on measuring with the help of environmental performance indicators (EPI). Meanwhile various guidelines (e.g. by the German Ministry for Environment or the ISO Norm 14031) are in use. Until today these indicators generally are input-output-indicators derived from a (sometimes though fragmentary) Input-Output Eco Balance. These instruments of environmental performance measurement today mainly are used for external reporting. First approaches to external environmental company ratings are to be found, concentrating on the evaluation of environmental reports and the included information on management procedures and on performance measurement.

Not clearly elaborated is here the distinction between eco-efficiency and eco-effectiveness, that is how to distinguish between the efficient improvement of production (e.g. emission per product unit) and the overall and absolute reduction of environmental damage (e.g. total amount of emission). It will be one of the main tasks of the future to introduce and methodologically improve this distinction between the eco-efficient and the eco effective company for the valuation, rating and taxation of companies, globally.

A second future task, representing equally ongoing achievements, is to include environmental aspects into everyday management decision making.

Environmental controlling so far has been the separate task of the environmental officer. It is necessary that every manager in every decision takes into account the environmental consequences to be expected from his decisions, decisions concerning e. g. investments, production procedures, purchasing processes, building construction, logistics.

This integrated environmental decision making needs more detailed information support than environmental controlling of the past, based mainly on corporate input-output-data, was able to provide. It needs controlling data from every relevant point along the flow of material, from every point where material is transformed, used more or less efficiently, turned into either productive material or residuals, waste, waste water, emissions, heat, noise etc.

This is why environmental controlling, as a basis of decision making, now is working on new methods and tools of material flow analysis.

For engineers this is not new. They have optimized physical material flows in the past: but with the dominating view to improve the functioning of the product. They have neglected cost controlling, they have neglected environmental controlling. Both of the latter tasks where fulfilled by different people, with different educational back grounds, different languages and different targets. Material Flow Analysis, Material Flow Management today has to integrate these different views, has to improve transparency of material flows in terms of technical functioning, costs and environmental aspects simultaneously. This is the present and future challenge.

Categorically academic or corporate projects working in this direction distinguish between a macro level and a micro level focus. Material flow oriented projects with a macro level view consider aspects of supply chain, forward and reverse logistics, life cycle analysis, questions of material cycles and reuse projects. Projects with a micro focus consider corporate production processes, material efficiency in the production process, material and energy losses, material or energy substitution. The ongoing endeavours to these projects again fall apart into two further categories: environmental projects, focussing on flow analysis in physical terms and managerial projects, focussing on monetary terms. The environmentally oriented projects are sponsored by environmental departments, agencies or ministries. Results are taken into account by environmental officers, only marginally by corporate line managers. Managerial projects are supported by line departments, business associations and ministries for trade, commerce, economy.

This separation has to be overcome. Physical and monetary terms are two sides of one coin. Line managers have to be supplied with both types of information, physical transparency, which means material efficiency and environmental consequences, as well as monetary transparency, meaning value, cost and revenue consequences.

Some environmental projects in the last five years started to bridge this gap by taking up cost information. Unfortunately many of these endeavours trapped itself in the co-called "Environmental Cost Accounting" debate, not only in Germany. Counterproductive to environmental interests these endeavours tried to show the costs of pollution prevention measures. The data were used by industry to show to the public how much money was spent for environmental protection. Internally the consequence of these - now transparent - high figures was to cut down on these, sometimes tremendous costs where possible, which means to cut down on environmental protection.

Another branch of projects works on the modelling of material flows.

These projects mostly try to use software tools or work explicitly on the development of corresponding software tools (tools like AUDIT or Umberto). These tools too started form the environmental point of view, modelling physical material and energy flows and providing environmental controlling indicators visualized in charts. These tools are add-on software to the ERP-systems (SAP etc.) the line manager used. Only recently they began to introduce into the add-on tools cost information to increase relevance and acceptance by line managers. But these cost information where derived by hand from various sources and equally fed into the add-on tools by hand. The main use of these tools still was for purposes of the environmental officers, and here mainly for internal or external reporting.

Projects and corporate endeavors with the highest future potentials therefore today try to use the standard management information systems, the enterprise Resource Planning (ERP-)Systems, to provide from these the material flow information every line managers needs within his operational responsibility, in physical and in monetary terms. Material Flow Cost Accounting (MFCA) today in Germany is developed as an instrument

- that gets its information from within the existing or newly introduced ERP-systems.
- For this purpose existing or introduced ERP-systems have to be restructured to provide the necessary information in physical and monetary terms.
- Main purpose is to achieve physical and monetary transparency of material flows at all spots of movement, storing or transformation,
- in order to increase material efficiency and by this cut down costs and reduce resource consumption and pollution simultaneously.

To enable the line manager to improve his every day decision making processes in this direction is the core of the present MFCA projects and the challenge of the future.

In the coming years these necessary data will be derived by data mining out of the companies data warehouse. The material flow data then can be packed for a wide range of decision making and reporting purposes, for production control, quality management, environmental reporting etc.

(For full text, please refer to page 52.)

6. Using Process Maps and Other Tools to Improve the Use of Flow Cost Accounting - The North American Experience

Robert B. Pojasek

The Flow Cost Accounting model has successfully combined a number of accounting methodologies to provide a useful tool for improving work processes in a variety of different industries. This methodology has been tested extensively in Europe and Japan. In the United States, Mexico and Canada, the Systems Approach has been used for similar applications. It uses a hierarchical process mapping technique to describe the work in a consistent fashion and links the resource, material and cost flows to these maps using object linking and a popular visual software tool.

On 11 September 2001, the developers of these techniques met at Harvard University to begin the comparison of the techniques. This paper reports on how the two methods are quite complementary and can work together to yield superior process improvement services to the companies that use these methods.

Process mapping is highly structured and can be applied consistently over any industrial or service sector. Supporting processes are linked to the main process using accounting sheets. These sheets are object linked to the process map at the lowest available level in the hierarchy. A resource accounting sheet

tracks all the resources used in each process step by taking a 360-degree look at the work performed in that step. Each resource used and lost in the operation can be assigned a cost on a spreadsheet linked to this sheet. An activity accounting sheet examines all the functional activities that are needed to manage each work step and the losses associated with that work step. A spreadsheet is linked to this sheet. Allocations of the resource and activity costs associated with the supporting processes can be assigned to each work step in proportion to their use. The two spreadsheets can be combined to prepare a cost accounting sheet. This process characterization element of the Systems Approach can be deployed using the Flow Cost Accounting model structure. In a similar manner, each technique can be successfully interfaced with available management information systems (e.g., the SAP enterprise resources planning software) to provide the information needed to analyze the process. By combining the methods, a superior process improvement opportunity assessment tool can be produced.

The Systems Approach goes beyond the analysis of the process to detail a systematic framework for facilitating the process improvement opportunities discovered through the use of the Flow Cost Accounting model or the hierarchical process mapping and accounting methods. Furthermore, the Systems Approach offers a means for converting the improvement program into a performance-focused effort that will help the company using it to outperform financially the companies that are not using this approach.

(For full text, please refer to page 62.)

7. Panel Discussion Overview

Under the theme of "How will Material Flow Cost Accounting Contribute to Better Eco-Efficiency?", a panel discussion was held at the end of the symposium. The panel session consisted of 2 parts:

○PART-1 Case Studies of Material Flow Cost Accounting (MFCA)

Business and the Environment Project, conducted by IGES Kansai Research Center, has actively been engaged in researching the methodology of environmental management accounting. As part of the research activities, the MFCA project was carried out with cooperation from Nippon Paint and Shinogi. Project teams were formed for each case study with selected members from IGES and respective companies that worked together.

In the symposium, Mr. Okajima of Nippon Paint and Mr. Kokuryou of Shionogi reported their efforts at introducing MFCA into their factories. The two following abstracts were distributed as handouts to the participants on the day of the symposium.

○PART-2 Panel Discussion

Based on presentations in the second session and two case studies on MFCA, the panel discussion was conducted with Prof. Kokubu as chairperson.

First, Prof. Wagner and Dr. Pojasek expressed their views on the two case studies respectively. Then, discussions were initiated by questions from floor. The questions were related to technique, examples and application of MFCA and Process Mapping, and panelists responded to each question with a concrete explanation quoting their experiences.

(For full text, please refer to page 70.)

8. IGES KANSAI Research Project: Material Flow Cost Accounting Case Study I : Nippon Paint

Jun Okajima

Nippon Paint was founded in March 1881. In the subsequent 121 years, we have developed, manufactured and sold paints and coatings for abroad range of industrial sectors, including automobiles buildings, industrial products and ships. We are the leading company in the Japanese paint industry. Our environmental management ideology is to become "a worldwide cachet as an environment-conscious company that contributes to protecting the environment and reducing the consumption of resources and energy".

1. Overview Project:

In December 2001 researchers explained Material Flow Cost Accounting (MFCA) to the key division staffs. The factory study tour of the trial was carried out in Osaka. The project team (the environmental quality headquarters, the accounting department, the manufacturing section, the center of engineering, and the safety emergency section) was organized to oversee this project.

A concrete trial was first made to prepare to introduce a water based paint manufacturing line in the Osaka factory from summer 2002.

Material Flow Cost was applied to the total range, with a data collection period of two months.

It has a manufacturing line "Mixture", and moves to the "Dispersion" process which makes the degree of quality of a grain equal when stirred with main raw material. Next, additives are poured and completed in the product through the "Dissolution" process. The filtration to remove the impurities of that completed product and so on is done, and 18 litre containers are filled and shipped.

It is composed of about ten kinds of raw materials, (mainly water, pigments, additives, vanishes, and water based paints) that become products by finally being filled into the 18 litre container as environmentally friendly goods.

Washing is made after each process is completed because other products are manufactured using this line, as well. Washed materials are recycled each time the next same product is manufactured. The quality is equal from the mixing process to filling up the pipe, ensuring that the liquid will not leak out halfway. The main raw material is a powdered body, and the powdered dust which appeared in the mixed process is recycled, with partly becoming waste. The paint which sticks in this pipe isn't left in the pipe. It is removed by the pushing out utensil (Pig), and it comes to be pushed out of the final process.

Therefore, material loss which becomes final waste in this manufacturing process is little. For example, it is collected, and that powdered dust is recycled, and only a small part is waste though powdered dust appears a little in the mixed process because main raw material is a powdered body.

The purpose of this project is to find out what made the process where the waste of the raw material was hardly lost from the trial. Future development was taken into account by verifying how to be aware of this process (like the amount of material from the viewpoint of cost), it decided to work with the understanding of the MFCA technique.

Furthermore, focus was put on electric power as a new subject in MFCA research, and the amount of electric power consumption of each equipment was measured by the sample. The number of the electric power measurement machine made 1 equipment one time a principle from being limited. The whole of the equipment was covered by measuring it with more than one manufacturing lot, and electric power consumption with 1 manufacture lot of each equipment was measured.

And, it was decided to consider how applications could use the measured amount of electric power consumption as MFCA based on data.

2. Result of this project

(1) Material Flow Cost Accounting Information

The loss of raw material is about 5,000 yen in about 0.14% from the viewpoint of the amount of money as well to understand if the flow cost matrix is seen.

This is about 150,000 yen even if it is made 30 manufacturing lots a year by around 1 manufacturing lot. The improvement point which needed urgent

Flow cost matrix (unit : yen)

	Material cost	System cost	Energy cost	Disposal cost	Total
Product	3,467,205	389,556	13,554	—	3,870,315
Material losses	4,917	1	0	—	4,918
{Recycle}	{154}	—	—	—	{154}
{Disposed}	{4,763}	{1}	{0}	—	{4,764}
Packaging	—	—	—	1,268	1,268
Total	3,472,122	389,557	13,554	1,268	3,876,501

Material loss cost ratio 0.127%（Total material losses/Total products）
0.142%（Material losses/Total material cost)
0.137%（Disposed material losses/Total material cost）

attention could verify that the improvement which reduced material loss when it can be judged that it was attained like the amount of material from the viewpoint of cost as well as in MFCA.

(2) Sample, the measurement of the amount of consumption of electric power in the manufacturing process

The thought is that electric power is measured for every equipment, and a trial is being made at present. However, the subject which hadn't been solved was how that electric power data was measured and being available as environment control account information in MFCA. That measurement value is compared with that, and it is the problem of whether it is suitable to calculate the energy loss though the consumption of electric power and if it can be measured by using the measurement machine. In this project, the power factor was considered as one of the solutions. As for the power factor, it is shown how concerned electric equipment throws electric power effectively toward the function of the electric equipment.

$$Power\ Factor = \frac{\text{The electric power which actually made electric equipment function}}{Voltage \times \text{Electoric current}} \times 100$$

This power factor was calculated by the measurement machine for every equipment. Even though the power factor of 85% was established as standard, the result was lower than was found in the plural as a result.

We decided to make use of it for future loss improvement by totaling the amount of electric power of the electric power loss and a cost on every equipment, with the amount of quantity center as logically calculated:

An injection electric power x (1— the power factor) = Electric power loss.

（Full text (page 72) was co-authored by the Nippon Paint MFCA project members.）

9. IGES KANSAI Research Project: Material Flow Cost Accounting Case Study II : Shionogi

Yoshitsugu Kokuryo

1. Outline of Project

Preparations / Examination to introduce Material Flow Cost Accounting (MFCA) began in July, 2002. Kanegasaki Factory held the first trial. The members of IGES went to this factory at the end of July, 2002 to explain the introductory experiment and to do concrete investigations of the production process. The project was operated by the staff of the Environmental Management Unit from the head office and the Kanegasaki Factory.

The trial product was a drug substance. The trail range intended for a serial production process of drug substance manufacturing, formulating and packaging. The investigation was from importing of materials into a factory to exporting of a product from a factory. Furthermore, sewage processing facilities were included, too. The data of a material flow were based on data of plural batches with a material flow per batch.

A production process consists of next processes. The first is a drug substance manufacturing process for synthesis of drug substance, and the second is a formulating process to mold a so-called tablet or a

granule, and the third is a packaging process wrapping the molded product. A drug substance manufacturing process includes synthesis, extraction, separation and drying. Also there is pelletizing and molding in a formulating process, as well as packaging it in a box, the filling up and packaging in a packaging process. They are set as a quantity center.

A drug substance manufacturing company must prepare to the "manufacturing control standard code" in the "Good Manufacturing Practice (GMP)" from the Ministry of Health, Labour and Welfare in Japan. Mass balance information in a production process is added up and recorded as needed. A master formula of production process is given by Shionogi & Co., Ltd. in more detail. The mass balance of each production process is understood by a material name and the amount of materials of input and output in the master formula. In addition, the mass balance has revised with a change of a production process. In the introduction of MFCA, it was essential to match an output with an original input material.

Data collection was expanded while being based on existing data. Moreover, it was assumed that the present mass balance was reexamined with MFCA. There was only the amount of materials data in the master formula, but, in MFCA, a new Kaizen point was going to be found by understanding the origin of output and its cost evaluation.

Furthermore, it was aimed at dealing with an open question of MFCA technique. In MFCA, it is basic to trace the flow and stock of materials in a company with input materials that are bought from other companies. This point is a characteristic of MFCA. However, it is a problem whether it is appropriate that a production process always recognizes a quality product and material loss as the first input material in a case with a chemical synthesis.

For example, the carbon dioxide is recognized as each input material which included carbon (C) and oxygen (O_2) constituting it in MFCA theoretically when carbon dioxide (CO_2) is exhausted out of a production process. In the case of a chemical synthesis, however, quality product and material loss are different from input material quite materially. It was examined how material costs of a quality product and a material loss should be calculated, and it found one of the solutions.

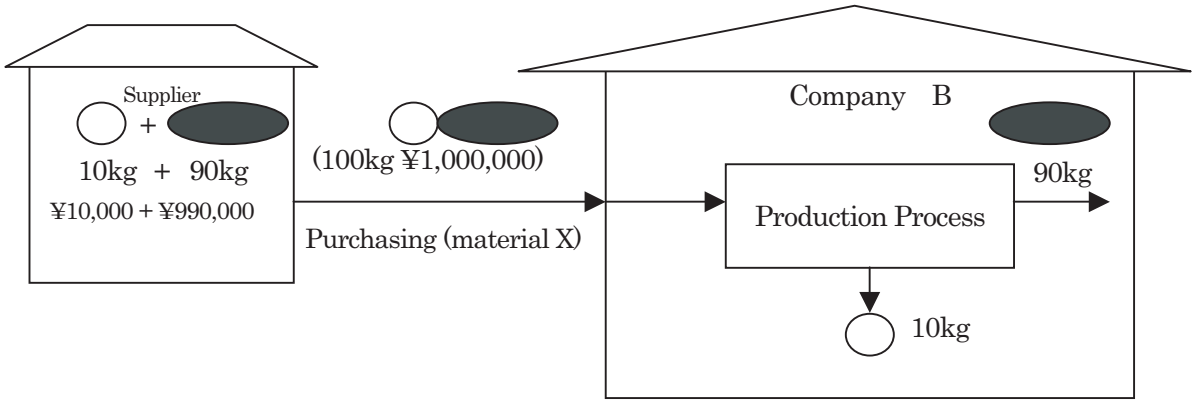
Moreover, it was considered to propose CO_2 emission information as new information of MFCA. CO_2 emission is calculated for each quantity center. An emission amount of CO_2 was measured and evaluated. This information in MFCA is relevant environmental management information to reduce an emission of CO_2 in each quantity center and for the whole company.

2. Project Result

(1) A calculation method of material costs in a chemical synthesis

In Company B in the above example, material X (100kg purchased for 1,000,000 yen) occurs as a quality product 90kg with a material loss 10kg. In this case 1,000,000 yen was distributed basically by the weight ratio, and it was estimated as quality product 900,000 yen / material loss 100,000 yen.

However, the material purchase price is generally decided in consideration of the composition when a chemical industry purchases materials from supplier of raw materials. In the given case, the material "○" serves only as the protector of the material "●", and its actual price is as low as 1,000yen per 1kg.



It is unsuitable to do this with the weight ratio in such a case, and it is appropriate to evaluate material loss "◯" with 10,000 yen per 10kg.

Therefore, all output was recognized as input material in this project, but the costs were evaluated at a purchase price (an estimate) for the composition, instead of principle of the weight ratio, on the basis of thought mentioned above.

In this case, production information of the supplier becomes necessary, as well. In particular, the development of MFCA to supply chain extends the possibility of MFCA.

(2) Material Flow Cost Accounting Information

The standard yield rate and actual yield rate of finished products for each process, (drug substance manufacturing, formulating and packaging), are understood and managed with physical measures. In MFCA, however, the yield rate and the losses could be evaluated obviously with financial measure, and the losses can be reduced into elements and places.

We can find new Kaizen points on the ground of MFCA information.

(Full text (page 81) was co-authored by the Shionogi MFCA project members.)

(unit : thousand\)

		Material Cost	System Cost	Energy Cost	Waste Disposal Cost	Sum
Product		8,867	1,967	200	—	11,034
Material Loss		3,150	373	—	29	3,552
Bd	Recycle	1,416	—	—	—	1,416
Bd	Material Loss (disposal)	1,711	—	—	—	1,711
Bd	Packaging Loss (Disposal)	23	—	—	—	23
Total		12,017	2,340	200	29	14,586

Bd=Breakdown

Material Loss Cost Rate 24.3% (Material Loss Cost per Total Costs)
26.2% (Material Loss Cost per Total Material Cost)
14.4% (Material Cost of disposed Material Loss per Total Material Cost)

2

Keynote Speech

Environmental Accounting for Corporate Management and Environmental Conservation

Katsuhiko Kokubu
Project Leader, IGES Kansai Research Center
Professor, Graduate School of Business Administration, Kobe University

Under the theme of "Cutting Edge of Environmental Accounting for Corporate Management and Environmental Conservation -Environmental Accounting in Japanese Corporate Management and Potentialities of Material Flow Cost Accounting-" this international symposium on environmental accounting will focus on two subjects : one is the actual status of and further issues for Japanese environmental accounting, and the other is material flow cost accounting, which is one of the new major tools for environmental management accounting. Based on these subjects, I will talk about the meaning of environmental accounting in present society and its potentialities, as well as the contents and purpose of today's symposium.

I am very pleased that so many participants have come to the Osaka International Convention Center all the way from Tokyo, Nagoya and many other parts of Japan. I believe the large attendance indicates increasing awareness of the urgency and importance of the theme of this symposium.

To begin with, I would like to briefly explain the environmental accounting practices in Japan and describe what environmental accounting is, although many of you may already know it well.

Environmental Accounting Mechanism

It was a long time ago that the concept of environmental accounting was developed in this country. The study meeting held by the Environment Agency (present Ministry of the Environment) in 1997 was probably the first governmental initiative on environmental accounting. Since then nearly six years have elapsed, many companies have already introduced environmental accounting practices and will further develop and promote the tool.

At this time, however, we need to think anew about what the important functions of environmental accounting are, how it differs from other methods or tools for environmental conservation, and what the distinctive characteristics of environmental accounting are and how we should integrate it into environmental conservation.

I consider that one of the most important functions of environmental accounting to be the integration of environmental conservation and economic activities. If we are to pursue sustainable development while maintaining the current economic system, harmony between the environment and economic activities will be absolutely essential. Such assertions have been made repeatedly on every possible occasion. Even so, we have been significantly slower in developing tools for the integration of environmental and economic activities than in producing tools exclusively for economic development or environmental conservation.

The environment and economy cannot be integrated in essence, without establishing the tools forintegration in companies, which play a central part in the development of the current economic system. In that sense, environmental accounting is one of the tools that integrate environmental and economic activities, and it can be applied to companies, local governments and other organizations. The functions of environmental accounting can be roughly divided into two categories : external environmental accounting, which is designed to disclose information, and internal environmental accounting, which is managed within companies.

In Japan, many initiatives on environmental accounting have mainly been implemented by government agencies. The Ministry of the Environment (MOE) issued Guidelines on Environmental Accounting in 2000 and its revised version in 2002. The MOE's comprehensive guidelines emphasize external disclosure, but at the same time reflect the trend toward internal management. The Ministry of Economy, Trade and Industry (METI) has continued research on internal management-oriented environmental management accounting, and issued the Environmental Management Workbook in 2002. The MOE focuses on external disclosure and also deals with internal management, whereas the METI emphasizes internal management. Overall, the governmental initiatives support the general trend of environmental accounting.

Now, I would like to talk about how environmental accounting is positioned in corporate management. Please take a look at Chart 1. Environmental management tools are categorized into two major types: those applied to companies or production sites and those used for products. The EPE, or Environmental Performance Evaluation, and LCA, or Life Cycle Assessment, are designed to evaluate environmental performance or product-related environmental load. In short, they are tools for recognizing, measuring and evaluating environmental information. The next step would be to reduce the environmental load. The tools for this purpose include EMS, or Environmental Management System, at the company level and DfE, or Design for Environment, at the product level. If a company successfully reduces the environmental load using these methods, the information will be disclosed in the form of an Environmental Report. As for products, environmental labels will be attached to the products as a means of external disclosure. Thus, the environmental management tools are interlinked in a comprehensive manner.

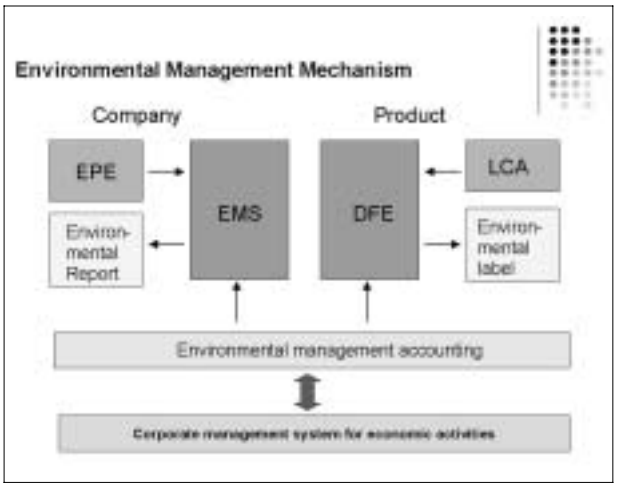


Chart 1

As you can see, a whole system of environmental conservation tools has been established, although the individual tools leave much to be improved. Many of the tools I have explained are standardized in the ISO 14000 series or specified by guidelines, as you know.

Prior to a company introducing this complete set of environmental conservation tools, however, the question lies in the fact that there is no link connecting this system with the corporate management system for economic activities. Therefore, it is not clear for companies how large an effect the introduction of the ISO 14001 system has in terms of corporate management, or whether it is financially viable to introduce DfE and LCA to manufacture products that will lead to a reduced impact on the environment. That is why there have been debates over the effectiveness of LCA.

It is necessary to connect the environmental conservation system and the corporate management system for economic activities. Environmental accounting (including environmental management accounting) precisely serves this purpose. I believe that environmental accounting should function as a link between the two systems. In that sense, environmental accounting is distinguished from ordinary environmental conservation tools, let alone the corporate management system for economic activities.

Another important point is that an environment-conscious corporate management cannot be achieved by companies alone. Companies will promote such management, if their environmental conservation activities lead to cost reductions or are certain to produce a profit. However, as is often the case, environmental conservation activities result in a cost increase.

Unless there is a market mechanism that supports

companies willing to pursue environment-conscious corporate management in place, it is difficult for a company to commit to carry out such management, or at least in a sustained manner. In manufacturing products, the use of non-hazardous substances in place of hazardous ones will increase costs, since non-hazardous substances are priced higher due to their lack of demand. Now, as more and more companies begin to use the material, the cost will eventually be lowered and the products will become profitable. However, companies with short-sighted business philosophies cannot wait that long. Without support from relevant markets, companies, as profit-oriented organizations, cannot easily put such management into practice, even if they are encouraged to do so through slogan campaigns.

Therefore, the markets for goods and services, the labor market, and the financial market should support companies that are addressing environmental issues. For that purpose, companies need to disclose information to these markets, and the stakeholders should make decisions through the markets. In that process, external environmental reporting will play a very important role. These relations are shown in Chart 2.

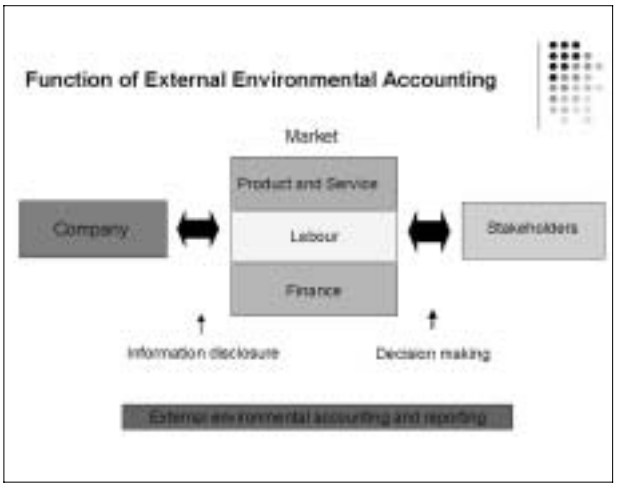


Chart 2

You may think that one element is missing in this chart: where are the citizens or society? Society is outside this chart. Market activities carried out by companies inevitably impose an external burden, or an impact on the environment. To avoid such social loss, the burden should be internalized through the markets. In other words, the external environmental burdens should be absorbed in the market mechanism. To this end, we need to screen environment-conscious companies through the markets to support them. Environmental accounting and reporting are important tools for that purpose.

Actual Status of Japanese Environmental Accounting

Now, I would like to talk about environmental accounting practices in Japan and the relevant issues that companies are currently facing. Although Mr. Miyoshi from the Ministry of the Environment reported earlier that 600 companies have published environmental reports and 500 companies have disclosed environmental accounting information, our survey showed slightly lower figures in both areas. The MOE conducted a questionnaire survey to obtain the data, while we collected and analyzed the environmental reports actually published. In addition, the MOE covered a larger number of subjects by sending questionnaires to all listed companies. That explains the differences.

According to our survey, of the 1,430 listed companies on the first section of the Tokyo Stock Exchange, approximately 20% of them published environmental reports in both 2000 and 2001. If the trend continues, the target of 50% for 2010 will be achieved. Although the rate of companies that disclose environmental accounting information is low overall, the ratio of companies disclosing environmental accounting information to the companies that publish environmental reports is very high. Approximately 80 % of the 318 companies disclose environmental accounting information. Accordingly, if 50% of the listed companies come to publish environmental reports, the rate of companies that disclose environmental accounting information will also reach nearly 50%.

Currently, companies are not required by law to disclose environmental accounting information in their environmental reports. The guidelines issued by the MOE are intended merely for voluntary efforts, that is, companies do not have to comply with them. Our survey revealed, however, that a large number of companies comply with the MOE guidelines and this

number is a sharp rise from figures for fiscal 2000 and 2001.

We surveyed companies that introduced an environmental accounting system to find out what benefits have been brought about by environmental accounting and what issues they are currently facing. The survey was conducted by the IGES Kansai Research Center about a year ago in October 2001 by sending questionnaires to 216 companies that we recognize as a company disclosing environmental accounting information. We received valid answers from 159 companies. It is unusual that more than 70 % of the target companies returned their questionnaires and our figures suggests that the companies are not only cooperative, but also very much interested in the issue.

According to the findings, environmental accounting has two functions: external reporting and internal management. When asked which of them they thought was more important, the largest number of the respondents chose the neutral answer "Same," while more than 40% responded "External reporting much more important" or "External reporting more important," with approximately 20% thinking that internal management was more important. The results show that Japanese companies currently tend to think external reporting is more important.

When asked what benefits were brought about by the introduction of an environmental accounting system, the largest number of the respondents cited "Understanding how much environmental cost was incurred." This is a natural result, given that the primary objective of the environmental accounting guidelines is to assess environmental cost. The second largest number of respondents, or 56%, chose "Improvement of corporate image from disclosure." Since the MOE guidelines set forth external disclosure as one of the objectives of environmental accounting, the fact that the majority of the companies surveyed recognized the benefits of environmental accounting in this regard indicates a certain measure of success.

Meanwhile, only 35.8% cited "Useful for internal environmental management." Our survey revealed that there were some issues to be addressed or room for improvement in terms of internal management.

To clarify why companies did not think environmental accounting was useful for internal environmental management, we asked them what sort of environmental accounting system they employed for internal management. Of them, 42.1% replied that they employed the "Same as environmental accounting for external disclosure," and 28.9% used "Modified environmental accounting for external disclosure." In short, approximately 70% of the companies apply an environmental accounting system for external disclosure to internal management. On the other hand, only 5.7 % responded that they use "Some different sort of environmental accounting from that of external disclosure." There seems to be a problem in this regard.

We can probably take two approaches toward solving this problem. Firstly, we may need more thoroughgoing guidance or instruction to let companies know to what extent and how an environmental accounting system based on the MOE guidelines can be useful for internal management. The MOE is currently conducting study sessions on environmental accounting. Secondly, it is also necessary to simultaneously develop a new environmental accounting tool while using existing ones. Instead of a single tool for environmental accounting, we need to develop various tools for use for different purposes.

Summing up what I have explained so far, I would like to cite the characteristics of Japanese corporate environmental accounting. It is heavily oriented toward external environmental accounting, under the strong influence of the MOE guidelines, and underdeveloped for the function of internal management. Based on these characteristics, we can identify two issues to be addressed. One is how we should refine ongoing external environmental accounting. As far as I know, there is no other country in the world where companies disclose environmental information, particularly on costs, in their environmental reports in such a systematic and comprehensive manner as in Japan. We need to develop this tool, the details of which will be given

by Mr. Sawami from the Ministry of the Environment. The other task is the development of environmental management accounting tools so that environmental accounting will become useful for internal management. Eventually it will be necessary to integrate external environmental accounting and internal environmental management accounting.

Improvement of the MOE guidelines is one of the topics for discussion this morning. Mr. Sawami will be giving a presentation on the efforts of the Ministry of the Environment and we will later discuss the issue. Since the Japanese Institute of Certified Public Accountants also puts great effort into the promotion of disclosure of environmental accounting information, Eriko Nashioka, Research Fellow of the IGES Kansai Research Center, will talk about environmental accounting as an expert in accounting. By successfully addressing these two issues, I believe, we will be able to create movement toward the development of a standard model for international communication. This is considered to be a rather mid- to long-term task.

Further Issues for Environmental Management Accounting

As for environmental management accounting tools, I think, we need to take different approaches. In the afternoon, we will discuss environmental management accounting, focusing on material flow cost accounting as one of such tools.

Environmental management accounting tools can be roughly divided into two types. The first one can be described as "Environmental + Management Accounting." Management accounting has been introduced in companies long before the establishment of environmental accounting. This type of environmental management accounting was developed by modifying conventional management accounting to cope with environmental issues. The second type can be described as "Environmental (Management) Accounting." It includes conventional management accounting in its own database. These are two types of environmental management accounting.

To be more specific, "Environmental + Management Accounting" covers environmental investment appraisal, environmental quality costing, environmental target costing, and environmental corporate performance evaluation. We do not have enough time today to explain each of these items however, they are described in detail in the Environmental Management Workbook published by the Ministry of Economy, Trade and Industry. If you are interested, please pick up a copy of that book for further details.

In the afternoon, rather than dealing with environmentally modified management accounting, we would like to discuss environmental accounting that includes management accounting, or Environment (Management) Accounting. Although it is a new tool, the introduction of this type of environmental accounting will enable a form of management that includes all conventional systems.

One example of such accounting tools is material flow cost accounting, one of the main topics for today's symposium. In the second session, Professor Nakajima and Dr. Wagner, who are leading experts on this field in Japan and Germany, respectively, will explain material flow cost accounting in detail, and we will have discussions following the presentations on findings from the trial introductions in Nippon Paint Co., Ltd. and Shionogi & Co., Ltd. in a collaborative project with IGES Kansai Research Center.

In the United States, researchers led by Dr. Pojasek, have developed a method called Process Mapping, in which the production process is broken up to determine the direction of improvement by focusing on material flow, instead of cost accounting. This method was developed through pollution prevention activities carried out with the assistance of the U.S. Environmental Protection Agency (EPA). Judging from what we discussed yesterday, beyond pollution prevention, this method pursues the improvement of the entire process, and can be regarded as an environmental accounting tool in a broad sense that includes management. We will discuss these two topics in the afternoon.

As I mentioned earlier, we will discuss environmental accounting from two perspectives today. In the morning, presentations will be given on the efforts by the Ministry of the Environment and the Japanese Institute of Certified Public Accountants, and we will discuss the function of external disclosure of environmental accounting. In the afternoon, the discussion will focus on material flow cost accounting with the main objective of exploring potentialities of environmental management accounting.

If we can successfully propose a new tool which integrates these two functions as an outcome of today's symposium, this will have been a very productive and proactive symposium. At this stage, however, it is more likely that the participants will end up presenting the forefront of their respective initiatives and discussing possible interrelations. It is likely that the levels of development of these tools and the status of their introduction in companies will also have relevance.

In recent years, environmental accounting has been attracting increasing attention in Asia. Among other things, material flow cost accounting and pollution prevention methods can be transferred and applied to Asian countries. I would like to add that introduction into small- and medium-sized enterprises will also be a new task.

Although we only have a limited time, I hope we will discuss as many issues as possible today to contribute to the future development of environmental accounting. I would like to conclude my speech by reiterating my appreciation for your participation. Thank you for your kind attention.

3

Environmental Accounting for Environmental Disclosure

Efforts of the Japanese Government -Focus on the Role of the Ministry of the Environment-

Kenji Sawami
Assistant Director, Environment and Economy Division
Environmental Policy Bureau, Ministry of the Environment

Today I would like to introduce the outline of the efforts by the Japanese Government, mainly by the Ministry of the Environment, in promoting environmental accounting.

1. Role of environmental accounting in policy making

i. Transition of environmental issues in Japan

I would first of all like to introduce the background of our efforts in promoting environmental accounting. Environmental issues in Japan can be roughly divided into three phases. The first phase was the high growth period from around 1960 to 1972 when industries served as a source of pollution and Itai-itai disease and Minamata disease became social concerns. The second was the period from 1973 to around 1984, the so-called stable growth period when pollution surfaced as a result of urban-centered life and issues of waste disposal became a major focus for people. The third phase was the period from around 1985 to the present when environmental issues became more complicated and diversified to a global basis and became very difficult to solve. The government looked to deal with these environmental issues throughout these periods by combining various policies.

ii. Role of environmental accounting in policy making

In the first phase, when industry-associated pollution was significant, a direct approach was the main method to regulate specific causative agents. As pollution issues became more complicated and diversified, however, the government changed its policy to take a more comprehensive approach. Waste problems caused by urbanization, for example, started to be dealt with by the set up of a framework. The conventional method to regulate a causative agent individually unavoidably places an extremely large burden on both companies and the government.

More recently, economic approaches such as an introduction of an environmental tax and green purchasing have also been incorporated. The government is currently coping with environmental issues based on a concept of the best policy mix, a mixture of various kinds of policies to create the most effective measures to protect the environment. Voluntary cooperation by all parties will serve as one of the most important factors in obtaining the best policy mix.

Since voluntary actions by companies and other organizations help improve their own social behavior, I believe that they are very effective in coping with current environmental issues that are complicated, diversified and widely spread. Some companies may wonder what is included in voluntary cooperation. We have therefore been developing procedures to support and promote their environmental activities as well as measures that facilitate their environmental information disclosure, which we call the "information approach."

The information approach helps all stakeholders to evaluate companies and their products, allowing them to make the right selection. As a result, a company's environmental awareness is expected to rise. Product-based measures for information disclosure include environmental labeling and life cycle assessment. As a company-initiated activity, we are encouraging them

to adopt systems of environmental reporting, environmental accounting and environmental performance indicators. The government is introducing a package of measures for environmental accounting, which is a mixture of other relevant measures.

First of all, companies must improve their environmental management system. To assess the environmental burden, which serves as an index for inner management, an environmental performance indicator should be selected. We are revising the guidelines for environmental performance indicators and seeking public comments.

After selecting an environmental issue and an indicator to explain it, companies collect and analyze data. This data can be used for self-evaluation within the company as well as for disclosing their environmental information by presenting them in their environmental report. Environmental accounting has been developed as a measure that connects financial accounting and environmental issues from the standpoint of cost.

There are two basic functions for environmental accounting: internal and external functions. Internal functions serve as a useful tool for corporate management, where internal staff including both the management and employees will be the receivers of information. Environmental accounting for external use serves as a tool to promote communication with local communities. Through communication, a company may gain a community's trust in its environmental protection activities, allows the community to evaluate its activities, or fulfill accountability. In Japan, an emphasis has been placed on this external function to promote communication with communities. The Ministry of the Environment considers that well-balanced development of internal and external functions is important.

2. Measures taken by the government and other organizations

i. Current prevalence of environmental accounting

Our data concerning environmental accounting is based on information collected from companies listed on the first and second sections, as well as non-listed companies with 500 employees or more. According to the most recent data, there are 367 companies that publish their environmental accounting information. If those who adopt an environmental accounting system for internal use are included, the number rises to 491. In addition, there are 580 companies that are considering adopting such a system within the next few years. Thus, the total number of companies adopting a system of environmental accounting is therefore expected to soon reach 1,000.

ii. Governmental policy to promote environmental accounting

I believe a wide adoption of environmental accounting would not have been possible without the support of the government. The fact that we have contributed to promoting environmental accounting in this way is the source of our pride. In the government's Basic Environment Plan, 3-year plan for regulatory reform promotion, and White Paper on the Environment, the governmental policy to further promote environmental accounting is emphasized, showing its intention to provide continuous support that facilitates a company's efforts.

Let me introduce some of the governmental measures. The Ministry of the Environment has developed and published guidelines which have been widely used. While these guidelines are designed for companies that use an environmental accounting system as a tool for sharing their information externally, we continue to do research in cooperation with companies and certified public accountants to make them available for internal use. In addition, the Ministry of Agriculture, Forestry and Fisheries has published manuals for food industries and the Ministry of Economy, Trade and Industry has provided results of studies on methods for the internal use of environmental accounting systems. Associate Professor Nakajima and Professor Kokubu have been the main people conducting these studies.

Chart-1 shows a list of materials published by the government and government agencies. There are also some efforts in the private sector to disclose their

research results.

Chart-1

iii. Development of the environmental accounting guideline

Next, I would like to talk about how the comprehensive environmental accounting guideline has been established by the Ministry of the Environment. The initial consideration was made around 1998, when the term "environmental accounting" was not yet widely known in Japan. The first guideline was published in 2000 and its revised version in 2002. Over the years, we have organized corporate management workshops for leading companies in Japan and conducted joint research with the Japanese Institute of Certified Public Accountants. Through these efforts, we have collected opinions from a wide range of business people and experts and have continued our efforts in seeking improvements.

The framework of environmental accounting presented in the Ministry of the Environment guidelines consists of two parts: financial performance, which can be measured in currency units, and environmental performance, which can be measured in quantity units. This framework is designed to recognize, measure and convey performances as quantitatively as possible. It is unique to put the emphasis not only on cost, but also on cost performance based on the comprehensive understanding of environmental conservation costs as quantity and economic benefits based on currency units.

We also provide a format which has been designed to be used for external information disclosure. As mentioned above, the framework provided by the government is a combination of the internal function, which is supposed to be used within companies and the external function, which is meant to be used when companies make their information public. This feature has helped develop environmental accounting in Japan.

3. Issues to be considered in the future

i. Transition in corporate sustainable development management

According to the White Paper on the Environment, the quality of corporate sustainable development management has been changing, as shown in Chart-2.

Chart-2

More changes are expected in the future. At which exact point in time of the development we are currently experiencing may differ from case to case. One thing that is commonly recognized is public awareness of environmental issues has rapidly increased since the 90s.

Let me give you an example with ISO14001. The number of work places in Japan with ISO14001 certification has started rapidly increasing after 1996 and now exceeds 10,000, the only country in the world with this number of certified work places. In the latter half of the 90s, the number of environmental reports issued also started gradually increasing. During the same period, some companies newly adopted an environmental accounting system. In the following years, corporate efforts to seek better environmental efficiency has been promoted since such efforts would

reflect well on the company's business decision-making and would be easier for those outside the company to evaluate.

Some say that the Japanese financial market does not respond well to corporate efforts in sustainable development management. However, some environmentally conscious investment trusts have recently been introduced. In Europe and North America, Socially Responsible Investment (SRI) has become popular. These newly introduced investing methods have made the evaluation of companies more diverse than ever before. In the midst of such diversification, disclosure of environmental information has still remained essential in corporate evaluation. I believe that a time will come in the future when companies and products will be selected by ordinary consumers based on the company's environmental consciousness.

ii. Issues to be considered ingovernmental policy

There are three major issues in governmental environmental policies: further promotion, improvement of comparability and improvement of credibility. The 3-year plan for regulatory reform promotion points out these three issues concern not only environmental accounting but also environmental reporting that incorporates environmental performance indicators. To cope with these issues, the Ministry of the Environment is now considering establishing a voluntary registration system of environmental reporting by companies.

iii. Harmonization with international trends

Next, I would like to talk about harmonization with international trends. Expert working group meetings of the United Nations Division for Sustainable Development (UNDSD) has been studying a system similar to the Material Flow Cost Accounting system. They have published a workbook based on the results of the study and the Ministry of the Environment has sent its officials to expert working group meetings to contribute to the study. The Japanese edition of the workbook is soon to be published. The Ministry is considering making use of the study results internally. Professor Kokubu and Professor Wagner have also participated in the expert meetings.

We think that Japan should be responsible for promoting environmental accounting in other parts of Asia. In September 2001, the Environmental Management Accounting Network-Asia Pacific (EMAN-AP) was created with the IGES Kansai Research Center serving as the coordinating office. In cooperation with the Network and other organizations, we are now promoting environmental accounting in the Asia Pacific Region. Korea and Australia are also joining these promotional activities. Having heard that many studies on environmental accounting have recently been performed in Korea and China, we hope that they would further deepen their understanding of Japanese approaches as well.

Regardless of the current situation, environmental accounting is still developing. Compared with conventional financial accounting, it is very difficult to set a strict standard and elaborate on an evaluation method. However, while always in consideration of harmonizing with international trends, we would like to further promote environmental accounting.

Efforts of the Japanese Institute of Certified Public Accountants (JICPA)

Eriko Nashioka
Research Fellow, IGES Kansai Research Center／Certified Public Accountant

I wish to take this opportunity to present you the research result on environmental accounting conducted by the Japanese Institute of Certified Public Accountants (JICPA), an effort that is little known in comparison to the initiatives being taken by the Ministry of the Environment and other offices of the Japanese government.

1. Environment-related Activities of the JICPA

Please allow me to first explain a little more about the Japanese Institute of Certified Public Accountants. All certified public accountants in Japan are required by law to become a member of the Institute. The Institute has several research study groups that carry out survey research, with the Management Research Study Group being in charge of issues related to the environment. The research study group consists of three groups currently doing research: the Environmental Accounting Research Group, the Environmental Audit Research Group, and the Emission Trading Research Group.

JICPA's Management Research Study Group was established in 1987, and in 1993 the Environmental Audit Subcommittee, the predecessor to the three research groups, was established. The Subcommittee became a Working Group in 1995 and was expanded to form a Research Group in 1998, as the number of constituent members rose. When guidelines from the Ministry of the Environment (MoE) came out in 1999, the research group was split into one section for environmental accounting and another for environmental auditing, and more members joined. The Emission Trading Research Group was newly established in 2002. The research results from these groups are made public as research reports. The Emission Trading Research Group was formed only recently, so it has not yet produced any reports, but the other two groups have released several reports of their findings. The Environmental Audit Research Group has produced several research reports on the issue concerning the assurance of environmental reports, including "Current Situation and Issues in Environmental Reports Assurance." "Toward the Establishment of an Environmental Accounting System" was published by the Environmental Accounting Research Group in November 2002, which addresses the focal issue of this presentation.

2. Concept of "Toward the Establishment of an Environmental Accounting System"

(1) Background for the Concept

I shall now explain the research report entitled " Toward the Establishment of an Environmental Accounting System." The full text in Japanese has been provided for more details.

First, JICPA proposes the use of a new term (and concept) "environmental accounting statement." Conventional environmental accounting provides no detailed criteria for the creation of reports or the disclosure of information, so it has all been based on voluntary corporate efforts, with an emphasis placed on free expression. However, as Mr. Sawami described earlier, we now have a thousand companies in Japan producing environmental reports, and as Professor Kokubu pointed out, most of those companies that are introducing environmental accounting now place

too much emphasis on independent expression, raising the concern that the reports they produce will be largely unusable as externally reviewable accounting. We therefore felt it necessary to take a new look at environmental accounting as a system of accounting and build a new system. The environmental accounting statement is part of this new concept that we are proposing.

(2) Corporate Evaluation in Terms of Environmental Conservation

In regards to environmental issues and the role of the JICPA, I feel there is a need for accountants, who are professionals in the field of accounting, to become engaged in environmental conservation efforts in accounting. Conventional financial accounting provides information to the market that indicates a company's business performance, financial condition, and cash flow-basic information necessary for proper corporate evaluation. This existing data does not, however, provide any basis for corporate evaluation in terms of environmental conservation. That is where environmental accounting comes in.

Environmental conservation activities are voluntary corporate efforts, and incorporating them into management is known as "environmental management" or "corporate sustainable management." Corporate management is sustainable when a company gives ultimate consideration to conserving the environment in order to help establish a sustainable society through its business activities. Societal mechanisms need to be established that enable corporations to implement sustainable management, thereby contributing to a sustainable society and becoming sustainable themselves. A social trend is now emerging that calls for corporate evaluation based on corporate sustainable management. Corporations and society as a whole are starting to work together in regard to the environment. Social investment and eco funds are just getting started in Japan, and while the trend is still quite small it will surely grow stronger over time.

(3) Role of Environmental Accounting in the Evaluation of Environmental Performance

How we measure environmental performance is a big isuue. At present, the Nikkei Shimbun has performed several corporate sustainable management evaluations using its own environmental performance surveys and other techniques. Most of this was done through questionnaires designed by the newspaper company itself. The results of any questionnaire will vary depending on how the answers are given and the style of expression. Differences in how questions are interpreted and other discrepancies can also change the evaluation of a corporation. All of these things bring the issue of consistency.

We therefore considered the conditions for a proper evaluation of corporate sustainable management in terms of the information that must be provided as a requisite for evaluation. We came up with the following two points. One is the establishment of standards generally accepted as fair and appropriate, and the other is the assurance of the reliability of the information to be used for evaluation.

Environmental accounting has a role to play here. Environmental accounting information should form the core of the information used to evaluate a corporation's sustainable management. Having different evaluative bodies conduct independent questionnaires incurs a social cost-it is an enormous waste of time and money. Even without independent questionnaires, if you make sure you obtain all the basic data and evaluate the data, interviews can always be conducted later as an easy way to obtain independent evaluation. We think that the basic data should be the information obtained through environmental accounting.

(4) Environmental Accounting: The Way to Proceed

Looking at current environmental accounting practices closely, you will soon find the lack of information. Two facing pages of an environmental report do not provide enough analytical and complete information of a corporation. Also, due to the absence of detailed environmental accounting criteria for the creation of reports or the information disclosure, companies have included different kinds of information under the same account headings, according to their own criteria. Concerns also remain as to what items should be

included and how things are defined and classified.

For this reason there is a movement in environmental accounting that aims to standardize the criteria, starting with examples common to a large number of corporations, such as current environmental conservation costs, etc. There are still many areas that are not so easily standardized, particularly in environmental conservation effects and environmental indicators. For these matters, corporate ideas created in the past years will be taken into account.

(5) Concept of the Environmental Accounting System

Under such circumstances we have taken the first step of proposing an environmental accounting system. The basic concept is to establish a system based on statements to provide more comprehensive environmental accounting information for the evaluation of corporate sustainable management, encompassing the current environmental accounting guidelines.

This system would not contravene the environmental accounting guidelines from MoE that are being widely adopted, but would subsume them into an even broader concept. Moreover, a statement system presupposes having an environmental accounting system made up of multiple reports containing a variety of environmental information.

The environmental accounting system being studied by the Institute is limited to external reports only, which further requires that the target audience be identified to determine the information that needs to be included. So we narrowed the field of readers. Instead of aiming to make the information accessible to just anyone, we focused on making it readily understandable for people who need the information.

In other words, once detailed information that can stand up to analysis is disclosed, numerical processing makes it possible to read the information in a variety of ways and enables comparisons of corporations in the same industry and the same corporation over time, things that are said to be extremely difficult to assure at present. To make this possible, it will require the clarification of numerical calculation criteria and a standardized form of disclosure.

(6) Environmental Accounting System in Detail

The specific content of the environmental accounting system is still under review at the present. Let me give you an example of the kind of things we are reviewing. Basically the system must include information in terms of both currency and quantity units, as well as the flow and stock information for each. An example of the flow information measured in currency is environmental conservation cost, which is covered under public environmental accounting based on the current MoE guidelines. Examples of flow information would include PRTR information and material flow cost accounting information, which is the theme for the 2nd session in this afternoon.

The concept of environmental assets and liabilities falls under stock information measured in monetary units, while soil pollution falls under stock information measured in quantity units. By linking, for example, the quantitative data for greenhouses gases with the financial data of energy costs and emissions trading through accounting methods, the data is no longer disparate and disjointed, but can be analyzed in a number of ways. In addition to this, a significant accounting policy (a term used in financial accounting) must also be disclosed. This entails the calculation criteria for the main data, and other information that is requisite for users to correctly understand the data.

In terms of the relationship between the environmental accounting system and environmental reports, the information on environmental accounting is an important part of the environmental report, and I believe it can also be treated separately and used as an independent system.

3. Requirements for Corporate Evaluation

Earlier I mentioned the establishment of standards and the assurance of reliability as the two conditions for evaluating corporate sustainable management. The first condition-the establishment of standards- is generally

based on comparing differences, but exactly what is to be compared is not specified, and they are highly arbitrary. The measuring criteria listed in the current MoE guidelines are just such an example. These standards need to be established urgently.

The other condition, assurance of the reliability of information, usually, the person with primary responsibility for creating the environmental accounting report is the corporate manager. Therefore, the corporate manager first must declare that the report is sufficiently reliable. Next, you need to have a mechanism by which to verify the reliability of the information, such as an internally controlled system within the company for producing the information, and you need to verify that the system is working effectively. Based on this, you then need to have verification by an external third party. This is currently being carried out, but still there is a lot of disparity and disjointedness in the process, and at JICPA we are still investigating this issue within the Environmental Audit Research Group. Nonetheless, I feel that we must raise the standards of verification (assurance) by an external third party if we intend to increase the reliability of information.

4. Future Issues

Please be reminded that this research report is only an interim report, proposing conceptual framework of an environmental accounting statement. The issue of what kind of accounting statement should be included in the accounting system is still on the table, along with many other issues. The important things are to stay focused on building the kind of system that is required, keeping a lookout for signs of progress in actual business practices, and to continue resolving specific problems.

Today I first pointed out the conditions for a proper evaluation of corporate sustainable management and then proposed an environmental accounting system to provide better information for such evaluation. As this is only an interim report, we plan to issue further reports. That concludes my summary explanation of environmental accounting from the accounting point of view.

Thank you very much.

4

Environmental Management Accounting for Better Eco-Efficiency

- Close Look at Material Flow Cost Accounting -

Introducing Material Flow Cost Accounting for Environmental Management Accounting System

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The Kansai Research Center of the Institute for Global Environmental Strategies (IGES) carried out a Material Flow Cost Accounting (MFCA) trial project in the 2002 fiscal year. This symposium intends to make a presentation of the results of that project and discuss MFCA from a global perspective under the title of Session 2, "Environmental Management Accounting for Better Eco-Efficiency - Close Look at Material Flow Cost Accounting-". Prof. B. Wagner from the University of Augsburg, Germany and Prof. R. B. Pojasek from Harvard University, the United States of America, will present their experiences as well as techniques on MFCA, which is globally studied and employed. Researchers from the USA, Germany and Japan (including corporate participants) will have opportunities to exchange their views with each other on their findings. Thus the symposium offers valuable opportunities for academic interaction as well as further international exchanges.

Allow me to outline the relationship between MFCA[1)] and the two professors. Prof. Wagner, the founder of the Institut fuer Management und Umwelt (IMU), invented the MFCA that is used in Japan. Prof. Pojasek developed the "Systems Approach", a major tool used for "An Organizational Guide to Pollution Prevention, EPA/625/R-1/003, August 2001" issued by the U.S. Environmental Protection Agency. His Systems Approach is similar to Prof. Wagner's approach in that it also emphasizes material flow in the production process for its improvement through the application of process mapping.

The three countries studying MFCA have one thing in common: we conduct research by applying MFCA to corporate activities in each country, as represented by Nippon Paint Co., Ltd. and Shionogi & Co., Ltd., who will present the results of their trial project. These projects have been conducted with collaboration between the business organizations and researchers (the research organization). This is unique and socially valuable in that business and research people are working on the same projects from the same perspective and on the same stance.

Now let me explain the point of view from which we will discuss MFCA. Japanese companies often use the term "environmental management", though they do not always present a clear definition of it. This is because they are not sure what they should do. They translate the term in any way they like; whatever they do, they can call it "environmental management". Therefore, before starting the discussion, allow me to define "environmental management" as the management that will maximize corporate profit while reducing environmental impact. Environmental management accounting is essential in the environmental management in order to reduce environmental impact in concrete terms and at the same time improve corporate profit. Environmental management accounting should be recognized as a tool to attain this goal. It is important to support management decision-making in terms of the environmental management by using this tool.

I would like to point out one important thing. The day before this symposium, a closed workshop was

1) Prof.Pojasek's Systems Approach is not quite same as MFCA, but in this symposium his approach is recognized as a sort of MFCA.

held where we exchanged our views with Profs. Wagner and Pojasek. We discussed how to translate the Japanese term "kankyo keiei" into English. If it is translated as "environmental management", it may be understood in English as being limited to the-end-of the pipe environmental management - for example, the environmental management of waste treatment. This is not what "kankyo keiei" means in Japanese. It was proposed that "corporate environmental management" or "sustainable management" would be a more appropriate translation.

In this way we are going forward while forming a common understanding and language. Unlike the definition of environmental management, the subjects of this symposium, that is, Material Flow or Material Flow Cost Accounting is universally recognized. The international community is interested in material flow management. Based on material flow management, a wide range of environmental management accounting information is offered and a variety of environmental management accounting tools has been developed in some countries. Among a number of tools, MFCA developed by IMU, founded by Prof. Wagner and the Systems Approach proposed by Prof. Pojasek are the most effective and practical tools.

Material flow management, the origin of the two approaches, emphasizes mass balance in the process of a company. Generally we focus on mass balance consisting of input and output to and from a company, when we review environmental impact. According to Profs. Wagner and Pojasek, we should look into the entire process, not the-end-of-the-pipe, to identify and get rid of the causes of environmental burden. More precisely speaking, mass balance is not necessarily applied to the process; however, both their theories focus on the analysis of process. Another element they have in common is that they analyze materials within a company. Most of the materials in the company are defined as raw materials or calculated as raw material costs in management accounting, particularly in cost accounting. In this sense, the biggest difference between MFCA and cost accounting is that while the former reflects the data of every physical material, the latter reflects the data of "most of the materials".

In material flow management, material physical data in terms of environmental information is integrated with cost information (economic information) and evaluated based on the physical data. Thus MFCA offers a new set of information - different from conventional cost accounting - relevant for decision-making. Profs. Pojasek and Wagner as well as the two Japanese companies will explain this new type of information and perspective in their presentation about their case studies. Specifically, Prof. Wagner will talk about MFCA developed by IMU in Germany. Prof. Pojasek will illustrate his Systems Approach using case studies in North America. The Japanese companies will explain the MFCA trial projects conducted in collaboration with IGES.

The IMU's MFCA can be described as the origin for MFCA applied in Japan. The term "origin" means that the MFCA applied in Japan is not a copy of the IMU's MFCA. We learned the basic concept of the German MFCA and modified it to the Japanese way. Therefore, the IMU's MFCA and the Japanese MFCA are not identical. The original MFCA was transformed to the Japanese MFCA in the process of application.

Systems Approach proposed by Prof. Pojasek is a little different in its approach. His tool also monitors the material and operation flow in the production process and the company, but as the name indicates, it uses several kinds of software to systematically archive it; it uses MS-Visio to make a process map and list the data on a database with MS-Excel or MS-Word. A folder is made at each point in the process : the folder is designated as an archive of the data for that point: the data and documents are systematically made into database for the whole process. As this demo software works on MS-Windows, it offers very illustrative and comprehensible data as well as a broad overview of the entire process. According to Prof. Pojasek, a flow chart similar to the one used by MFCA can be easily produced by inputting the data step by step on MS-Visio.

Although their approaches are a little different, the IMU's MFCA and Prof. Pojasek's Systems Approach are similar in that both of them intend to find the

waste of materials for the improvement of the production process. In spite of their differences, both produce similar maps and the attached data is also expected to have little difference. Even if some variation exists in the results, it could come from the different approaches that were employed to attain the same goal, which intends to elicit material flow in the process. It may be possible that the two approaches are not mutually exclusive: they may even be complementary. This is because quantitative data is physically constant even if it is affected by the measurement range or level. Although they employ different cost evaluation methods (differences originating in different definitions and procedures), it seems that the Systems Approach does not rule out other cost evaluation methods and thus it can include MFCA's cost evaluation method as well.

Now the development of MFCA in Japan is shown briefly. A committee, whose activities were limited to three years, was established in 1999 to develop environmental management accounting tools as one of the Millennium Projects commissioned by the Ministry of Economy, Trade and Industry(METI).[2] A total of five working groups were set up under the committee : one of them was for the research of MFCA (chairman : Prof.Nakajima). As far as I know this was the first project introducing MFCA to business entities.

IGES Kansai Research Center in cooperation with Nippon Paint Co., Ltd. and Shionogi & Co., Ltd. conducted the second such project in fiscal 2002. Each case study will be presented in the following section. We can see some differences in these two projects. The METI's project seems to place more emphasis on contribution to the improvement of profit or reduction of costs than the reduction of environmental impact, though the goal of MFCA was set to both improve profit and reduce environmental impact. On the other hand, IGES aimed to reevaluate the benefit of MFCA as an environmental management accounting tool with an emphasis on cutting back on environmental impact and a validation of that effect.

As a result of the IGES project, it has been reconfirmed that MFCA is capable of analyzing the current status of a company just like a CT (computed tomography) scanner. With MFCA, we can observe the inside of a company and examine its health. As Prof. Wagner says, MFCA provides a company with a mirror to look at itself.

Whether it is likened to a CT scanner or mirror, the implication is the same. Let me expand the professor's analogy. A mirror reflects your appearance or how you appear to someone else, offering you a strong motive to change yourself. However, compared with a CT scanner, it gives you less information. A CT scanner offers you cross-section images of the insides of your body. Even if you look healthy, the scanner can show what is wrong with you internally. The scanner, however, cannot automatically identify the abnormality. It is a doctor (management) that decides what is normal and what is abnormal. MFCA is a useful tool for people and organizations to justify change. Prof. Wagner shares with us the experiences and potentiality of changing companies.

The process can be improved and changed by using a mirror and CT scanner. Therefore new communication opportunities will arise among corporate staff in analyzing the process. MFCA contributes not only to the reduction of costs and environmental burden but also the creation of a new corporate culture that emphasizes communication. Then we can easily imagine the necessity to introduce MFCA to the supply chain and the magnitude of the effect gained from it.

In the course of developing MFCA in Japan, the triangle consisting of theory building, methodology development and corporate-level validation has been established. Theory interacting with methodology is applied to business activities. The results are fed back to the theory and methodology for further development of MFCA. I propose that we look at the presentations by the two professors and Japanese companies from this aspect: we will learn specific results and values for MFCA, which has been successfully used as a

2) The Ministry of Economy, Trade and Industry established and commissioned to the Japan Environmental Management Association for Industry a three-year project under the theme of "Research on Environmental Business Development and Promotion: Establishm ent of Environmental Management Accounting Tools", which was completed at the end of March 2002. The Ministry made public the results in its own name in the Workbook of Environmental Management Accounting (2002) in Japanese.

business tool for environmental management accounting.

This symposium may motivate some companies to use MFCA. Business management should have a global or an international perspective beyond the company itself. Environmental issues call for international/global attention. Through international communication like this symposium, we, as a member of the global community, are able to further explore environmental management as sustainable management.

The reality in Japan's business community is that the environment is treated as a special addition to business management. Some environmentally conscious companies use the term "environmental management as sustainable management" and address environmental issues by reanalyzing and restructuring their businesses and identifying a variety of issues from a new point of view. However, the environment is still treated as something special in their system. It has now become necessary to build up the (environmental) management framework where environmental activities are included as a normal management factor rather than something special.

Let me cite what one environmentally advanced company said: currently the environmental department is an independent unit in the company, but when we have achieved the goal of our environmental management, that environmental unit would be no longer necessary. This does not mean that the company will lose interest in the environment. It means environmental efforts will simply be blended in with management factors.

The enhancement of profit and reduction of the impact on the environment may be difficult to combine, but that compatibility is demanded today. It is very important to manage business with an environmental management accounting tool such as MFCA in order to achieve these ends. It is very meaningful and creative to share and discuss the experiences of Japan, Germany and the USA.

Developments of Material Flow Cost Accounting in Germany

Bernd Wagner
University of Augsburg, Germany

Thank you very much for the invitation giving me a chance to present to you some of the ideas and experiences with Material Flow Cost Accounting (MFCA) in Germany. I will first go back to where MFCA comes from, back to its roots. Then I will present some ideas on present trends and developments - what we are currently doing in Germany - and finally we will have a brief look into the future. (Chart 1)

Chart 1

1. The Roots of MFCA

In some of these ideas I am presenting today, you will find similarities to developments in Japan. We, probably as well as you, started with environmental protection measures: the classical approach to environmental management. (Chart 2) This approach is technology driven and mainly compliance oriented. In the last few years we have emphasized environmental management systems like ISO14001 and the European scheme EMAS, which you are probably familiar with.

Environmental Management Systems

These systems emphasize organizational methods

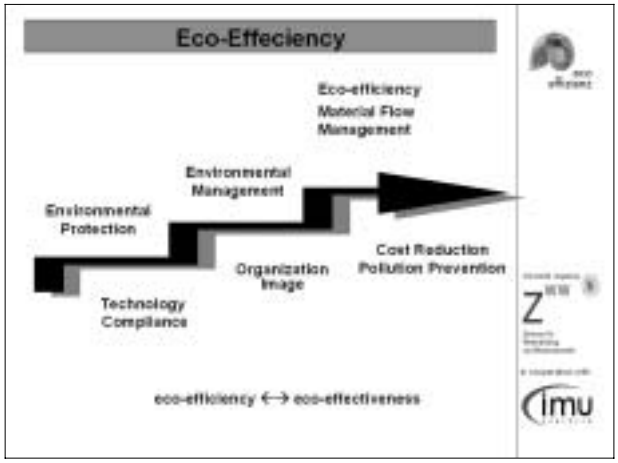


Chart 2

and approaches. They concentrate on improving the company's image, and they do this by reporting to the outside world. But recently, we have gone one step further with the concepts of eco-efficiency and material flow management. These concepts go beyond technology, compliance and organization, combining the objectives of cost reduction and pollution prevention. This is the main idea targeted with material flow management. (Chart 3) This international chart gives you an impression of the development of ISO14001. You might recognize on the very left side that Japanese companies are the worldwide leaders in the number of ISO14001 certifications. You will also find the European scheme EMAS in the upper right corner. EMAS meaning: "Environmental Management and Audit Scheme". The total number of EMAS participants is not as high as the number of ISO14001 certifications shown below. One will find the greatest number of EMAS certificates in Germany, but Germans are also strong in ISO 14001. So, if they are both added up, Germany comes closer to the Japanese level. Lately, we have observed the number of ISO

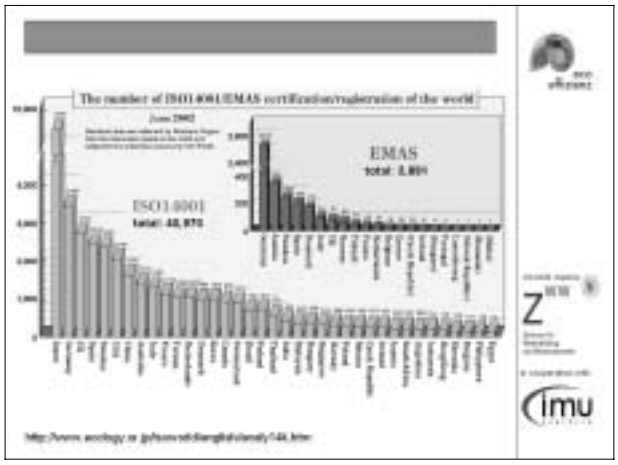


Chart 3

certifications increasing worldwide while the European standard remains at its present levels.

Environmental Costs

Now back to the topic of MFCA. When we start talking about "environmental costs", we have to make sure that we talk about the same notion. Many people use the same term "environmental costs" but many of them talk about different things. For example: talking about environmental costs, many people mean social costs, damage to the environment (Chart 4-1). Now in the business world, people talking about environmental costs, quite often mean end of the pipe costs for environmental protection, expenditures for environmental technology etc. (Chart 4-2). Others also include the costs for integrated environmental protection measures (Chart 4-3), not only end of the pipe costs. Others include costs of waste, some at the point of disposal, meaning disposal fees; others also include the handling, maybe even the purchasing

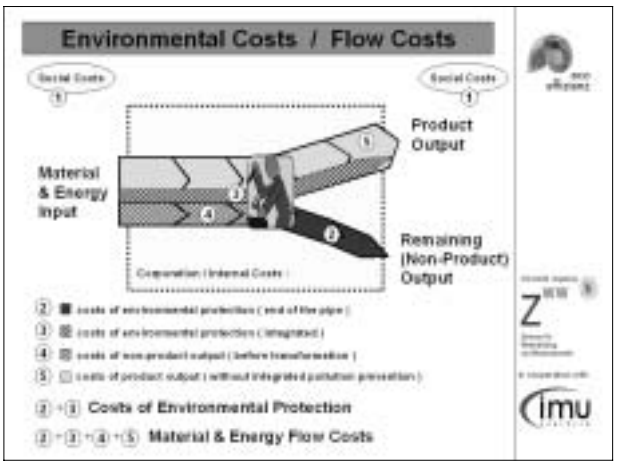


Chart 4

prize of disposed material (Chart 4-4). When we look at flow cost accounting, we talk about all of these cost types (Chart 4-2,3,4,5). But we make sure to explain which one of the various types we mean. One has to make sure when talking about "environmental costs" to talk about the same subject. Within Material Flow Cost Accounting we consider the whole process from input to output and therefore all types of costs 2 to 5 (excluding social costs) may be calculated.

To make the importance of this point more clear: In Germany we have a law requiring companies to report on their "environmental costs". The law talks about "environmental cost accounting" but more precisely it means investments and expenditures for end of the pipe environmental protection technologies. The problem now is that different companies report on different types of cost, all relying on their individual definitions, and thus developing their own reporting systems. And we face another problem with this information; the expenditures for the environment can be very high. We have German chemical companies that invest several millions of Euro in waste treatment, water treatment, filtering emissions etc.. The higher the figure for these "environmental costs", the more likely the company management will say: "Well, this is too much money spent for environmental management. We have to cut down on this". So this turns against environmental protection. Counterproductively, it will lead to the reduction of environmental protection expenditures. Or management will say, "Germany is too expensive, we have to go somewhere else because the law is too strict."

If one wants to enforce environmental protection and motivate management to reduce environmental burdens one has to look at all types of environmental costs in the whole process, not only at the end pf the process.

Approaches to Environmental Accounting

Today, we find various approaches to achieve a higher level of transparency and control of environmentally relevant material flows in physical amounts and monetary values or costs. Some of them were already mentioned by Professor Kokubu. I will just name a few more. (Chart 5)

We find eco-balance, we talk about environmental

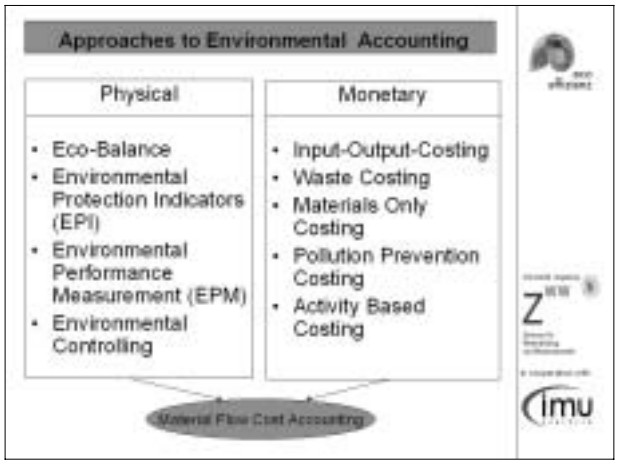


Chart 5

Chart 6

protection indicators (EPI), environmental performance measurement (EPM), environmental controlling and so forth. These terms will be familiar to most of you. They usually all show the same approach: They measure environmental matters, material flows, in physical terms, in kilograms or kilowatt /hours. Only lately have we tried to transfer this information also into monetary terms in order to meet the language and logic of the company's decision makers. This means today we are concerned about input-output-costing, waste costing, material-only-costing, approaches presently used in the United States, pollution prevention costing, which I mentioned before, or activity based costing. I will not go into any detail of these approaches. I just wanted to give a brief overview to the approaches and the vocabulary that is presently used in this field.

So, this was where the development to Material Flow Cost Accounting came from.

2. Present Trends and Developments

International Trends in Environmental Cost Accounting (ECA)

I now want to point out some recent international trends and developments of Environmental Cost Accounting in general (Chart 6) and its relationship to environmental management (Chart-7,8).

＊In Germany, we find a new standard, an industrial standard, called VDI 3800, asking for environmental cost accounting, standardizing terms and procedures. (Chart 6)

＊We find the above-mentioned law on corporate reporting of environmental costs. But this law quite often works counterproductively, as I mentioned before: Companies are able to show to the public that they have invested a lot of money in environmental protection, but it does not motivate them to do more for environmental purposes.

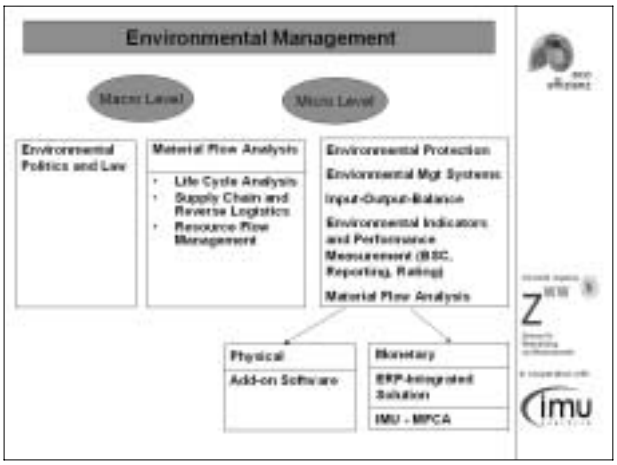
＊Then we have various programs by ministries and by academic associations and so forth.

＊Other approaches have been mentioned, there are quite a number of projects running in the United States. You will probably know more than I do about endeavors in Japan. And there are some global activities sponsored by international bodies that have been already mentioned, meaning also that the matter has been discussed worldwide.

Environmental Management and ECA

In general when we talk about environmental management, we must consider various levels. Chart 7 shows that in Germany you will find similar approaches to Environmental Management, like in Japan. We must distinguish between a macro level and a micro level. On the macro level, political programs and some laws concerning environmental management and protection are found. On the micro level, the company level, instruments and concepts are in practice that are familiar to Japanese companies too: technology oriented end of the pipe environmental protection measures, environmental management systems and environmental indicators. Recently, these instruments also cover the environmentally oriented use of the balance score card, of various new reporting procedures (e.g. via the company's website), lately going into corporate rating too, and finally into Material Flow

Analysis, Material Flow Accounting and Material Flow Management.



Char 7

Some of the recent instruments also might serve as links between the macro and the micro level. For example: Life Cycle Analysis, Supply Chain and Resource Flow Management usually start from a company's point of view but extend to a national or even global perspective.

Back to the micro level, where we find Material Flow Analysis: here again one might distinguish, as mentioned above, between physical and monetary approaches. We have a number of companies doing just the physical part of the material flow analysis (e.g. starting with an input-output balance), resulting in a classic environmental statement. But more and more companies now continue to accompany the physical analysis with the monetary one: translating physical terms, like amount of waste, in monetary terms, like costs or value of waste.

For the physical part, a number of add-on software offers are available, which I will mention a few slides later. For the monetary part, a number of projects are to be found that try to derive the necessary data from the existing information systems, not via add-on software that generally does not provide an automatic link to the existing data (ERP) systems.

In respect to environmental management procedures on a micro level, you are familiar with ISO14001 as well as we are. Looking closer at the ISO 14001 management system (Chart 8), one might distinguish between organizational aspects, aspects of technology and aspects of information that are covered through the ISO system. The information side of an environmental management system serves various purposes: Companies need some documentation of their environmental management system. They need reporting, internal reporting, external reporting, and they need tools for decision-making.

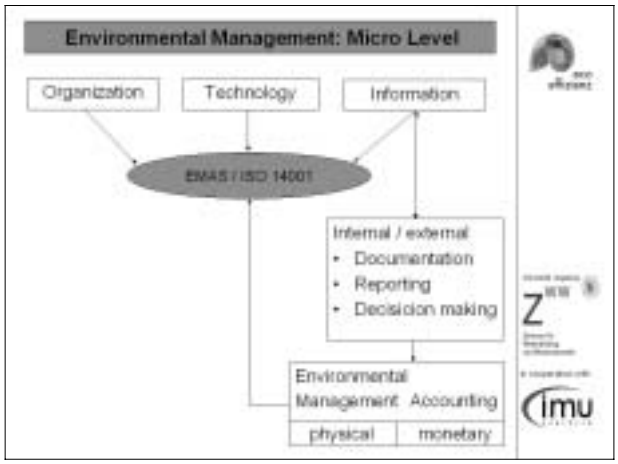


Chart 8

This is where the environmental accounting part comes in, distinguishing again between physical and monetary accounting, as prerequisite for decision making or reporting. Here, the relationship between environmental accounting on the one hand and environmental management systems, the ISO standards, on the other hand can be understood.

The number of add-on software we find in Germany today is quite plentiful (Chart 9). These are software tools that may be used for mapping and for tracing materials and material flows, but usually only on a

Chart 9

physical basis and outside the ERP system, outside of the regular information system of the company. Presently, they are not linked to the ERP system, so you have to feed them with data separately and often by hand. And there are no links yet to the standard accounting and controlling procedures in the company. Generally, these add-on tools therefore are used separately by the environmental officer. Their information is not prepared and not available for the decision-making processes of the line manager. This will not be a perspective of the long run.

The Beginning of Material Flow Cost Accounting (MFCA)

MFCA has its roots in "input-output balances" used within environmental management systems in order to gain environmental indicators for reporting purposes. Sometimes they are also called "mass balances" or corporate "eco-balances". The eco-balance goes into detailed analysis of the material or energy inputs and output. It all matches if the inputs are in "balance" with the outputs. The input-output analysis delivers ratios or indicators: Ratios of materials bought, compared to materials in the product or lost; percentages of various forms of energy (input) used, percentages of waste fractions (output) etc. The original indicators were only in physical units, like tons of waste per unit produced or kWh energy consumed per unit. It soon became obvious that, for the company's decision makers, it was necessary to translate the physical indicators into monetary units because company management was not so much interested in tons of waste, but in costs of waste, not so much in environmental waste or energy ratios, but in waste cost or energy cost ratios (Chart 10). So we had to translate the physical indicators into cost indicators, energy costs per units, raw material costs per units, waste cost per unit, per capita, per year etc. This seemed very simple, but as we looked at it closely it turned out to be much more complicated than we expected. To give an idea of how this worked in real life with working groups on site (Chart 11). When the working group started, we asked, "What are your waste costs?" The officer in charge left and couple of days later he showed up with a figure (Chart 11-1. run), "Well, we have this," he would say. The figure shows that this is quite a large company with 350,000 USD in waste costs. Looking at the company closer in a second run, we found that the first calculation was not complete and did not include all the information. There was, for example, a laboratory disposing waste too, but it was accounted for on a separate account. All together, in this second run, we found an additional 200,000 USD in disposal costs spread all over the company, not known to the officer in charge in the first run. During the next meeting of the working group, somebody argued: "This is not all the waste costs we have. We should consider transportation costs in order to get rid of the waste." In this case we found another 100,000 USD for waste transfer. Then somebody else suggested "Well, the wasted material also had been treated, separated, stored etc, the waste was handled, there was staff involved, this costs money, too", and we added personnel costs for the handling, the sorting etc. The staff had made

Chart 10

Chart 11

use of equipment such as forklifts, containers, space for storage was needed and so forth. We added depreciation and other positions like rents for rooms. And suddenly we had a completely different total sum for "waste costs". The company started with this sum up here (350,000 USD), and now was aware of 1,000,000 USD.

The next step then was obvious: the waste that was disposed of at the end of the pipe had been bought for a considerable amount of money at the beginning of the pipe. But nobody really knew the value of waste materials in terms of purchasing prices. Quite some research was necessary to get this information. Finally, we ended up with a material value of 1,500,000 USD. When company management, at the beginning of this process being aware of only 350,000 USD was only complaining about high disposal costs, at this point, looking at the total amount of 2, 500,000 USD, they decided on a new waste reduction program.

This was the example from a large pharmaceutical company. But we had the same experience with smaller companies. One just has to take off one zero at the end of the figures to get realistic figures for smaller companies.

This exercise, for us, was the start of Material Flow Cost Accounting: We started at the end of the pipe, and we traced the materials flow back to the beginning of the pipe, to materials purchasing. Today we follow materials flows in both directions. We distinguish between "material cost" for purchasing on the input side, the "system costs" for materials handling in the process, and "delivery" or "disposal costs" on the output side.

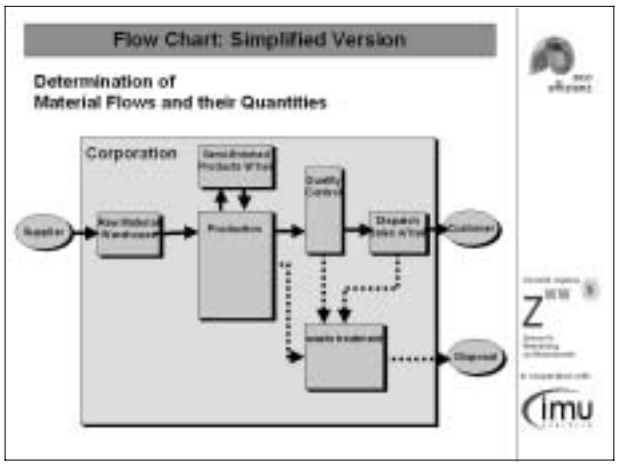


Chart 12

This was the start of Material Flow Cost Accounting, a simple idea, but challenging in the follow up.

Material Flow Cost Accounting Today

Today we trace the flow of materials with the help of flow charts (Chart 12: simplified version). And we are looking for the corresponding information in the accounting or ERP- system. Quite often, for example, we find waste flows not included in the accounting process.

Material flow charts for companies can depict quite a complicated network of materials flows (Chart 13).

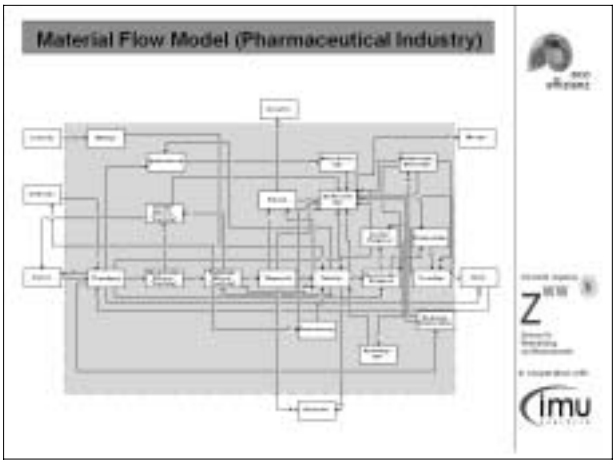


Chart 13

The boxes in the flow charts represent "quantity centers", equivalents to "cost centers", where the material is treated or stored. The arrows represent material flows. Clicking on the flow numbers brings up information on type and amount of material flowing and other additional available details. As mentioned before, along the flow of materials, three cost categories are distinguished (Chart 14): "material costs", "system

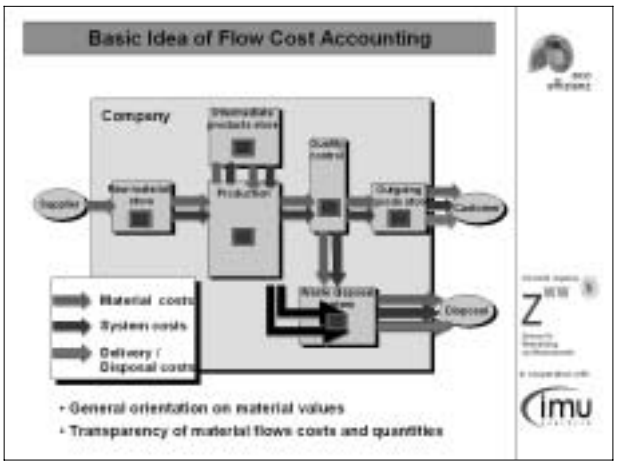


Chart 14

costs", including mainly personnel costs and depreciation, and, end of the pipe, the "delivery" and " disposal costs". Due to traditional cost accounting procedures (Chart 15) material costs are not allocated to

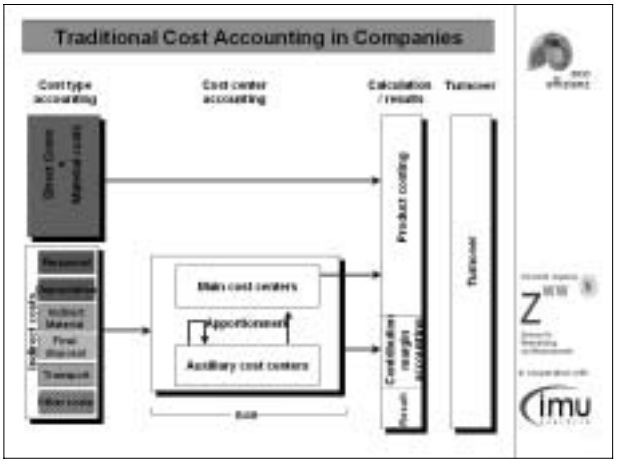


Chart 15

cost centers but posted directly to products. This means cost center managers have sufficient information on personnel costs, but insufficient information on costs and amount of materials handled. If managers are asked to reduce costs, which happens regularly, they are therefore bound to concentrate on reducing staff instead.

Aggregated results of the flow cost accounting process can be shown in flow cost matrices (Chart 16). The

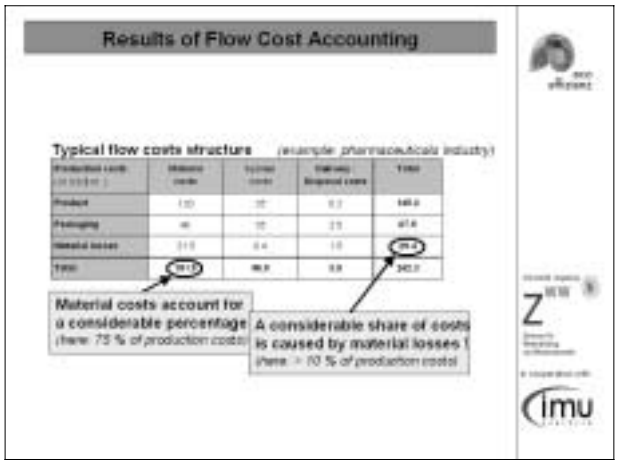


Chart 16

matrix shows the amount of material costs going into the product, cost of packaging material and costs of material losses. The matrix teaches us two lessons. First, it shows that quite often material costs are considerably higher when compared to system (mainly personnel) costs. Second, material losses are usually considerably higher than regular accounting systems calculate. The matrix again suggests it might be much more rewarding to look for cost saving potential on the material side, than on the personnel side.

In the next step, therefore it is necessary to trace down along the material flow the sources of the material losses. This example of pharmaceutical company (Chart17) lists some of the main causes or reasons for material losses. Here again, one might start to concentrate on the higher numbers, deriving measures for improvement or Kaizen where there are better opportunities for improvement.

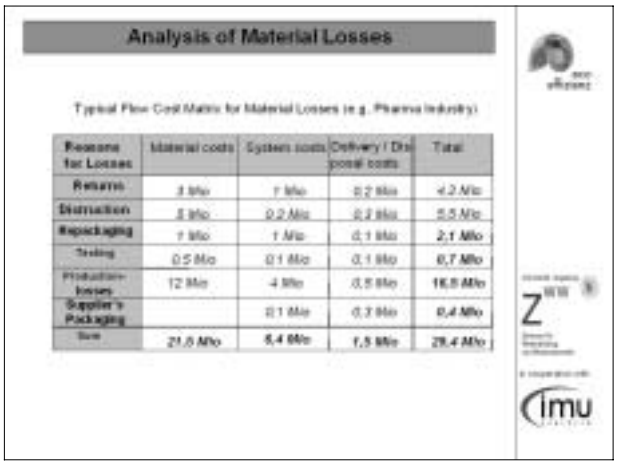


Chart 17

Here is some general statistical evidence for the above flow cost matrix we found in the German Statistical Yearbook (Chart 18). On average, in the German production industries, and this might be similar in Japan, material costs amount to 54 percent of the overall costs, personnel costs make up for only 18 percent and 28

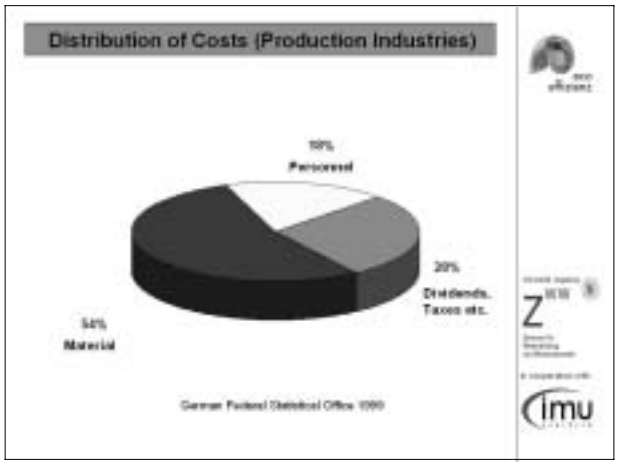


Chart 18

percent for the rest. In spite of this ratio the main part of the energy and consideration of cost accounting systems go into personnel cost accounting, resulting in the demission of staff.

For the largest block of costs, representing the highest potential for saving, the material costs, we had to realize that transparency is lacking. Companies know about material costs in the product, but the production process itself, the flow of materials, is quite often a black box in terms of material value in process, on stock etc.

This lack of transparency on the other hand offers new fields for improvement and Kaizen. It offers new chances for cost savings. The next chart, Chart 19 shows the example of another pharmaceutical company, where, looking closely at the flow of materials and the reasons for material losses, we were able to spot a number of actual cost saving measures.

The general experiences from MFCA pilot projects in the last few years are: (Chart 20)

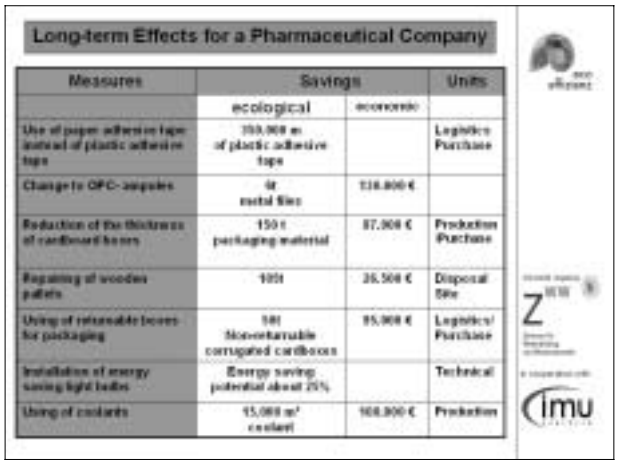


Chart 19

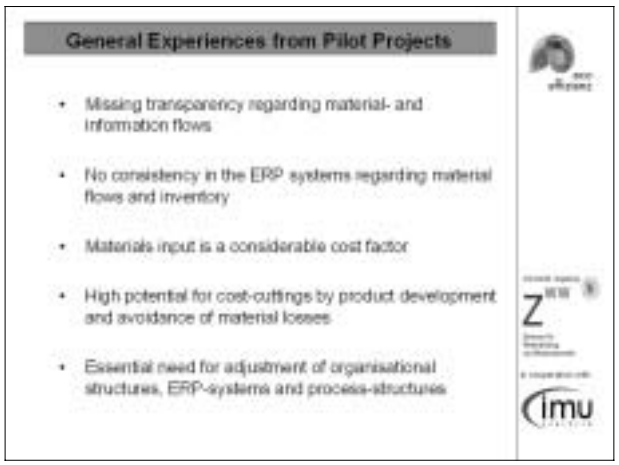


Chart 20

∗We found in companies a missing transparency regarding material flows information. We hardly ever found exact cost information on the material flow throughout the company. But without transparency, without exact information, companies are not able to organize and control material flows or production processes efficiently. If companies do not have exact information on the costs of material losses there is little incentive to reduce these losses.

∗We also found that companies' information systems, the ERP systems, like SAP, do not provide much information on material flows and, if at all, often had wrong or inconsistent information. As long as we do not have good information here, we cannot be very efficient in the material flow.

∗Material input in many companies was an underestimated cost factor.

∗If this is the case, it simultaneously offers considerable cost cutting potential.

∗In order to increase efficiency of material use, improvements might be necessary in various fields : by restructuring the organization, by remodeling the ERP system or by reengineering process structures.

If we consider the improvement of material efficiency as a relief to the environment it might be interesting to note that this relief is achieved through the reorganization of functional structures, remodeling of information systems and reengineering of production processes, not through typical environmental management programs like cleaning, filtering or sorting out of material. And the earlier within the flow of materials these measures are introduced, e.g. through purchasing or R&D, the more promising they are.

3. The Future

Where are we headed with MFCA? Presently, we are running a research project in Germany with 12 companies involved, including companies like Fujitsu-Siemens, Ciba-Geigy and others (s. www.eco-effizienz.de).

Reducing Functional Separatism: Material Flows as a common core of communication

In these and other companies we find people speaking

various languages, so they do not talk to each other or do not understand each other. For example, we meet management with an economic focus (Chart 21),

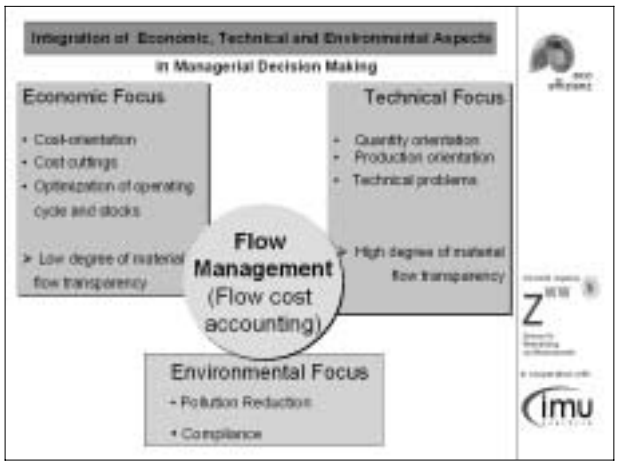


Chart 21

speaking a monetary language or we find the production or construction people speaking a technical language, thinking in the logic of the technical functioning of the product or the production process. Or there are people from the environmental department thinking in terms of pollution reduction or legal compliance. They all use their own language and follow their own proper logic. As they usually work and live in separate parts of the company they do not communicate with each other.

Administrative management knows a lot about accounting and marketing, but they do not understand the intricacies of the technical production processes including the flow of materials. The technical people have a high degree of material flow transparency, but in physical terms, not in monetary terms. They do not have good cost information. They have to reach quantitative and qualitative production goals and resolve technical problems. The people from the environmental department again try to motivate employees to comply with ISO standards, but have little information on costs or on technical interdependencies.

The task of the future is to bring these people together and make them talk to and understand each other. Flow charts, visualizing the flows of materials throughout the entire company, are communication tools to this purpose. People from various departments come together and start to talk about the same thing, the flow of materials, linking various departments. Interdependencies of departments are visualized. People at the end of the flow have a chance to talk to those at the beginning. The flow is their common topic. Flow charts are the tools of communication. Flow management is an integrative measure.

MFCA at the Click of a Mouse

A second future task: In all environmental accounting projects, in Japan or elsewhere, for statistical or MFCA purposes, data, at present, is collected by hand from various sources. This will not be possible in the long run. We will need information on material flows automatically out of the existing information systems, out of the ERP systems. What is needed is an ERP-integrated solution (Chart 22). The future will be a data warehouse including a huge amount of information. Through data mining, information for various purposes might be retrieved, for example, for various kinds of material reports: balanced scorecard, flow cost accounting, production report, procurement report and reports for EH & S, modular information.

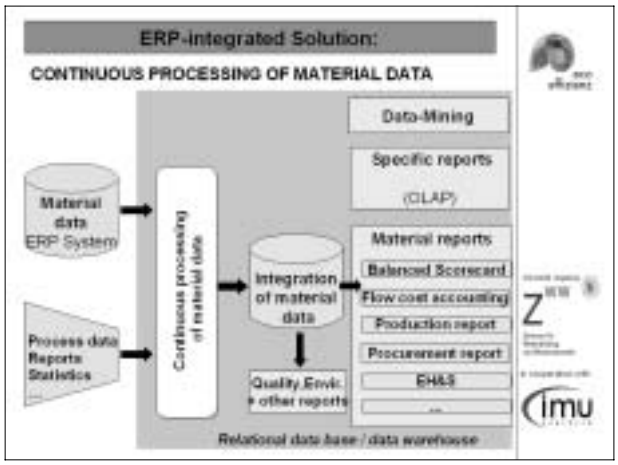


Chart 22

These reports are mainly for internal information and decision-making. But they might as well be used for external reporting, for environmental reports and other purposes. There is an enormous basis of information already stored in the present ERP-systems. But the information is not easily available. It is hidden somewhere in the black box of the ERP-system. If presently we are able to retrieve some MFCA-relevant information, it quite often is still of poor quality or even wrong or badly aggregated.

In the future, there is no way around a more

precise data based information on material flows, on their physical amounts and values. And this information must be easily and automatically accessible. If a company wants to be efficient in the use of its material, it must have exact information on its material, its flows and its stocks. The companies with better information will have a competitive advantage and there will be a natural selection. But there is still some work to be done until we are able to obtain the necessary information at the click of a mouse. The ERP-systems today are, in principle, able to provide the information, but they are customized with different objectives.

I would be happy if we could do some of this upcoming work together, in order to make material flows more efficient, and by this reduce costs and environmental damage.

Using Process Maps and Other Tools to Improve the Use of Material Flow Cost Accounting : The North American Experience

Robert B. Pojasek, Ph.D., Trudy Pedrosa and Geovane Beltrao
Pojasek & Associates, Boston, Massachusetts, USA

Introduction

I am honored to have been invited to this international gathering to introduce you to the Systems Approach to process improvement. This approach should be useful to help the material flow cost accounting methodology become more consistent and visual. The Systems Approach will also allow you to implement material flow cost accounting in harmony with your kaizen efforts to conserve the use of resources and to eliminate wastes.

The Systems Approach has enjoyed widespread use in the United States and elsewhere in the Americas. It is featured in the US Environmental Protection Agency's publication, "An Organizational Guide to Pollution Prevention." Each participant in this conference has been provided with a CD version of a demonstration of this methodology. An updated version of this demonstration can be found on the Internet at http://courses.dce.harvard.edu/~envree105/DEMO_START.swf.

Material flow cost accounting has made much progress in Japan with the efforts of IGES and the companies that the Institute is working with. I have been very interested in the kaizen methods that have been presented by Nippon Paint and Shionogi Company. The Systems Approach can provide six important roles as other companies seek to follow their example:

1. All process maps will be consistent and visually compelling;
2. All resource flows will be visually linked to the process maps using "object linking" techniques;
3. Opportunities for improving the process will be identified using materials flow cost accounting;
4. Kaizen activities will be systematically facilitated using the Systems Approach tools and formal employee action plans;
5. Material flow cost accounting will be used to quantify the results; and
6. A unique performance measure will be used to track and trend the process improvement effort and compare it to other improvement efforts.

The Systems Approach can serve as an effective means to facilitate the entire process improvement effort.

Material Flow Cost Accounting Model

The material flow cost accounting model (Chart 1) has evolved from material flow analysis (i.e., input/output models) and environmental cost accounting. Significant advancements have been made by IMU in Augsburg, Germany to help make this methodology useful to industry. IGES has been developing this model here in Japan - adapting it, as necessary, to

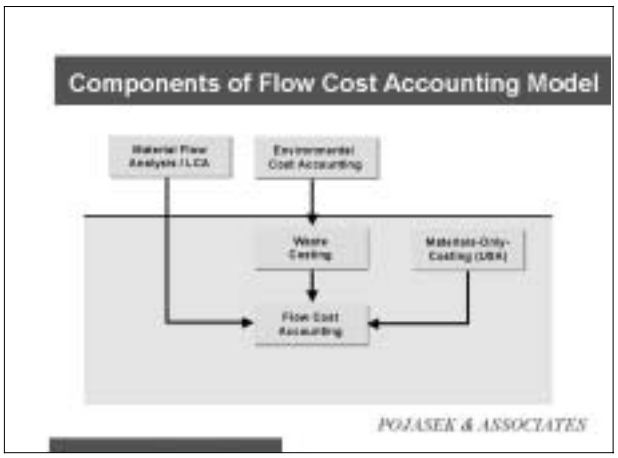


Chart 1

fit the culture and industrial variations that differ from the model's application in Europe.

Material flow cost accounting (Chart 2) tracks materials from suppliers into the incoming stores. After production, the throughput materials pass through packaging and outgoing stores before being sent to the customers. You will note that material losses from these steps are accounted for in an "environmental technology" area.

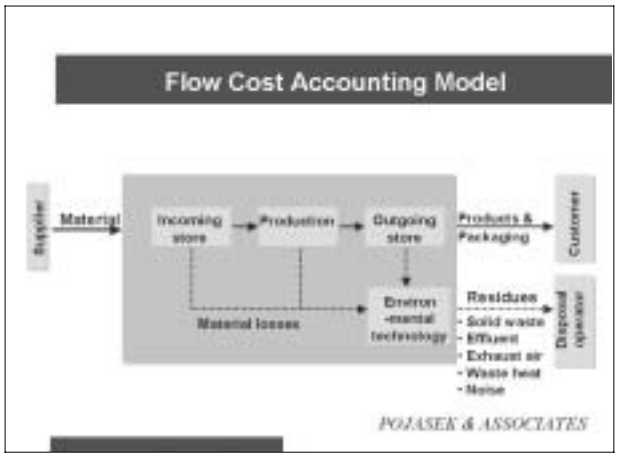


Chart 2

A simplified model (Chart 3) of the materials flow cost accounting model is represented by the "top level" of a hierarchical process map. The discharges, emissions, noise, odor and wastes from the process work steps are accounted for in the form of "supporting processes" that are linked to the main process by means of a resource accounting sheet. This linking will be described later in this presentation.

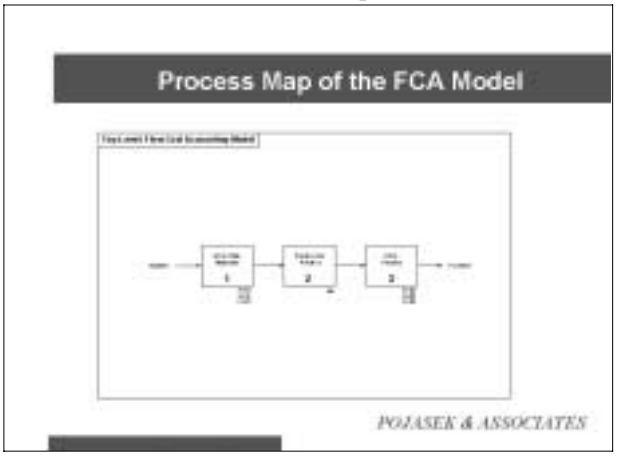


Chart 3

Please note the simplicity of this model. Everything is on one line with a consistent flow from left to right. There are links to the various accounting sheets under the first and third work steps. The "PM" under the production step indicates that there is more process mapping detail linked to this work step.

Process flow diagrams (Chart 4) have been used by the materials flow cost accounting teams to track materials through the production process. These diagrams are often complex. This complexity makes it difficult to explain the materials flow cost accounting to management and other interested parties. There is a need to have a simplified process mapping technique and a logic for mapping that enables the various applications to be compared on a consistent basis.

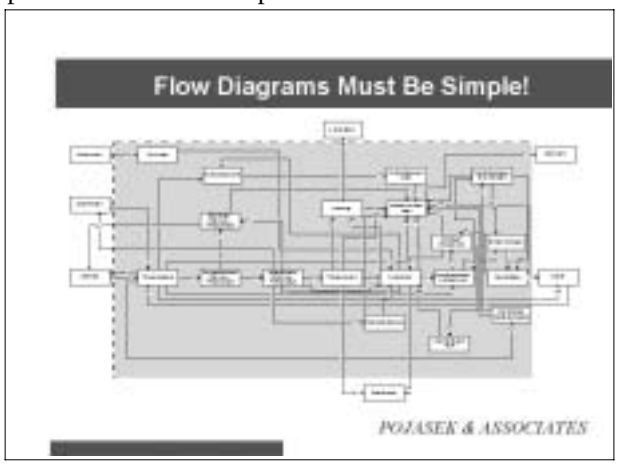


Chart 4

Systems Approach Process Mapping Tool

The Systems Approach characterizes the process using a hierarchical process mapping technique. Each level in the process map is restricted to three to six work steps. This rule allows the process map to be useful to the material flow cost accounting team while being understandable to everyone else with an interest in this methodology. Flow charts, process flow diagrams, piping & instrumentation diagrams, and value stream maps can all be converted to hierarchical process maps.

Process maps can be computerized with software that enables the user to only show the process sequence that is being considered. If we go back to Chart 3 and click on the PM, the second level of the process map will appear on the computer screen (Chart 5).

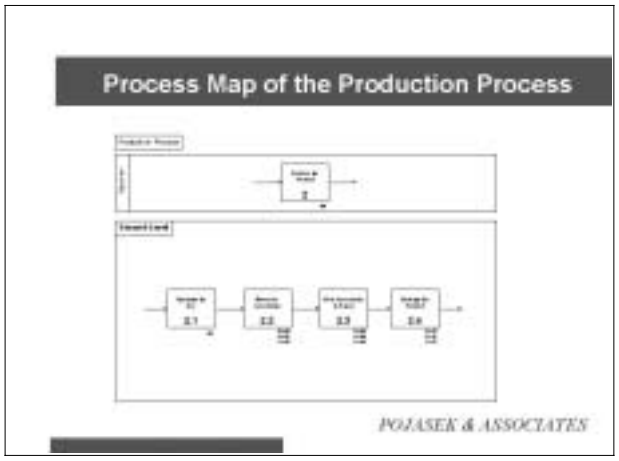


Chart 5

You should note that each work step has two numbers in the work step boxes. This tells you that you are in the second hierarchical level. Please notice that this segment of the process map at the third level under work step 2.1. Work steps 2.2 through 2.4 cannot be described in more detail at a lower level. They have accounting sheets associated with them as you will note.

Now if you click on the PM under work step 2.1, the third level process map (Chart 6) will be visible on the computer screen. Please notice that there are three numbers visible in each of the work step boxes.

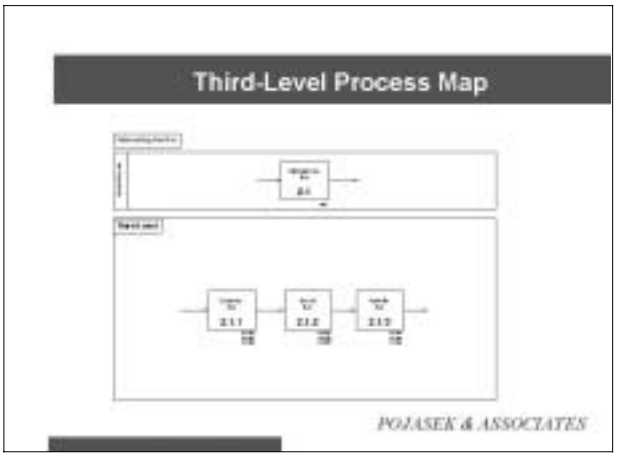


Chart 6

All manufacturing and service processes can be presented using this hierarchical process mapping technique. Books of process maps can be prepared to show different processes in the same company. Process maps can be used to link the supplier processes with the company processes. This is useful for supply chain management programs. Process maps can be used to link the company processes with customer processes. This linkage can facilitate product stewardship activities and product take-back activities. Every aspect of a product's life cycle can be linked using this process mapping technique. By using these process mapping techniques, it should be easier to integrate material flow cost accounting throughout this product life cycle.

Resources, Activities and Supporting Processes

Let's take a closer look at work step 2.1.3 - "Paint the Box." (Chart 7). You will notice that the description of the work step involves a verb-noun combination of words. This shows that "work" is being done here. There are three items below the work step: RA#4, AA#4, and CA#4. Let's take a look at how information is linked to the process maps. If you were to click on "RA#4," the process map would leave the computer screen and a resource accounting (RA) sheet (Chart 8) would appear. This resource accounting sheet is divided into three sections.

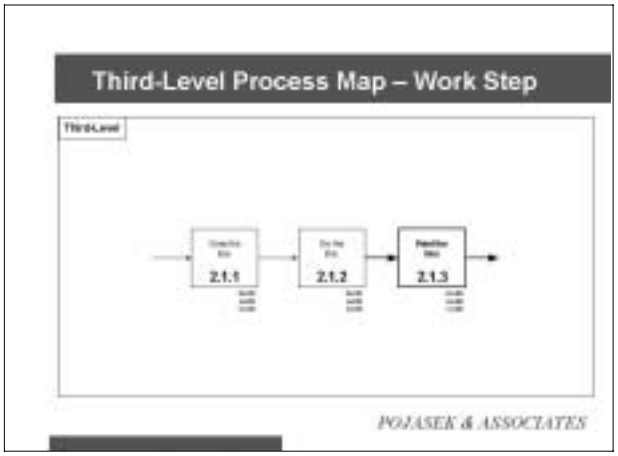


Chart 7

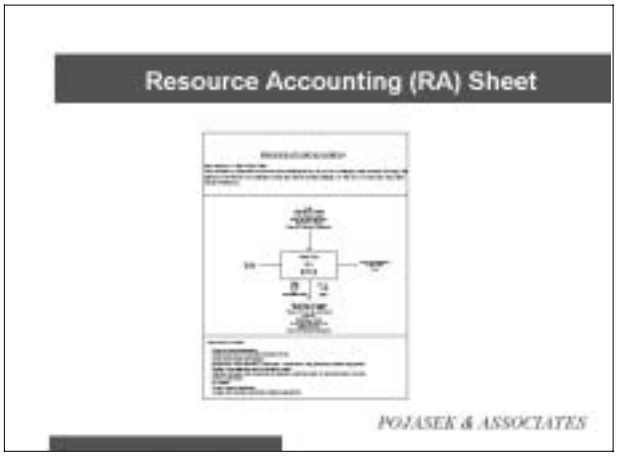


Chart 8

In the top section (Chart 9), there is a description of the work that is taking place in this work step. This description often comes from the Standard Operating Procedure (SOP). The company's ISO 9000 program is one place where you can look for this description in an electronic format.

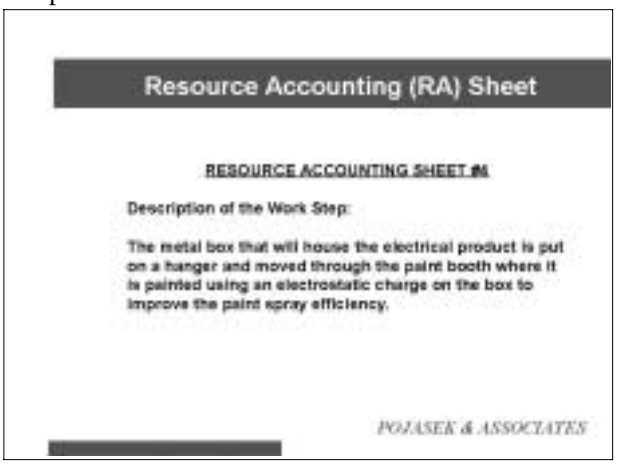


Chart 9

In the center of the resource accounting sheet (Chart 10), there is a 360-degree look at the work taking place. On the left is the work step that takes place before this work step. On the right is the following work step. Above the work step are all the resources (i.e., energy, water and materials) that are required in this work step. Below the work step are all the resources that are lost (i.e., wastes) as a result of the work step. This provides a visual means of accounting for the resources used and lost at each work step at the lowest level in the hierarchical process map. The user can create a "glossary" for these resources so they can be tracked to any work step where they might be used or lost in the entire process. This linkage

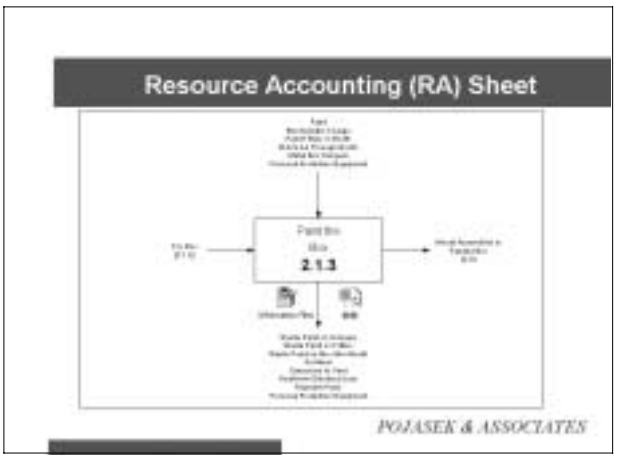


Chart 10

will provide many strategic leveraging points for the material flow cost accounting methodology.

In the lower part of the resource accounting sheet (Chart 11), a listing is provided of all the supporting processes that are necessary in order for the work step to take place. You should notice two things here:

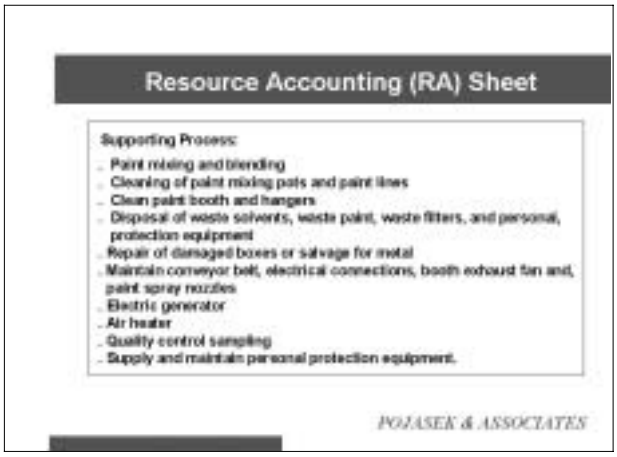


Chart 11

1. All discharges, emissions, noise, odor, and waste are controlled or handled by supporting processes; and
2. All these supporting processes use and lose resources.

It is possible to determine the resource use and loss from these supporting processes and determine the costs associated with this resource flow. In this manner, the resource flow cost analysis can be extended to the entire "system" through the process depicted in the hierarchical process maps.

While the use and loss of resources are costing the company money, there is also much money spent to have people manage these resources. To account for the time people are spending in this regard, we have created an activity accounting (AA) sheet (Chart 12). You can view a larger version of this sheet on the CD demonstration of the Systems Approach.

It is very similar to the resource accounting sheet, except in two ways. Above the work step box, all the activities are listed that are needed to manage the work step. Below the work step box, all the activities that manage the losses (i.e., discharges, emissions, noise, odor, and wastes) are listed. Below the box

activities are consistent with the material cost flow accounting model's "environmental technology" box.

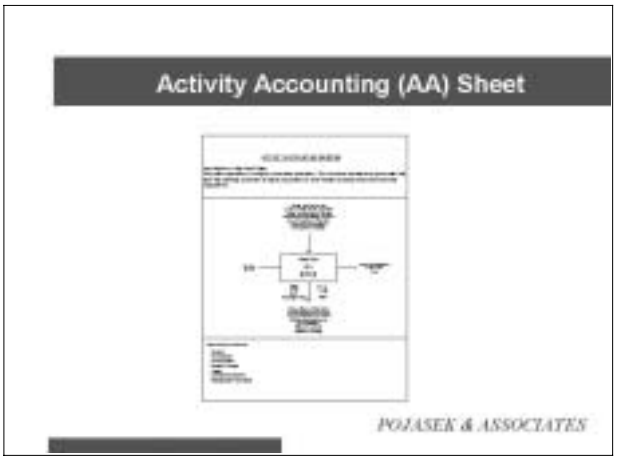


Chart 12

Cost Accounting

IMU (Germany) and IGES (Japan) have been perfecting means to use the facility's enterprise resources planning (ERP) system to automate the generation of costs for the material flow cost accounting service. By combining that knowledge with the Systems Approach, companies will have a more visual means to link resource flow accounting with cost accounting. The users of the combined system can use a more visual framework to "see" where the cost impacts are in the process and to leverage this knowledge to reduce costs in other similar work steps and supporting processes.

Costs are assigned to both the resource and activity accounting sheets (Chart 13). These costs can be combined and displayed as a cost accounting (CA) sheet. The resources are typically linked to the materials resources planning (MRP) component of the ERP or a stand-alone MRP information module. We have used the computerized maintenance management system (CMMS) module to track the activity based costs of managing activities associated with process improvement activities. The CMMS is often embedded in the ERP or can exist as a stand-alone module.

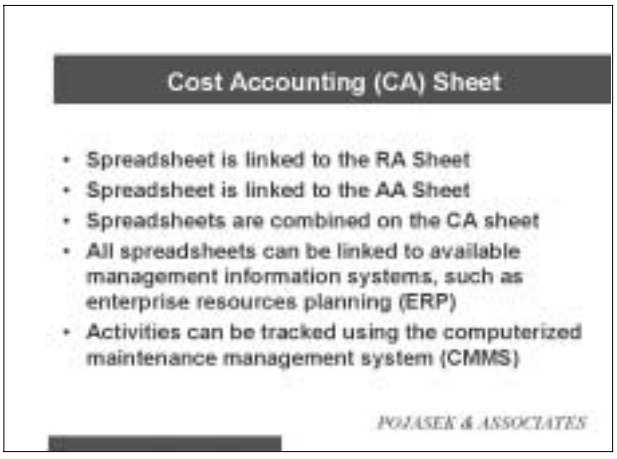


Chart 13

It is very important to automate the cost accounting activities. Experience has shown that process improvement efforts often fail because this information is not properly maintained and used to justify the efforts. Material flow cost accounting efforts have made significant strides in allowing process improvement teams to have this very valuable information to plan, implement and report on the kaizen efforts.

Conclusions

There are many reasons to consider the integration of material flow cost accounting with the Systems Approach (Chart 14):

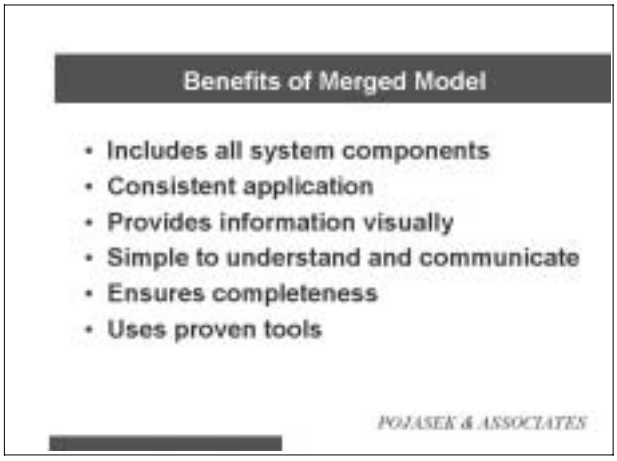


Chart 14

System. It is important to apply the material flow cost accounting in all aspects of the systems found in most manufacturing companies. In this way, important linkages and other leverage points can be identified to help improve the effectiveness of the methodology.

Consistency. Application of material flow cost accounting can be enhanced if everyone involved can "see" how it is affecting them. The Systems Approach methods provide this visuality.

Communication. All of the items help material flow

cost accounting implementers to communicate their work to people at all levels in the firm. As they begin to penetrate the supply chain, this enhanced communication using the Systems Approach will allow the divergent interests to be focused on the value creation that is desired.

Completeness. It is important not to leave out supporting processes and their use and loss of resources. The Systems Approach links all activities and work in the company back to specific work steps in the main process(es).

Proven Tools. All the quality tools in the Systems Approach have been proven in applications around the world. The youngest tool in the approach was published in 1943. The use of the Systems Approach provides a solid platform for implementing material flow cost accounting in any company.

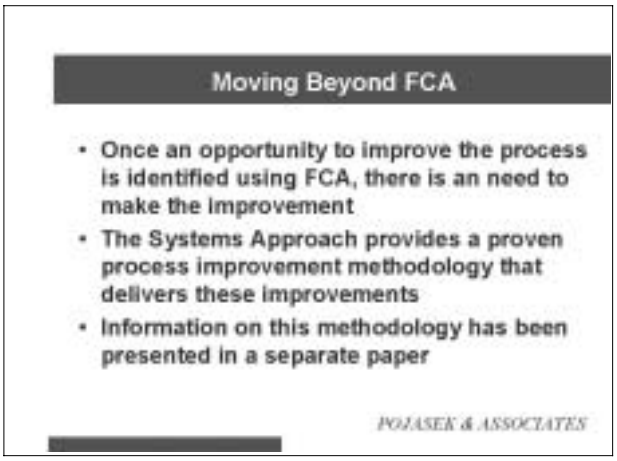
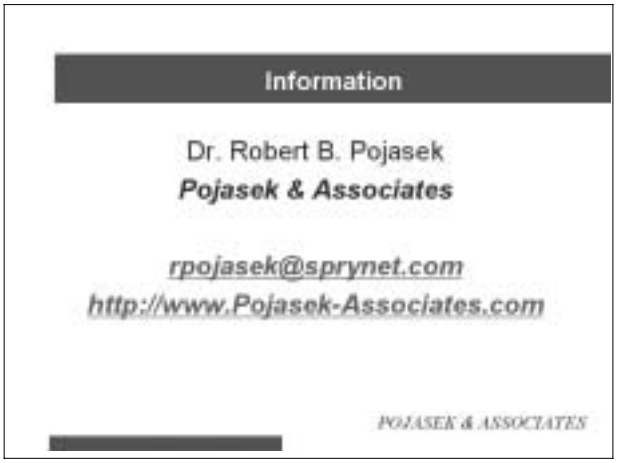


Chart 15

In a workshop hosted by IGES (Chart 15) the day before this conference, we presented a paper that addresses the manner in which the Systems Approach can help to facilitate the kaizen process improvement effort and link them back to continuous improvements using the material flow cost accounting model. This paper has focused on the front end of the application. The CD presents an interesting metric that can score the *performance* of the facilities that use an integrated suite of these methods. I hope that this meeting will provide the seeds that will grow as we all work together to integrate these value creation methodologies. I would be pleased to correspond (Chart 16) with anyone



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seeking more information on the Systems Approach. I have appreciated this opportunity to present these ideas with each of you and look forward to hearing more about the elements of this integrated approach.

5

Panel Discussion Part-1

Case Studies of Material Flow Cost Accounting

Introductory Research on Material Flow Cost Accounting
IGES Kansai Research Center Research Project

Michiyasu Nakajima
Associate Professor, Faculty of Commerce, Kansai University

As a part of its "Business and the Environment Project," IGES Kansai Research Center is promoting the research and development of practical tools to help facilitate the internal management of companies engaged in environmental management as sustainable management. In social scientific studies, field research whose outcomes can be widely applied in the real world is as important as academic research. What is essential in making an academic theory applicable to actual business activities is to study its feasibility and usefulness through fieldwork so that we may understand issues to be solved and propose measures for improvement. IGES holds bimonthly workshops under the title of "Study Meeting on Environmental Accounting for Corporate Management," hereinafter referred to as the IGES Corporate Management Workshop. The objective of the workshop is to provide researchers, who are developing the most advanced theories, and corporate staff who could apply those theories in their business, opportunities to exchange their opinions, facilitating experimental research. Nippon Paint Co., Ltd. and Shionogi & Co., Ltd., members of the workshop, joined the project introduced below.

In order to promote research on MFCA theory, research based on literature and materials available both in Japan and overseas is of course important. In addition, we should apply the theory and tools in real business management in Japanese companies to study its usefulness and understand the issues to address. We therefore included the introductory application of the MFCA system to Japanese companies in the IGES 2002 research project.

IGES asked for cooperation from Nippon Paint in December 2001 to analyze their production by the MFCA since the company had shown its interest in a lecture on the MFCA theory given at one of the IGES Corporate Management Workshops. Nippon Paint and IGES then repeatedly had preliminary meetings, followed by MFCA investigative meetings including a study tour of a Nippon Paint plant during the period from the end of December 2001 to January 2002. By the end of the series of the investigative meetings, one of the production lines was chosen to participate in the experimental research.

In April 2002, an IGES research team gave an explanatory session on the MFCA theory to a plant manager, the staff in charge of production lines, Environmental Quality Headquarters and Finance & Accounting Department. In the session held at the Osaka plant of Nippon Paint, staff in charge of each step of the production process asked questions regarding a specific work procedure of the selected production line, helping us to understand issues to address in applying the MFCA theory in actual management. In addition, we discussed scheduling of the project, the objective of the MFCA introduction, a flowchart to show outcomes of the research and how to use data to be collected.

In April 2002, the IGES research team visited the Environmental Management Unit at Shionogi headquarters to explain the outline of MFCA and the planned experimental research. Questions about specific items were brought up at this exploratory session such as differences between the MFCA and Shionogi's existing system including environmental management information, advantages gained by introducing the MFCA system, and additional time or costs required for research cooperation. There had been two examples of MFCA being introduced to pharmaceutical companies in the past: one by IMU in Germany, which created

the MFCA concept and the other by the Japan Environmental Management Association for Industry (at Tanabe Seiyaku, Co., Ltd.) under a commission from the Japanese Ministry of Economy, Trade and Industry. IGES set its objective in the research at Shionogi to address new environmental issues in the MFCA system based on the outcomes from the former two examples.

After obtaining Shionogi's approval for the experimental research, we held a meeting in May 2002 to create a comprehensive plan, including selection of a plant and line to join the research. Responding to Shionogi's proposal, IGES selected a pharmaceutical product manufactured at the Kanegasaki Factory that included the entire production process from drug substance manufacturing, to formulation and packaging. Based on detailed explanation about the selected production line from Shionogi and consideration of the scientific characteristics and annual production schedule of this drug, data collection times and scope of research data were decided. The Ministry of Health, Labor and Welfare regulates that pharmaceutical companies should make detailed data of physical flow. IGES, therefore, was to collect very detailed data at the chemical compound level, limited to the manufacture of one lot of the target product.

Case Study I : Nippon Paint Co.,Ltd.

Michiyasu Nakajima Associate Professor, Faculty ot Commerce, Kansai University
Katsuhiko Kokubu Professor, Graduate school of Business Administration, Kobe University
Jun Okajima Manager, Finance & Accounting Department, Nippon Paint Co.,Ltd.
Eriko Nashioka Research Fellow, IGES Kansai Research Center, CPA
Koichiro Saio Visiting Researcher, IGES Kansai Research Center, CPA

1. Company Profile

For 122 years, since its initiation in 1881, Nippon Paint[1)] has been a leading manufacturer in the Japanese paint industry developing, manufacturing and selling various types of paints and coatings for automobiles, buildings, industrial equipment, ships and other products in various sectors. As of March 31, 2002, they had 27,712 million yen in capital, 192,467 million yen in consolidated net sales and 4,515 employees.

The company has eagerly addressed environmental issues and has been an active member of the Japan Responsible Care Council since its foundation in 1995. In March 1999, it was the first company in the Japanese paint industry to acquire ISO14001 certification for all Japanese facilities. In addition, the company also formed its environmental management policy, building a worldwide cachet as an environment-conscious company that contributes to environmental protection and reduction in resource and energy consumption. Their basic policy is as follows:
"Through its offering of color and design services, as well as its endeavors to develop better ways to protect our natural resources, Nippon Paint is determined to fulfill its responsibility of beautifying and conserving the global environment. By enhancing the environmental awareness of all its employees, Nippon Paint is initiating a corporate-wide effort to promote environmental commitment."

The company has also established environmental management targets to be achieved by 2005: the targets are for environmental conservation activities and energy and resource saving; and to provide products and services with an aim of developing products and technologies that minimize environmental load.

2. Project overview

2.1 Meetings prior to implementation of the project

In December 2001, IGES researchers visited the Osaka Plant to explain MFCA to the related division staff members and to take a plant study tour. As it is important for the project staff members to understand MFCA prior to its introduction, a meeting was held to clarify points of implementation.

Among the problems posed in the meeting, the issue regarding data collection had to be solved immediately. As the Osaka Plant is located next to the head office, the project team members visited the plant as frequently as they needed and swiftly found proper solutions through close and frequent communications with related plant workers in charge of process flow. Through such bilateral communications, many proposals were presented from the plant workers. In this way, two or three meetings between the IGES researchers and the project team members were held each month.

The data collection sheet, including flowcharts, was prepared by the Accounting Department and it took several months for preparation. This sheet was well designed and very easy to use, with illustrations and pictures showing processes and tasks of the manufacturing line to be surveyed in detail. Taking into consideration the manufacturing plan of the related product, a trial test was carried out in July, followed by improvement of the sheet, and the beginning of a three-month period of data collection in August.

1) For further detailed corporation profile, please refer to http://www.nipponpaint.co.jp/

MFCA was first introduced to the water-based paint manufacturing line in the Osaka Plant. MFCA covers material cost, system cost, distribution/waste disposal cost and energy cost. The manufacturing line is composed of five processes: mixture, dispersion, dissolution, filtration and filling. In the first process mixture, a dozen types of raw materials including water, pigments, additives and resin are mixed. In the dispersion process, the grain size is made equal. In the dissolution process, additives are poured and stirred. In the fourth process filtration, impurities are removed from the finished product. In the final process filling, the finished product is placed into 18-L containers.

To carry out the project to introduce Material Flow Cost Accounting (MFCA), the following team has been organized.

Project team members:

Head office (3):

Environmental Quality Headquarters
Accounting Department

Factory (14):

Manufacturing Section
Center of Engineering
Safety and Emergency Section

2.2 Data collection

In principle, material-related data was collected through actual measurement, while labor and other costs were collected from financial data.

In calculating material cost, the data written in the work control form (manufacturing indication form) was not used, but all raw materials used in each process was weighed and the cost was calculated by multiplying the weight by the price of each material.

The system cost includes labor cost, depreciation cost and other expenditures. The data related to the system cost was collected from financial data. As more than two products are manufactured in a single manufacturing line, the depreciation cost and other expenditures of the product to be surveyed were calculated according to the specified rule. The labor cost was calculated based on the record of individual work time for each process. In the survey conducted this time, only the cost directly relating to the manufacturing work was taken into account. (The cost necessary for auxiliary work was excluded.)

The main delivery/waste disposal cost is the cost for disposing of packages and containers of purchased raw materials. It was calculated by multiplying the weight (kg) by unit disposal cost. The general delivery cost was excluded.

The energy cost was calculated by multiplying the integrated energy consumption of each machine in each quantity center by unit power cost. As every quantity center was not equipped with watt meters, sample data was collected using power measuring devices.

2.3 Preparation of flowcharts including data

1) Flowchart (material cost)

As the manufacturing line surveyed is also used to manufacture other products, the machines and tools are washed after each process has been completed.

After materials were mixed with water in a tank in the quantity center during the mixture process, shown in Fig. 2.1, it is transferred to the subsequent dispersion process and the tank is washed with water. The drainage (water used to wash the tank including a small amount of material residue) is stored for reuse the next time washing of the same type of product is required.

From the mixture process through to the final filling process, pipes were used to connect each process. As products that complete each process are transferred via the pipes, no leaks occurred. Also, no paint is left in the pipes as paint adhering to the inside of the pipes is extruded with a utensil (called a pig) following the filling process.

As a result, in the water-based paint manufacturing line, a very small amount of material loss (final waste) was generated. What little fine powder was generated from powdered materials during the mixture process was collected with a dust collector and recycled as materials. Only a small amount of residue that could not be collected or adhered to the dust collector became waste.

2) Flowchart (system cost)

The system cost of each quantity center is shown in Fig. 2-2. The depreciation cost related to the manufacture of water-based paint (survey target of this project) was calculated according to the specified rule.

3) Flowchart (delivery/waste disposal, energy costs)

In Fig. 2-3, the energy cost is shown in the upper boxes and waste disposal cost shown in the lower boxes.

4) Flow cost matrix

In Fig. 2-4, the amount invested in each quantity center is shown above the material loss in the middle of the figure.

- Material loss cost ratio: 0.127%
  (total material loss cost/total costs)
- Final waste cost ratio: 0.137%
  (disposed material loss/total material cost)

These ratios, derived from MFCA, show that water-based paint is manufactured with only a small amount of material loss.

2.4 Another application of MFCA -a study of power consumption loss-

The purposes of this project were to verify that material and cost losses of the water-based paint manufacturing line are nearly zero, as expected, and to fully understand MFCA procedures for further applications to other manufacturing lines in the company.

Furthermore, we discussed a new application for MFCA. With the aim of minimizing environmental load, power consumption was analyzed and studied through MFCA. First, power consumption for each machine was measured. As the number of power measuring devices was limited, the power of one machine was measured only once. By measuring power consumption during two or more batches of operations, the entire related manufacturing line was sampled. The power consumption during one batch of operations for a machine was then estimated. We discussed the practical use of the data for MFCA.

So far, the power consumption of each machine had been measured, but the problem of how to link the data with MFCA as an environmental management accounting data had not yet been solved. Simply speaking, the question was what the measured power consumption data should be compared against when calculating energy loss.

In this project, the power factor was used as a solution. The power factor, as shown by the following equation, is the ratio of electric power consumed to activate the functions of each machine to input power.

$$\text{Power factor}(\%) = \frac{\text{Electric power consumed to activate machine functions (W) (effective power)}}{\text{Voltage (V)} \times \text{electric current (A) (apparent power)}} \times 100$$

The power factor of each machine was calculated based on the data obtained using measuring devices. In several cases, lower power factors than the standard power factor of 85% were obtained. It is considered logical for MFCA to calculate and collect data for power loss and its cost for each machine and each quantity center and to use them for minimizing power loss. Power loss is obtained using the following equation: apparent power × (1 - power factor) = power loss

1) Possibility of reduction in power consumption loss

We examined how we might reduce power consumption loss, which is found by calculating the operating power consumption for each machine and the power factor. Reduction in power consumption loss leads to cost reduction.

Calculations of possible annual cost reduction resulting from reduction in power consumption loss

Electricity rates are roughly divided into a basic charge and a power charge. Each charge is calculated as shown below:

Basic charge = (unit cost/kW) × (contract demand) × (modified power factor)

Power charge = (consumed power) × (unit power cost/kWh) ± (adjusted fuel charge)

The basic charge, a fixed cost that consumers must pay, is calculated based on contract demand. When contract demand is lower than 500 kW, the highest value from the past year (including the current month that related electric rates are paid) among the maximum actual demand measured each month, is used for the calculation. The maximum demand was the maximum value of average demand for 30 minutes in a month. On the other hand, the power charge is a fluctuating cost that consumers pay based on the amount of power they consume.

Accordingly, to reduce electric costs, contract demand and consumed power should be reduced. In this project, power consumption for each machine was measured.

		①	②	③	④	⑤	⑥	⑦	⑧	⑨
					③／②	③÷0.85	⑤－②	①×⑥/60/1,000	⑦×8.5 ※	⑧×20says×12months
Manufacturing machines	Process	Operation time per day (min.)	Apparent power (W) (input power)	Effective power (W)	Power factor	Apparent power calculated based on the standard power factor (85%)	Possible power reduction (W)	Possible power reduction per day (W)	Possible cost reduction per day (yen)	Possible annual cost reduction (yen)
Machine A	Dispersion	300	4,000,000	3,100,000	0.78	3,647,059	352,941	1,765	15,000	3,600,000
Machine B	Dispersion	300	370,000	222,000	0.60	261,176	108,824	544	4,625	1,110,000
Machine C	Dispersion	300	200,000	110,000	0.55	129,412	70,588	353	3,000	720,000
Machine D	Dispersion	420	1,000,000	800,000	0.80	941,176	58,824	412	3,500	840,000
Machine E	Filtration	240	350,000	122,500	0.35	144,118	205,882	824	7,000	1,680,000
Machine F	Filling	300	100,000	30,000	0.30	35,294	64,706	324	2,750	660,000
Machine G	Filling	360	110,000	44,000	0.40	51,765	58,235	349	2,970	712,800
Machine H	Filling	420	90,000	36,000	0.40	42,353	47,647	334	2,835	680,400
Machine I	Common	360	950,000	665,000	0.70	782,353	167,647	1,006	8,550	2,052,000
Total				5,162,240		6,034,706	1,135,294	6,834	50,230	12,055,200

※ Unit power cost/kWh

As a result, in several cases, the power factor was found to be lower than the standard 85%. Improvement of the power factor is considered to lead to a reduction in contract demand and consumed power. For an effective investment, investment efficiency must be appraised by estimating the amount of investment needed for improvement and expected cost reduction achieved by the investment. The power factor of the machines with higher investment efficiency should be improved sooner.

The following table shows the actual power consumption for each machine, power factors, power to be reduced and annual cost to be reduced.

First, the power factor of each machine (④) was calculated based on the apparent power (②) and the effective power (③) obtained through actual measurement. Second, the difference between the apparent power calculated based on the standard power factor (85%) (⑤) and the real apparent power (②) was obtained. This is shown in (⑥) as possible power reduction. Next, the possible cost reduction per day (⑧) is estimated by multiplying the possible power reduction per day (⑦), calculated based on the possible power reduction (⑥), by unit power cost (8.5 yen/kWh: applied by Kansai Electric Power Co., Inc. on and after October 1, 2002). Furthermore, possible annual cost reduction (⑨) was estimated (operation days per month: 20). Through the project, the following was found: in total, 12,055,200 yen in power costs will be reduced annually. Machine A specifically, will reduce 3,600,000 yen in power costs (the highest amount among machines A to I).

With regard to the basic charge, theoretically, the maximum demand is considered to be reduced by improving the power factor, followed by a decrease in contract demand per year. If contract demand is reduced by 100 kW a month, for example, the basic charge is estimated to be reduced by 2,136,000 yen per year. (100 kW × 1,780 yen <unit cost for basic charge per kW applied by Kansai Electric Power Co., Inc. on and after October 1, 2002> × 12 months)

To most effectively improve the power factor, reductions in power cost resulting from a reduction in consumed power, and reductions in the basic charge resulting from a reduction in contract demand, should be taken into account. It is important to start improving the power factor from the machine that the largest amount of power cost and basic charge can be reduced.

2) Estimating investment recovery period

Installation of condensers, employment of high-efficiency motors and other various methods will lead to an improvement in power factors. Effect and necessary cost vary depending on method. The corporation should survey the investment efficiency of each machine and give priority to the machines with higher investment efficiency when improving the power factor. Investment efficiency was studied based on the investment recovery period.

The table shows the power cost-related investment recovery period, calculated based on the amount of

investment needed for power factor improvement. Among machines A to I, machine F has the highest investment efficiency: 1.5 years, and machine A has the lowest: 5 years. If reduction in the basic charge resulting from reduction in contract demand is taken into account, the investment recovery period will become shorter.

Currently, to prevent global warming, reduction in CO_2 emissions are a pressing need. Various schemes, such as an emission trading scheme and the introduction of a CO_2 tax, have been considered. As these plans may lead to a cost increase, a reduction in power consumption becomes increasingly important. When such reductions for future possible cost increases is taken into account, the investment recovery period becomes shorter; accordingly, machines that have been considered not worth the investment may prove worthy. It is important for the company to determine its investment based on its payable amount, investment recovery period, and future trends.

From the viewpoint of power factor improvement, we studied the possibilities for a reduction in power consumption loss. The amount of investment and the results (amount of reduction) will vary depending on methods of improving the power factor. Cost reduction estimates based on the difference between the actual measured power factors of each machine and the power factor achievable by improvement, will be very useful information for the company that must decide to invest or not to invest.

2.5 Future issues to be addressed

The scope of material costs to be measured was discussed. When determining the loss of input materials, should residues left in a container be measured as a material loss? Should powder dust that is collected by the whole factory be measured as a material loss of each process? In the former case, if the amount of residue in a single operation is minute, residues of two or more operations are collected and measured. In the latter case, we contended that when substances are difficult to measure and the data is important, estimated values are employed. The powder dust of each process, for example, is calculated by dividing the monthly average amount of powder dust by production amount. In addition, one type of substance can be surveyed separately by purpose and origin to properly determine the cost. Take water for example. Water used as a material is studied separately from water for washing.

Manufacturing machines	Process	Possible annual cost reduction (yen)	Investment amount (yen)	Recovery period (years)
Machine A	Dispersion	3,600,000	18,000,000	5.0
Machine B	Dispersion	1,110,000	2,000,000	1.8
Machine C	Dispersion	720,000	1,500,000	2.1
Machine D	Dispersion	840,000	2,500,000	3.0
Machine E	Filtration	1,680,000	5,000,000	3.0
Machine F	Filling	660,000	1,000,000	1.5
Machine G	Filling	712,800	1,300,000	1.8
Machine H	Filling	680,400	2,000,000	2.9
Machine I	Common	2,052,000	4,000,000	1.9
Total		12,055,200		

Next, the meaning of time was discussed in measuring energy and system costs. In other words, when studying energy and system costs, does the time only mean the duration that the machines operate manufacturing products, or does that include idle time? Time will be dealt with depending on machine type and conditions. The same issue was discussed for delivery and labor costs.

We also concluded that to obtain useful information about electric power, it was significant to measure electric power consumption for each machine. We decided to do the measurement. As a result, we found that this measurement allows comparisons between the measured value of power consumption and power factor, and this can provide useful information for decision making regarding investment in machines.

The manufacturing line, the research target of this project, has been known as a line with little material loss. Through the introduction of MFCA, this fact was numerically verified. In addition, by comparing detailed measured data, such as power consumption of each machine, with theoretical values and then analyzing them, new improvements were discovered. The knowledge of this research will be applied to other manufacturing lines, which will lead to the improvement of manufacturing lines and processes of the whole plant.

Furthermore, the method to link MFCA information to (external) environmental accounting is an important issue to be discussed in the future.

Flow Chart (material cost)

Nippon Paint

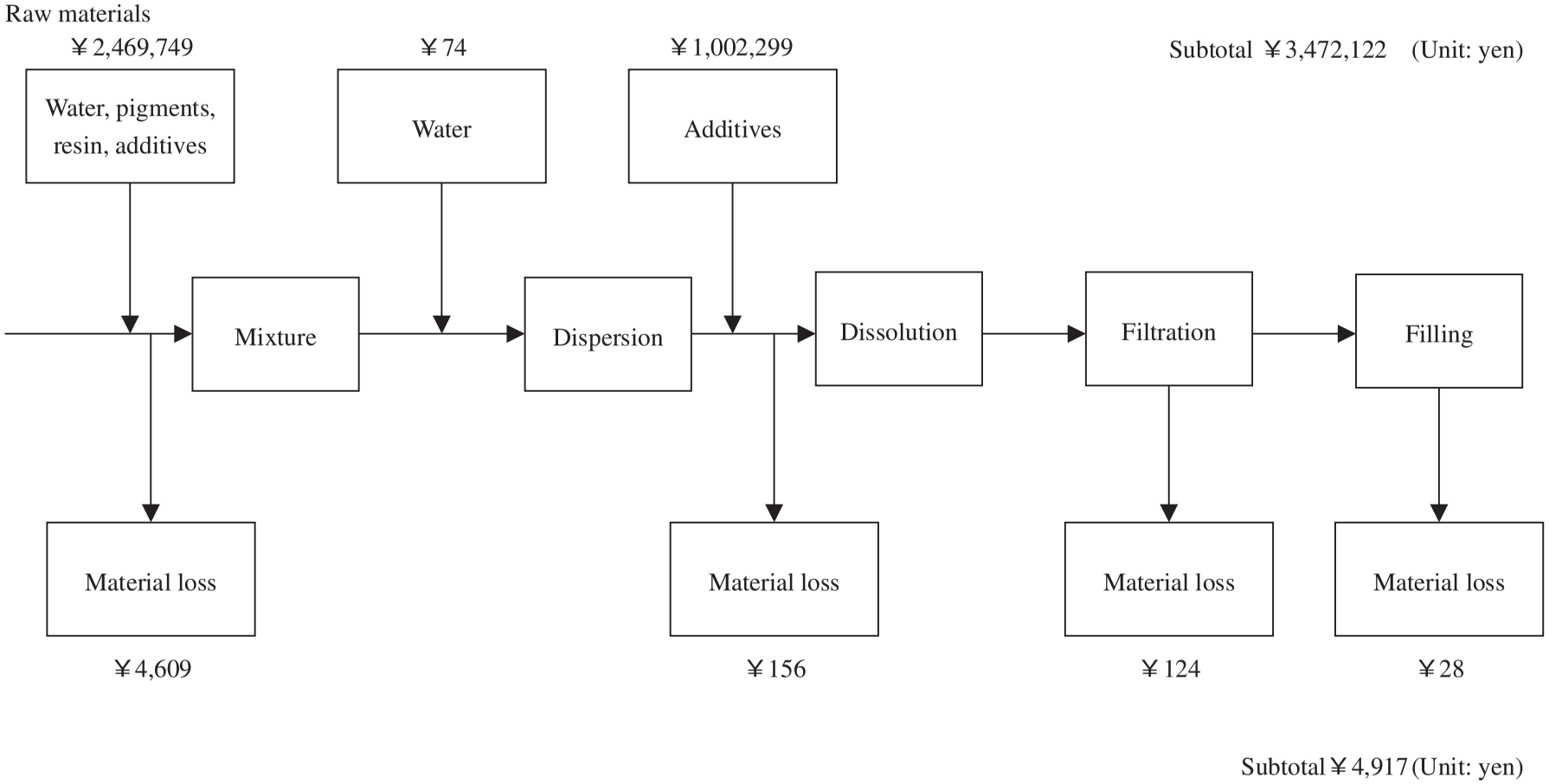

Fig. 2-1 Nippon Paint Material Flow Cost Flow Chart

Flow Chart (system cost)

Nippon Paint

(Unit: yen)

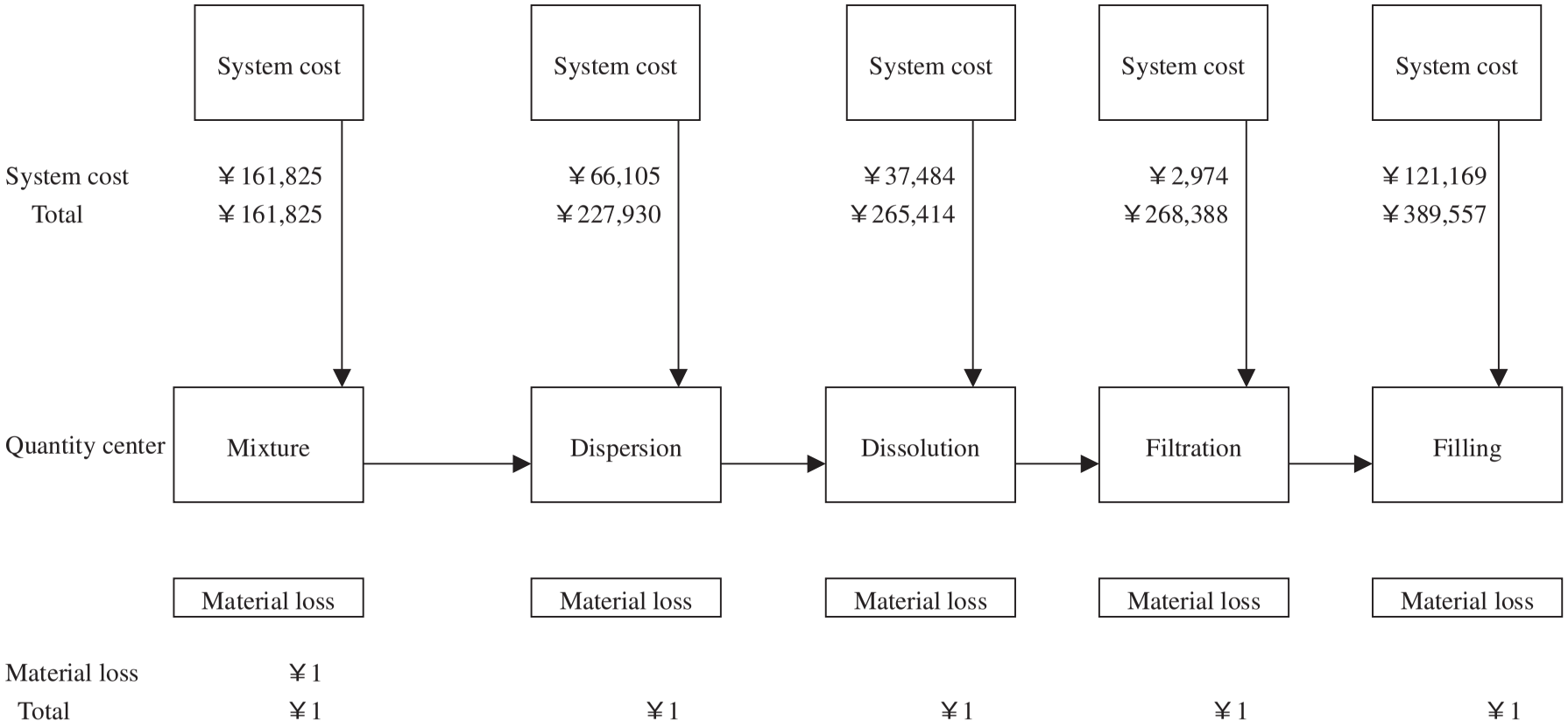

Fig. 2-2 Nippon Paint System Cost Flow Chart

Flow Chart (delivery/waste disposal･energy costs)

Nippon Paint

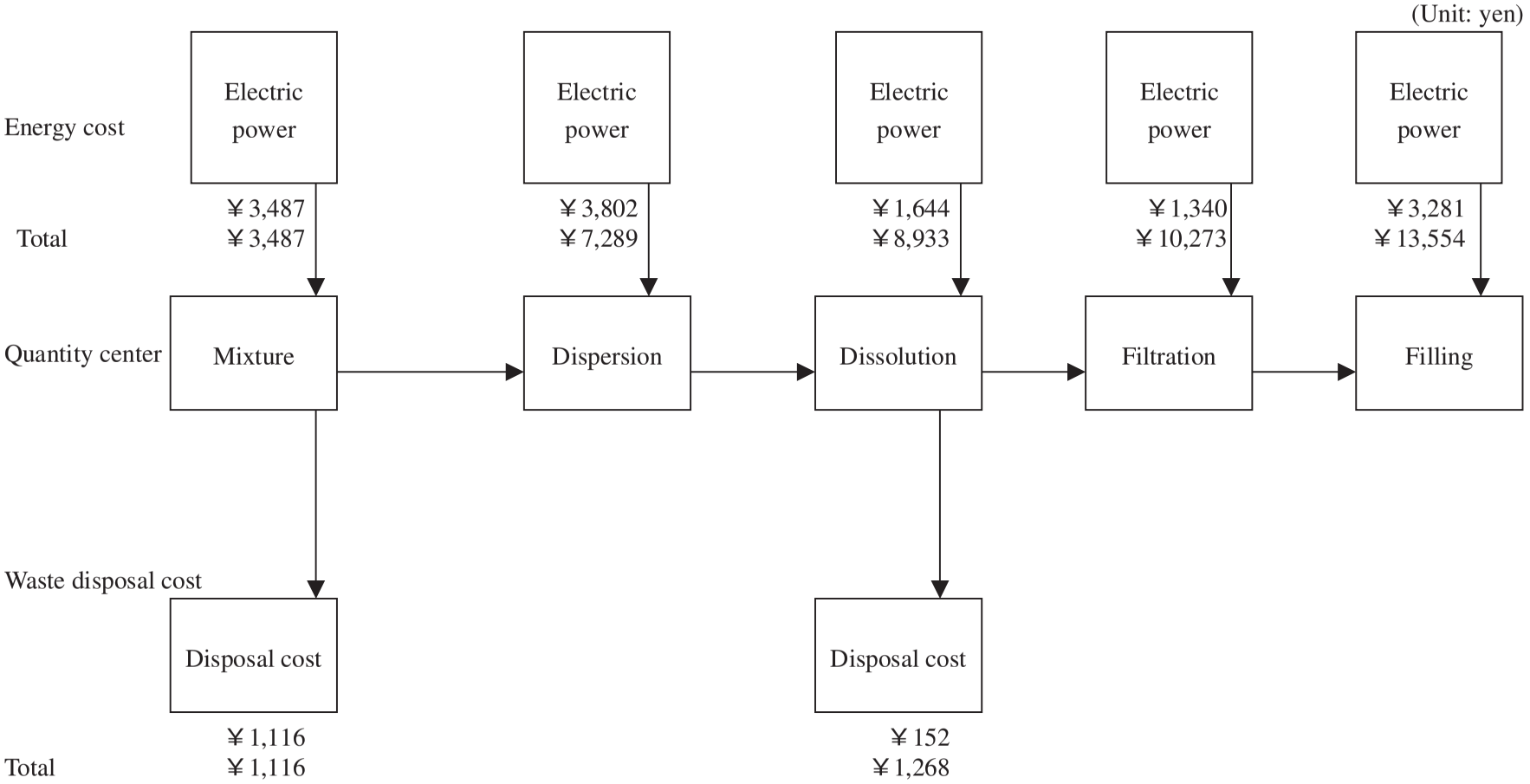

Fig. 2-3 Nippon Paint Delivery/Waste Disposal･Energy Costs Flow Chart

Flow Cost Matrix

Nippon Paint

(Unit: yen)

Quantity center	Mixture	Dispersion	Dissolution	Filtration	Filling	
Input						Total
Material cost	¥2,469,749	¥ 74	¥1,002,299	¥ 0	¥ 0	¥3,472,122
System cost	161,825	66,105	37,484	2,974	121,169	389,558
Energy cost	3,487	3,802	1,644	1,340	3,281	13,554
Subtotal	¥2,635,061	¥ 69,981	¥1,041,427	¥ 4,314	¥124,450	¥3,875,233
Material loss						
Material cost	¥4,609	0	156	124	28	4,917
System cost	1	0	0	0	0	1
Waste disposal cost	1,116	0	152	0	0	1,268
Subtotal	¥5,726	0	308	124	28	6,186

	Material cost	System cost	Energy cost	Waste disposal cost	Total
Product	3,467,205	389,556	13,554	0	3,870,315
Material loss	4,917	1	0	0	4,918
Packaging	0	0	0	1,268	1,268
Total	3,472,122	389,557	13,554	1,268	3,876,501

Material loss cost ratio 0.127% (total material loss cost/total costs)
0.137% (disposed material loss/total material cost)

Fig. 2-4 Nippon Paint Flow Cost Matrix

Case Study II : Shionogi & Co.,Ltd.

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1. Corporate Profile

Since its establishment in 1878, Shionogi & Co., Ltd.[1] has continuously supplied pharmaceutical products for medicinal and other uses. Its company policy, "Shionogi constantly strives to provide medicine of the best possible kind essential for protection of the health of the people", was established in 1957. According to its corporate information as of the end of March 2002, the company has 21,279 million yen in capital, annual sales of 206,403 million yen, and 5,237 employees. Through its conscientious attitude toward science and its conduct based strictly on ethics, the company strives to fulfill its responsibility in the best possible way as a company that operates in areas closely related to the life and health of the people.

The company's effort in environmental conservation is milestoned by its establishment in 1971 of its emissions treatment policy for preventing pollution and its establishment in 1994 of Shionogi's Basic Environmental Policy. In addition, the company defined the goals of its company-wide environmental activities in Phase 1 of the Environmental Protection Plan in 1995 and Phase 2 of the Environmental Protection Plan in 2000. Shionogi, as it operates in the pharmaceutical field, strives to protect the global environment, prevent pollution, safeguard people, and reduce environmental impact.

Harmonious relationship with society is one of the aims expressed in Shionogi's Basic Environmental Policy. In the context of this aim, the company has been actively disclosing its environmental information in the form of environmental reports since 2000. Shionogi believes that for the company to perform its environmental activities effectively and efficiently with limited resources, it must have a tool that facilitates the evaluation and validation of the effectiveness of such activities. The company, therefore, has introduced the concept of environmental accounting to its activities since its first publication of environmental data in an environmental report.

The company regards Material Flow Cost Accounting (MFCA) as a useful means for corporate management in the context of environmental accounting. In the recent trial project, the company implemented MFCA as a means for reducing its environmental impact and production cost at one of its factories, where the entire pharmaceutical production process was subdivided into the processes of synthesis, formulating, and packaging. The project team included the following members:

Project team configuration:

Head office	
Environmental Management Unit	2 people
Accounting and Financial Dept.	1 person
Factory	
Factory Chief	3 people
Drug substance personnel	3 people
Formulating and packaging personnel	2 people
Energy (utilities) personnel	1 person
Logistics and warehouse personnel	1 person

2. Project

2.1. Preliminary activities

The preparations and examination for the trial implementation of MFCA started in July, 2002. In

1) For more information about the company, visit their Web site at: http://www.shionogi.co.jp/index_e.html

late July, the team visited the Kanegasaki Factory to explain the trial project and to study the production processes on site.

1) Discussions before the factory visit

On-site observation of material flow is essential for the introduction of MFCA. However, the Kanegasaki Factory, the target of our study, is located in Iwate Prefecture, a considerable distance from the company's head office at Osaka, as well as from the IGES Kansai Research Center at Kobe. This made it difficult for the research team to pay frequent visits to the factory. The research team decided to visit the factory only once. The research team, before visiting the factory, obtained as much information as possible through hearings from Shionogi's Environmental Management Unit at its head office. Through repeated meetings, the team learned the details of pharmaceutical production processes using existing flow charts and identified issues that would require on-site investigation.

In these meetings, we learned about three categories of values that could be used for calculating the mass balance at each quantity center. These are: measured values; standard values (target values) derived from measured values; and theoretically-derived ideal values. We discussed these categories of values and their suitability in material loss calculation. Generally, at a chemical company, it is possible to keep track of both the theoretically-derived ideal values and the experiment-based standard values. For the present project, we decided to include the ideal values in the scope of our analysis. We also discussed the system cost such as electric and other utility costs, depreciation cost, and labor cost, in order to define the portion of such costs that should be included in our analysis.

Concurrently with these discussions that preceded our visit to the factory, Shionogi's Environmental Management Unit at head office used existing data to produce prototype MFCA flow charts. They gave some special features to the flow charts to improve their usefulness in our research project. For example, tracing the original materials from the products of chemical reactions was made easier.

2) On-site meeting (factory visit)

In late July, the research team visited the Kanegasaki Factory with data prepared at the preliminary meetings. At the factory, we walked through the production processes in the order given in the flow charts, receiving explanations from the people in charge of each process. We collected information and summarized them as we discussed with the factory personnel the points raised at the preliminary meetings. At the same time, we were made aware of some issues that would require further examination. This experience of actually seeing the production processes allowed us to understand the flow charts in a three-dimensional way, helping us to clarify issues. Additional issues were raised at the factory as we looked at the utility supply facilities, warehouse (storage/logistics) facilities and waste disposal /recycling facilities. In our discussions about the material loss calculation, we came to an agreement that measured values should reflect losses by quality control sampling and losses by accidents.

We revised the flow charts based on the results of these discussions. In this process, actual values were clearly distinguished from estimated values (interpolated /extrapolated values). We produced new flow charts for utility cost and system cost.

3) Review meetings

For three months after the factory visit, we held meetings roughly on a monthly basis to continue our discussions based on the revised flow charts and newly-collected data. From November, we started to meet approximately twice a month to complete the flow charts inclusive of cost data and to identify issues that required further examination. We completed the cost-inclusive flow charts in early January. We held several meetings to produce the presentation data from the complete material flow data prior to our presentation at the international symposium on January 31.

The most important issue discussed in our meetings was the evaluation of costs for the products of chemical reactions. When chemical reactions are involved, it is arguable whether it is appropriate to calculate the cost based on the mass ratio as is done usually in MFCA. Considering the chemical compositions of purchased raw materials and the nature of chemical reactions that take place in the production processes at Shionogi, we came to the conclusion that it would make the evaluation more useful for corporate management decision making if we evaluated the cost of different materials not simply by their mass ratios,

but in consideration of how the raw materials, purchased by Shionogi, were manufactured. Making such a consideration in the evaluation would require information from the suppliers, such information as the cost of materials used to produce the materials supplied to Shionogi. Thus, the feasibility of expanding the scope of MFCA to include the entire supply chain became another topic that required further exploration.

Our trial project covered the manufacturing flow of one particular pharmaceutical product, comprising a serial production process of drug substance manufacturing, formulating, and packaging. We investigated all the processes from the importing of materials to the factory to the export of products from the factory. We investigated the sewage processing facilities as well. The material flow data per batch was calculated from data of plural batches.

The complete production process is composed of three processes. The first is a drug substance manufacturing process for the synthesis of a drug substance; the second is a formulating process for molding the drug substance into tablets or granules; and the third is the packaging process. We defined several quantity centers for each process. The manufacturing process included quantity centers at the points of reaction, extraction, separation, drying, and so on; the formulating process at the points of palletizing, molding, and so on; the packaging process at the points of filling, packaging, boxing, and so on.

In our effort to determine the mass balance at different points in the production process, we took advantage of a large amount of existing data on the material quantities, which had been recorded and summarized by Shionogi for different purposes. Such data was readily available because pharmaceutical manufacturers are required to produce a "manufacturing control standard code" and other documents defined in the "Good Manufacturing Practice (GMP)" issued by the Japanese Ministry of Health, Labor and Welfare. In addition, Shionogi had master formulas that described details of production processes and defined mass balance for each production process in terms of the names and quantities of input and output materials. Shionogi was experienced in the process of revising the mass balance information with changes in the production process. For the implementation of MFCA, however, it was necessary to enable matching between output materials and input materials.

In the trial project, our task was to complement existing data with newly-collected data and then reevaluate the existing mass balance information using MFCA. Since Shionogi's master formula documents contained data on material quantities only, we strived to find possibilities for further improvement (Kaizen) by associating the outputs with the inputs and their costs using the MFCA methodology.

2.2. Data collection

With regards to the manufacturing, transportation, storage, waste disposal, and sewage processing, we collected data on the material flow, material cost, energy consumption/cost, and labor cost. With regards to the production facilities, we collected data on the depreciation cost, repair/maintenance cost, and the cost for consumables.

Before calculating the material cost, we determined the material flow in different production processes beginning with input materials, referring to the material balance information in the master formula documents and complementing it as required by measured values or values estimated from theoretical values. The material cost of the products of composition or decomposition that arise in the production process was initially calculated from the cost of input materials based on the mass ratio, as is usually done in MFCA. The validity of this method, however, was a subject that required further examination during the project. In areas where no data existed, we collected data during the project. For example, we collected data on the weight of packaging materials that were used with the input materials and later discarded.

With regards to the energy consumption and utility cost associated with production, we sorted out data on the consumption of resources such as electricity, water, and steam. At the same time, we evaluated the energy consumption associated with the transportation and storage of raw materials, intermediate products, and end products by measuring the amount of energy consumed by trucks, forklifts, elevators, refrigerators, and so on. Labor cost was determined separately for the individual areas of drug substance manufacturing, formulating, packaging, waste disposal, sewage processing,

and transportation. In addition, we collected records on the facility's depreciation cost, repair/maintenance cost, cost for consumables, and commission for having the waste disposed.

The mass per lot in drug substance manufacturing differs from the mass per lot in formulating and packaging. When combining different sets of data to prepare the basic data for MFCA, the material quantity and cost data pertaining to formulating, packaging, and utilities were adjusted to match the mass per lot in drug substance manufacturing.

2.3. Creating flow charts with data

In MFCA, it is basic to trace the flow and stock of materials within a company starting from the input materials that were brought to the company. Even though this approach is characteristic of MFCA, its validity is questionable when the production process involves chemical reactions; the question is whether it is appropriate or not to always evaluate quality product and material loss in terms of input materials. One of the aims of our project was to address this open question about the MFCA technique.

If the production process involves the emission of carbon dioxide (CO_2), for example, the application of MFCA theoretically requires the evaluation of the carbon dioxide in terms of the input materials that contained its components, carbon (C) and oxygen (O). In cases where a chemical reaction produces output materials that are entirely different in physical properties from the input materials, the calculation of material cost for quality product and material loss becomes problematical. We addressed this problem in our project and found a way toward its solution.

MFCA can make available a wide range of information that was not available before, among which is the information about the generation of carbon dioxide. With MFCA, it is possible to identify the locations at which the carbon dioxide is generated, measure the amounts of carbon dioxide generated at these locations, and determine the costs thereof. Such environmental information is valuable for a company in determining its strategy for overall and local reduction of carbon dioxide emission.

Figure 1: Material cost flow chart

In the flow chart, the drug substance manufacturing process is broken down into the processes of synthesis, post-processing, and purification, for each of which we defined a quantity center. Even though it may seem in the flow chart as if each of these processes had its own retrieval process, there exists in reality only one integrated retrieval facility for the entire drug substance manufacturing process.

Figure 2: System cost flow chart

The system cost includes the facility's depreciation cost, repair/maintenance cost, cost for consumables, and labor cost. We identified the system cost and distributed it by the material cost.

Figure 3: Utility and waste disposal cost flow chart

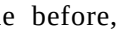
The utility cost includes the costs of electricity, steam, water, and the fuel for vehicles used for transportation inside the premises.

Figure 4: Flow cost matrix

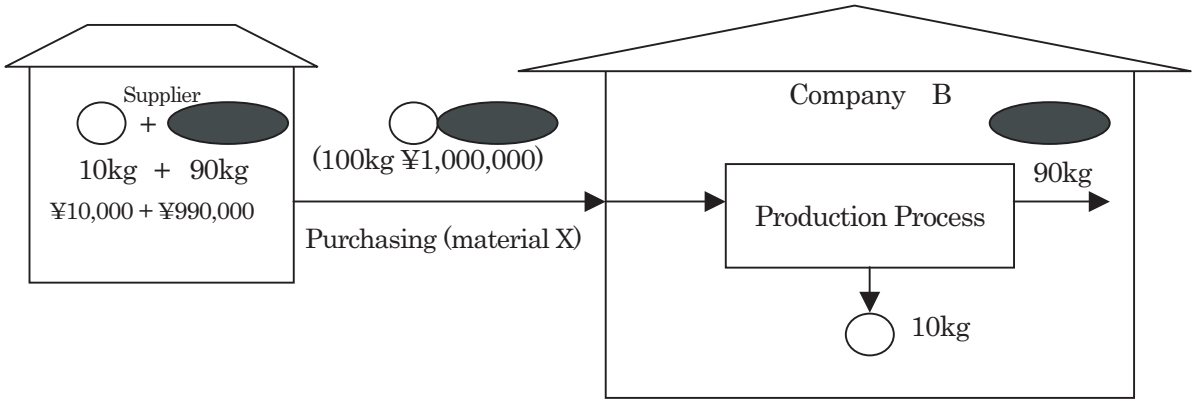
2.4. Evaluation of the implementation results

1) Calculation of material cost in cases that involve chemical reactions

In the given case, 100kg of material X purchased for 1,000,000 yen yields 90kg of quality product and 10kg of material loss. If we are to distribute the material cost of 1,000,000 yen by the mass ratio, the cost associated with the quality product and the cost associated with the material loss are 900,000 yen and 100,000 yen respectively.

However, in chemical industry, the purchasing cost of input materials is decided and negotiated with the supplier in consideration of their compositions. In the given case, for example, the material "○" serves only as the protector of the material "  " and its actual price is as low as 1,000yen per 1kg. In a case like this, it is inappropriate to distribute the material cost by the weight ratio. The cost associated with the material loss (the cost of the later-discarded material "○") should be corrected to 10,000 yen per 10kg.

We followed this principle in our trial project. Even through we traced all the discarded materials back to their sources; we determined their costs not by their weight but their estimated purchasing prices based on their composition.



This approach required information about production processes at suppliers. Thus, our project revealed the need for and potentiality of expanding the scope of MFCA to the entire supply chain.

2) MFCA information (unit: thousand yen)

	Material cost	System cost	Utility cost	Waste disposal cost	Sum
Product	8,866	2,196	115	—	11,177
Material loss	3,150	145	11	28	3,335
Material loss breakdown: Recycled	1,417	—	—	—	1,417
Material loss breakdown: Abandoned	1,734	—	—	—	1,734
Sum	12,017	2,341	126	28	14,511

Material loss rate:
26.2% (material loss cost per total material cost)
Abandoned material rate:
14.4% (abandoned material cost per total material cost)
Material loss cost rate per gross costs:
23.0%

The conventional method of material control at Shionogi has been to measure the actual yield and compare it with the standard yield in terms of quantity. This comparison is done for each end product in the drug substance manufacturing process, formulating process, and packaging process. MFCA allowed the company to understand the yield with cost broken down to processes. The company may use this process-based cost information to improve its processes.

3) Process-by-process measurement of carbon dioxide production and its significance

a. Effects of the Kyoto Protocol and the obligation of industry to reduce their carbon dioxide emission

In June, 2002, Japan ratified the Kyoto Protocol. Under the Kyoto Protocol, which will come into effect soon, Japan is obliged in the period between 2008 and 2012 to reduce its global warming gas emission by 6% from its 1990 figure. The Guideline of Measures to Prevent Global Warming defines Japan's step-by-step legislative approach toward achieving this reduction. The Guideline defines the period up to 2004 as Step 1, the period dedicated to the evaluation and review of various measures. Concrete measures will be enforced in the Step 2 period from 2005.

Following the effectuation of the Kyoto Protocol, especially from the outset of the Step 2 period, the reduction of carbon dioxide and other global warming gas emissions will be an important issue for corporate management. For a company to be able to make evaluations about concrete measures, it will have to produce a main inventory of carbon dioxide emission in different sectors of its activities. According to the GHG Protocol, which aims at standardizing the methods adopted by corporations for calculating and reporting their emissions, companies should make a distinction of emission sources of different categories. Sources and causes of direct emission, for example, should be divided into the following categories: production of electricity, heat, or steam; physical or chemical manufacturing processes; transportation of raw materials, products, wastes, or employees; and temporary emission sources.

For a company to be able to promote global warming countermeasures without losing their competitiveness through extraordinary expenditures, it has to be aware of the maximum amount expendable for various measures including the sales or purchase of a portion of the emission allowance. Each company must pursue economical efficiency when carrying out measures for reducing its emission of global warming gases. Comprehensive evaluation of various measures in terms

of economy is a prerequisite for decision making.

b. Control and evaluation of carbon dioxide emission by material flow charts

Generally, a major proportion of carbon dioxide emission in corporate activities is associated with the use of energy. In the steel industry, cement industry, and some other industries, however, a large amount of carbon dioxide is generated from reactions taking place in production processes, which must be measured and reduced. Even in other industries, there are many physical and chemical processes that produce carbon dioxide.

It is certainly significant to consider the application of MFCA to such production processes in order to control carbon dioxide generated in each process. When applying MFCA to such processes involving chemical reactions, it is important that we analyze the input materials down to the molecular level. In the trial project, we traced the origins of the quality product and its material loss all the way back to the molecules of the input materials using source material identification numbers.

Combining cost data and quantity data with MFCA enabled cost-wise evaluation of carbon dioxide emission.

2.5. Issues for further exploration

In the trial project, we determined the amount of carbon dioxide generated by chemical reactions at different points (quantity centers) in the production process by using material flow charts and identified the origin of carbon dioxide at each of the points in terms of the input materials that included the carbon which reacted with oxygen to produce the carbon dioxide.

In the trial project, we calculated the material cost associated with the resulting carbon dioxide based on the purchasing cost of the input materials that contributed to its formation, even though MFCA generally demands the cost of input materials distributed to the cost of quality product and material loss be based on the mass ratio. If we were to follow this convention in MFCA, the cost calculation for the products of chemical reactions would have required the distribution of input material cost according to the molecular weight of their elements. We questioned the appropriateness of this method when the process involved a chemical reaction that totally changed the physical properties of the materials. If such common products as H_2O and CO_2 are formed in a chemical reaction involving an expensive input material, for example, the distribution of input material cost by molecular weight would attach them a cost much higher than their ordinary manufacturing cost or purchase cost. Another problem with this cost distribution method is that it can largely give different costs for the same substance if it is derived from different input materials or different purchasing prices. The usefulness of information resulting from this cost distribution method in corporate management, therefore, is questionable. Therefore, we deemed it more appropriate to choose a cost distribution method based not on the molecular weight, but on the manufacturing method and cost of the associated input materials.

In MFCA, carbon dioxide is definable as one of the output materials from a production process involving a chemical reaction. MFCA, therefore, allows a company to locate the sources of carbon dioxide and identity its quantity and costs. Such information is valuable because it can help the company make an intelligent decision about environmental management.

In the trial project, we paid attention to the carbon dioxide produced in the production process by reactions involving raw materials. Our project has successfully demonstrated the MFCA's ability to supply information that helped the company make environmental management decisions. With regards the reduction of carbon dioxide emission. MFCA can help the company identify its location or sources, as well as its quantity and associated costs.

We believe that more detailed and more useful environmental management information can be made available in future by adding quantity data and cost data about carbon dioxide emissions from other categories: emissions caused by energy use, transportation, and so on. Even though every company is already making efforts to obtain data about its own emission of chemical substances to the air and water under the Pollutant Release and Transfer Register (PRTR) and other requirements, it is rare that a company has data on the cost associated with emissions in addition to data on the quantity of the emissions. We expect further applications of MFCA to include substances

other than carbon dioxide and the use of resulting information for cost-efficient implementation of eduction measures.

Our experience in the trial project that applied MFCA to a production process involving chemical reactions has shown that correct financial evaluation of such a process should involve the evaluation of upstream and downstream processes, or even of the entire supply chain. The availability of information about upstream processes is particularly important because it enables the feedback of useful information to upstream suppliers. The implementation of MFCA to the entire supply chain will be an important step that should be taken in the near future for simultaneous pursuit of economic and environmental efficiency.

We expect the MFCA flow charts to be used in the near future as a valuable tool for gaining environmental management information and a reference for tasks such as the analysis of measured and theoretical values, comparison with and analysis of financial accounting data, and the examination of Kaizen plans.

Our trial project addressed the new challenge of using MFCA for obtaining data about carbon dioxide and other global warming gas emissions, the importance of which has rapidly increased in recent years. For a company that handles materials that produce such gases through a chemical reaction, a MFCA system can be help in locating the sources of emission and quantifying the amount of emission at different locations. Such data is useful for a company when it has to decide on global warming gas reduction measures or about the sales or purchase of a portion of the emission allowance. The supply of such data is one of the most important tasks in our ongoing research about MFCA, successful execution of which will contribute to the national project for global warming gas reduction.

Figure 1 Material cost flow chart (unit: thousand yen)

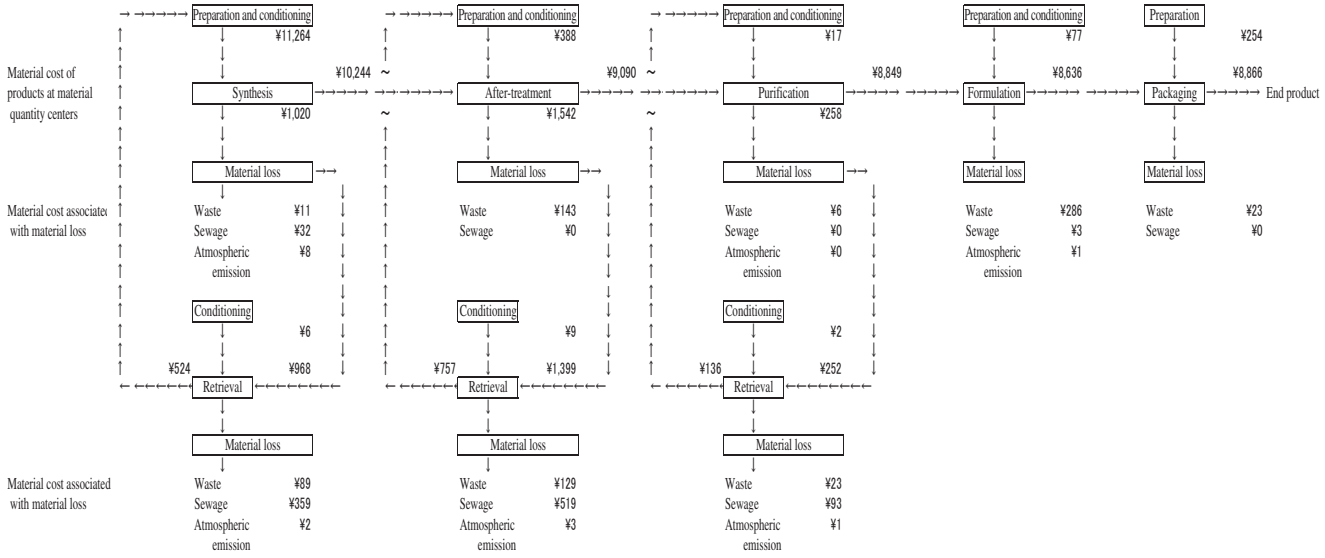


Figure 2 System cost flow chart (unit: thousand yen)

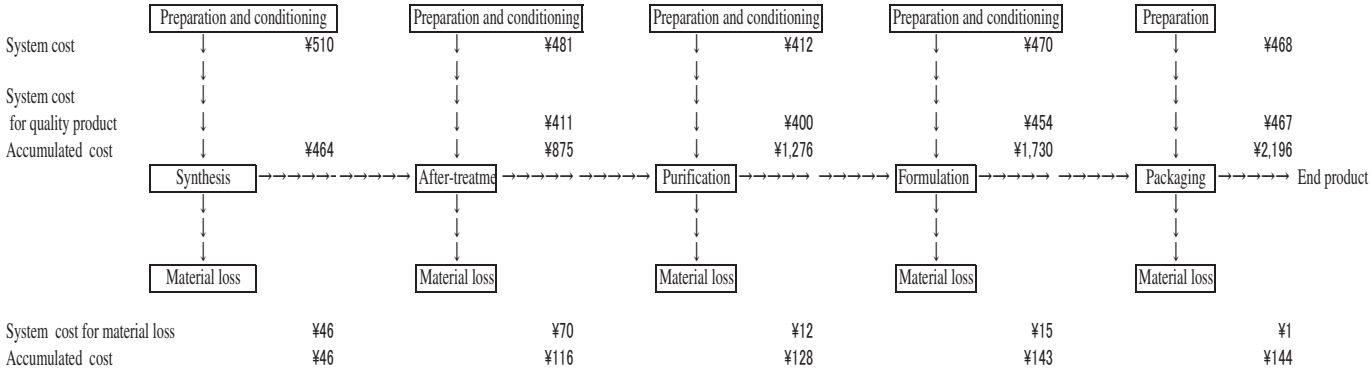


Figure 3 Utility and waste disposal cost flow chart (unit: thousand yen)

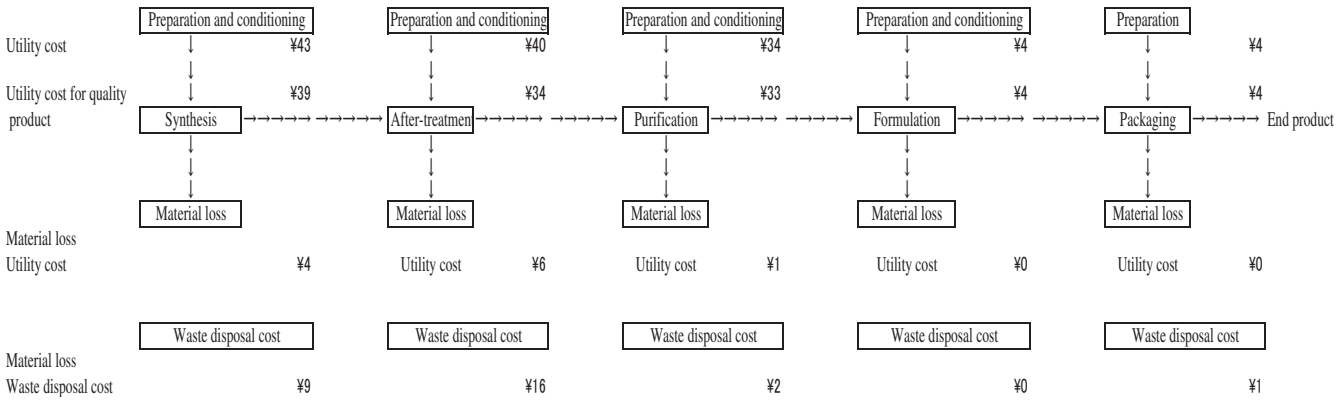


Figure 4-1 Flow cost matrix (unit: thousand yen)

	Synthesis	After-treatment	Purification	Formulation	Packaging	End product
Input:						
Material cost	¥11,271	¥397	¥19	¥77	¥254	
System cost	¥510	¥481	¥412	¥470	¥468	
Utility cost	¥43	¥40	¥34	¥4	¥4	
Subtotal	¥11,823	¥918	¥466	¥550	¥726	
	¥0	¥0	¥0	¥0	¥0	
Material loss:	¥0	¥0	¥0	¥0	¥0	
Material cost	¥1,026	¥1,552	¥260	¥290	¥23	
(recycled)	¥524	¥757	¥136	¥0	¥0	
(abandoned)	¥503	¥795	¥124	¥290	¥23	
System cost	¥46	¥70	¥12	¥15	¥1	
Utility cost	¥4	¥6	¥1	¥0	¥0	
Waste disposal cost	¥9	¥16	¥2	¥0	¥1	
Subtotal	¥1,085	¥1,643	¥275	¥305	¥25	

Figure 4-2 Flow cost matrix (unit: thousand yen)

	Material cost	System cost	Utility cost	Waste disposal cost	Sum
Quality product	8,866	2,196	115	–	11,177
Material loss	3,150	145	11	28	3,335
Material loss breakdown: recycled	1,417	–	–	–	1,417
Material loss breakdown: abandoned	1,734	–	–	–	1,734
Sum	12,017	2,341	126	28	14,511

Material loss rate: 26.2% (Material loss cost per total material cost)
Abandoned material loss rate: 14.4% (Abandoned material loss cost per total material cost)
Material loss rate per gross costs: 23.0% (Material loss cost rate per gross costs

	System cost	Utility cost	Waste disposal
Synthesis	510	43	9
After-treatment	481	40	16
Purification	412	34	2
Formulation	470	4	0
Packaging	468	4	1

	Input	Quality product	Abandoned waste and emission	Recycled
Synthesis	11,271	10,244	503	524
After-treatment	397	9,090	795	757
Purification	19	8,849	124	136
Formulation	77	8,636	290	0
Packaging	254	8,866	23	0

6

Panel Discussion Part-2

"How will Material Flow Cost Accounting Contribute to Better Eco-Efficiency?"

How will Material Flow Cost Accounting Contribute to Better Eco-Efficiency?

Coordinator:

Katsuhiko Kokubu	Project Leader, IGES Kansai Research Center Professor, Graduate School of Business Administration, Kobe University

Panelists:

Michiyasu Nakajima	Associate Professor, Faculty of Commerce, Kansai University
Bernd Wagner	Professor, University of Augsburg, Germany
Robert B. Pojasek	Adjunct Professor, Harvard University/ President, Pojasek & Associates
Jun Okajima	Manager, Finance & Accounting Department, Nippon Paint Co.,Ltd.
Yoshitsugu Kokuryo	General Manager, Environmental Management Unit, Shionogi & Co.,Ltd.

Kokubu

Now let us begin the panel discussion, the last part of the symposium. We have had a number of fruitful presentations since this morning and this panel discussion will be the conclusion for the day. With distinguished speakers from session 2 and speakers of the two case studies of MFCA invited as panelists, we shall begin the discussion.

During the break, we collected the questionnaires. We are glad to have received many more questions than we expected. Since we are not able to address them all, I will choose several for the panel discussion. If your question was not answered during the panel discussion, please remember that Dr. Pojasek and other panelists are willing to respond to your questions by e-mail.

As reported earlier, speakers from two companies made presentation respectively about their attempts to implement MFCA at their plant. I would like to invite Prof. Wagner from Germany and Dr. Pojasek from the USA to speak shortly about the impressions from these presentations.

Prof. Wagner, would you speak first?

Wagner

I have been to both companies and I expected to come to Japan having lot of experience in this area and show people what and how to do it and how to improve on their method. I found out I can learn just as much as they can learn from my knowledge. These were pioneer experiences in the two companies I visited. They were not on a too big scale, so it's not too complex to introduce the method and learn from it. We use some common instruments like we all do the material flow chart and we use the same metrics including material costs, system costs, and disposal costs. But all the projects produce new developments and new ideas which improve the method, which we are very interested to share, and where we can maybe have in future joint projects to develop this method on an international basis.

Kokubu

Thank you. Dr. Pojasek, would you please speak next?

Pojasek

I had an opportunity to learn about these case studies for the first time in a pre-conference workshop. I was very impressed with the excellent work.

From the materials presented, there seemed to be a focus on the main process in each case. In many cases, the supporting processes can have more wastes and costs associated with them than the main process. In the case of Nippon Paint, there would be the costs of cleaning the tanks and pipes. What are the reformulation costs associated with a bad batch of paint? What are the costs to treat the wastewater, the disposal of the paint filters, the maintenance of the equipment, the laundry of the workers' uniforms, and the clean-up associated with the "pigging" operations? These supporting processes also use energy, water, and

materials. When you are cleaning the tanks, the company cannot be making another batch of paint. This also represents an indirect cost to the operation. There are many supporting operations in a batch process like this one. I realize that they captured many of these costs. The Resource Accounting Sheets and the Activity Accounting Sheets in the Systems Approach helps to keep track of these supporting processes and makes certain that their costs are properly allocated to the specific work step(s) that are responsible for these costs. By looking at the whole "system" from both a resource and indirect activity perspective, there may be many additional opportunities to improve the process. I really enjoyed Nippon Paint's last slides where they stated that they are striving for ZERO EMISSIONS. That is a wonderful proclamation and goal. I hope many other companies follow their excellent example!

Shionogi & Company can also benefit from the use of the Systems Approach. Their process information can be readily converted into a hierarchical process map. Using the Resource Accounting Sheets and the Activity Accounting Sheets, it is possible to link all the supporting process to the work steps in the main process that are responsible for them. In this way, the systems costs can be evaluated with much more accuracy. Quality control (laboratory waste costs) and recycling are examples of supporting processes in their operations. There are many activity costs associated with obtaining and maintaining permits from the government.

Shionogi has made an excellent start to look at the transportation costs associated with the interface with their suppliers. Their suppliers could use the Systems Approach to lower their own costs and look for opportunities to better service Shionogi & Company. Shionogi & Company could also use the Systems Approach to better service their customers. Could they deliver the pharmaceuticals to the customer in smaller blister packs or some other form? The answer to this question would change many things back at the factory. The Systems Approach helps a company ask these questions and look for a wider variety of opportunities to improve.

It is important to consider that management does not like us to be changing any of the main processes. They may think that these are working just fine. However, they do not have the same opinion of the supporting processes. Usually it is easy to make changes in these processes. This kaizen in supporting processes helps to save money and build trust in the Systems Approach. After a couple of years, the focus of the program can shift to the main process while further improvements are being made in the supporting processes. In the case companies, the management has been enlightened by letting them address issues in the main process. These cases were excellent. I am very impressed with their work.

Kokubu

Thank you. We have heard comments from Prof. Wagner on the two companies' efforts to implement MFCA from a German point of view, praising them as excellent pioneering activities. Dr. Pojasek gave valuable comments from a systems approach standpoint, inviting us to be aware of the possibility of making new discoveries as we divide a process into supporting processes.

Through various projects, we have been trying to introduce MFCA methodology developed in Germany into Japanese companies with the aim of improving their eco-efficiency and cost reduction. In the USA, Dr. Pojasek pursues the same goal but with a new different methodology of his own development. One of the great significance of this symposium is to discuss over the integration of these two different methodologies.

Mr. Okajima (Nippon Paint) and Mr. Kokuryo (Shionogi), would you like to respond to the comments from Prof. Wagner and Dr. Pojasek?

Okajima

I would like to thank Prof. Wagner for praising the new ideas of our projects. One particular achievement in our project is our realization about the importance of the power factor as a result of improving energy loss.

In relation to the comment from Dr. Pojasek, I would like to add some practical details about the cleaning cost. For the calculation of cleaning cost, we have chosen the example of a water base paint manufacturing process, in which some materials are

retrieved for reuse in later production of the same paint. The labor cost and labor hours associated with the cleaning process were taken account of in our material flow cost calculation.

As to the Dr. Pojasek's comments on our concept of zero emission, it has been set as our goal of environmental management.

Kokubu

Thank you. Mr. Kokuryo, would you please speak next?

Kokuryo

Concerning comment from Prof. Wagner, with regard to the calculation of material flow cost, I became more convinced that the price ratio of cost contribution out of chemical reaction is more efficient than that of conventional weight ratio. Dr. Pojasek mentioned various types of costs, some of which may not have been addressed in our calculation. It made us realized that we had not taken account of the sampling cost and the cost for maintaining the test facility, for example. In the future, we would include a wider range of data in our calculation, which will facilitate us identifying the targets for further improvement and cost reduction. Thank you.

Kokubu

Thank you. Mr. Okajima and Mr. Kokuryo have responded to the comments from Prof. Wagner and Dr. Pojasek. Now I wish to remind you of one important point in Dr. Pojasek comments.

Dr. Pojasek has pointed out that management is often reluctant to change the main processes but open to changes in the supporting processes. As I understand, Dr. Pojasek has emphasized the validity of process mapping in breaking down the supporting processes into details so that possible improvement can be identified. The improvement of such details may lead to the improvement of the main processes.

Based on my research on MFCA and my experience with Japanese companies, I am quite convinced that MFCA has potentiality of supplying valuable information with main processes not just with supporting systems.

Prof. Wagner, could you give us some comments on this?

Wagner

This is true. We see a slight difference between a normal or general process-oriented approach and the material flow approach. The slight difference is that we take as core process, the material flow, and this material flow can give the supporting processes and all the other processes a structure and a logic. You find a lot of companies that do a process mapping and process orientation. But there's not a real logic behind how to select processes and which are the main processes and which are supporting processes. We feel in our project that the material flow can give to this whole thinking, a systematical approach and the material flow can be the core of everything. And everything can be structured around this. So this, I think, is the connection.

Kokubu

Thank you. Prof. Nakajima, do you have any comments on this?

Nakajima

As I previously compared the role of MFCA with that of a mirror, we would like it to reflect the entire real production process as much as possible. The systems approach proposed by Dr. Pojasek, on the other hand, first identifies problematical areas and then maps out processes starting from these areas. It is rare to find major environmental problems in main production lines from the standpoint of environmental load. Environmental problems, such as those related to the sewage treatment, air pollution and noise nuisance happen more often on the periphery, at points often described as the "end of the pipe." Problems appear to originate not from the main production lines but from the periphery.

The concept of MFCA is to find out hidden problems in company processes from the viewpoint of material flow. This explains why its primary attention is paid to the mass balance. It can be concluded that there is a distinct difference in starting point between the systems approach and MFCA.

However, MFCA and the systems approach share the same approach of seeing the comprehensive picture as a result of breaking down the process into details. The difference lies in the strategy, procedure and in

the starting point. It will be very interesting to see how these differences may contribute to the difference between the two methodologies.

Kokubu

Thank you.

We have received many comments and questions from the audience. Now let's address some of them to further develop our discussions on the topic.

To start with, I wish to address a comment from Mr. Anjo from Canon. In his comment, he explains that Canon sees its environmental management activities as a way to maximize its eco-efficiency and pursues developing eco-efficient products through cost-efficient production processes using what they call a "cell production method". Though independently from IGES, Canon also has been working on the implementation of MFCA. Here we have a precious opportunity to hear about their experiences.

Anjo

We started our experimental study on MFCA in 2001 within the framework of an environmental accounting project sponsored by the Japan Environmental Management Association for Industry, a research project assigned by the Ministry of Economy, Trade, and Industry (METI).

As we implemented MFCA to a lens processing at our Utsunomiya Factory, we found that one third of the materials were wasted as material loss. In other words, we were producing large material loss that worth a half of the amount of lenses that we supplied to the market, which was a very shocking news for us. We finally realized our ignorance about such wastefulness after more than 60 years of experience in manufacturing lenses.

For a long time, we have repeated many trials and errors in our attempt to define the economical value of the waste. MFCA gave us a clear guideline in this respect with its principle to evaluate the outputs based on the purchasing cost of the inputs. For example, it was difficult to measure the resulting carbon dioxide until we based the evaluation on the cost of energy (electricity) that we purchased to produce it. Similarly, it was difficult to measure the material wastes in polishing lenses until we divided the gloss material cost according to the weight of the wasted portion. Such methodologies are very understandable. We are now getting ready for company-wide implementation of such methodologies.

The second session of the today's symposium is titled "Environmental Management Accounting for Better Eco-Efficiency." This has been a surprising title because it coincided with the slogan of our environmental management, "maximization of our eco-efficiency".

In addition to lenses, Canon manufactures a wide range of products like toner, ink, copiers, and cameras. Different products may have different patterns of manufacturing processes. We wish to continue our efforts in reducing material loss and optimizing our eco-efficiency, thereby reducing the cost and saving energy.

Kokubu

Thank you for your valuable comments. If time permits, we shall come back to this topic for further discussion later on. Since we have received many questions about the earlier presentations, we now have to include some of them in our discussion.

We received some questions about MFCA, which was the subject of the presentations by Prof. Wagner and Prof. Nakajima. In addition, we have received almost similar number of questions about the process mapping method presented by Dr. Pojasek. Many of these questions include various topics for the discussion. Please allow me to choose some of the topics as we will not be able to cover them all in our discussion.

The questions we received fall generally into the following three categories: questions about the methodology of MFCA or process mapping; questions about a particular case; and questions about the application. Let us start with the questions about the methodology of MFCA.

Mr. Higashida from Kobe University raised a question about the relationship between information flow and material flow, a topic mentioned by Prof. Wagner. Though he raised a number of questions, this seems to me as the most important one: "Prof. Wagner has shown us information flow and material flow on the slides at the same time. Should these two types of flow model be produced by a company at the same

time? Or, should they be developed step-by-step independently from each other? Please explain the relationship between them."

Prof. Wagner, would you like to respond to this question?

Wagner

The way we approach this matter in the company projects is like this. We first start with the mapping of the material flows. Then we are interested to get closer information on each single material flow in terms of physical quantities and costs. We ask, "Where do we get this information from?" We look at the existing information systems because we don't want to get all new types of information which you have to collect by hand. We started mapping the existing information systems and we found out that it was a very useful tool to do a mapping of the information flows as well as we did it for the material flows.

This for us was a new experience too and for the people doing it in the company it was very interesting too because they discovered their own information flows on a visual basis and found things they did not know before. So we had a second tool suddenly develop, which we did not account for before when we started. We now could use both tools. We usually start with the material mapping and then we ask what kind of information in the information system is availing for the material flow. By this we improved the method for information flow mapping and improving, too. Today in some cases, especially in the service industries we also start with information flow mapping. I think this is the answer to your question.

Kokubu

Thank you. I appreciate your simple explanation to this very complex issue.

Mr. Tsuji from Kawasaki Heavy Industries raised another question about the methodology of MFCA. His question is about the necessity of paying attention to both energy flow and material flow. He says that energy has also much to do with the cost of environmental load. I think this question is related to the presentation by Prof. Wagner, Prof. Nakajima, and Mr. Okajima from Nippon Paint. Does any one of you wish to respond?

Wagner

We do both, but there's an interesting difference between the two. When we work with bigger companies, they have ERP systems, small and medium sized companies often don't have ERP systems but their own information systems.

In the general ERP systems like SAP, Baan, Oracle or others, you find information on material, on each article of material and you can get this information out of the ERP systems. For energy, it's different. You have an energy input bill, where you can get information. Maybe sometimes you measure energy in flows. Today we heard about the Nippon Paint Experiment, which is a very good example on how you can do this in detail. But generally you don't have very good information on energy flows in the ERP systems.

So, there's a difference in approaching it but you can do the both steps one by one like I pointed out before. You start mapping the energy flow, then ask what kind of information do I have in the information systems concerning these flows. On energy generally, you get the information from other sources, not out of the ERP system. After that, you start going into Kaizen and ask how to improve energy efficiency.

As Professor Nakajima pointed out, the information mapping and the material mapping is first of all a communication tool. We use it as a mirror to show people, "This is your reality." They look at it themselves and they ask themselves, "Is that true that at this point we used so much energy?" And they come up with their own ideas on how to improve this situation. We don't give them advice. We just mirror, this is your consumption at this point and this consumption at that point. They find the weak spots and initiate the improvement by themselves.

Kokubu

Thank you. We shall move on to the next topic.

In short, Prof. Wagner says that energy flow is one of the important items that can be analyzed using the basic methodology of MFCA.

Even though we received more questions about MFCA, now I would like to look at some questions

addressed to Dr. Pojasek. After looking at some questions about the methodology of MFCA, it seems appropriate to look at some questions about the methodology of process mapping.

Ms. Nakao from Kwansei Gakuin University raised a basic question about process mapping: "When we draw boxes in a process map, shall we do it based on the results of new mapping activities or can we do it at each center prior to the process mapping?" Dr. Pojasek, would you please respond to this question?

Pojasek

Most companies already have process information that can be converted into hierarchical process maps. Process flow diagrams, piping and instrumentation diagrams, and flow charts are all good sources of information to prepare a preliminary process map. In some cases, I use information found in the literature to supplement the information provided by the company. This helps me to formulate many questions that will be resolved in the verification activities. There are two advantages that can be realized by this conversion to hierarchical process maps:

First, the process maps are much less complicated and never have more than six objects on a page. This helps workers and management to better understand the process. Other forms of process information are very confusing to use to communicate effectively to others.

Second, hierarchical process maps can be computerized with object linking software. A company can have a "book of maps" that link the processes and all of the supporting processes in a large system. These linkages between processes and supporting processes enable a company to leverage its "lessons learned" so there can be breakthrough improvements.

I typically prepare the preliminary process maps before going to the factory. The maps are used to gather information and search for opportunities to improve the process during the verification activities at the factory. This verification activity can take two days at a smaller facility and up to a week at a larger, more complex facility. The company helps to gather the materials for the Resource Accounting and Activity Accounting Sheets. I have used this Systems Approach process mapping technique in some very complex operations and in some of the largest facilities of their kind in the world. I have prepared process maps for over 200 facilities. This process always teaches the people in the company new facts about their operations, especially with the linkages between supporting processes and the main process.

Kokubu

Thank you. As I understand, the uniqueness of this methodology lies in its basic procedure of continuously mapping out new boxes representing supporting processes for main processes.

Pojasek

Yes, this is true. However, the association between the main processes and the supporting processes is made visual. It is possible to allocate the resources used and lost by the supporting processes back to the work steps in the main process that are responsible for these uses and losses. Sometimes the main process can be changed to have a lesser need for a supporting process and still maintain its function. This can lead to resource conservation and lower waste.

There are many other uses of hierarchical process mapping. I think the visual nature of these process maps provide a better means of communicating the specific information from the process to all those who have an interest in the improvements that can be made in the process. From the point of view of material flow cost accounting, all the costs associated with the operation can be visually linked to specific work steps. It is at this lower level in the hierarchical process map where kaizen is applied. Furthermore, the uniform logic used in this process mapping methodology will help the users of material flow cost accounting to leverage and compare the results between processes and companies. All these things contribute to the uniqueness of this Systems Approach hierarchical process mapping technique with its Resource Accounting, Activity Accounting and Cost Accounting Sheets.

Kokubu

Thank you. Mr. Yoneyama from the Himeji Institute of Technology submitted a question in relation to this subject: "What would be a specific measurement for the process improvement that you mentioned? Does

the process improvement reach a higher level as the information system develops? What metrics has been used for measure the improvement?"

Pojasek

I am using a proven performance measurement technique known as the Baldrige performance excellence model. It is the same performance model used by the Japan Quality Award program http://www.jqac.com/Website.nsf/NewMainPageE?OpenPage This model is currently used in more than 60 countries, including the European Union. While you may recognize this model as an award program, the scoring of performance can also be used as a metric to track and trend process improvement. It has been demonstrated that companies that use this performance excellence model outperform financially the companies that do not use the model. This model scores a company in each of six performance categories and then scores the results separately before combining the scores within a 1000-point maximum.

The performance score increases as a company begins to provide links between the performance criteria categories. Further increases in the score occur with the company links its improvement efforts to the key business factors for the company. Integration of efforts and alignment with the business are very important drivers of performance and are reflected in this scoring methodology.

Remember that the performance score is a single number with no units. About 700 points out of a possible 1000-points puts a company in the excellence range. A company seeks to measure its continuous improvement using this score on an annual basis. Results (the large variety of environmental results are indicators that are volume and quantity driven) are scored by looking at the way the company plans for its results (planned versus actual), the way they are tracked and trended, and how they are benchmarked against other companies in the same business. Even the financial results from material flow cost accounting can be scored in this way. Remember, the actual results per se are not scored. Management never makes decisions on financial information in a vacuum. It has to be looked at in context. This performance excellence scoring method provides that context. Having a single score is about as simple as you can get. Everyone can understand this. It enables different sized companies in different sectors to be compared on a uniform basis. A larger company could score its entire supply chain and compare these scores against its own operations so the entire enterprise is improved. I have written a number of pages on performance metrics that can be found on my Internet site http://www.Pojasek-Associates.com.

Kokubu

Thank you. I think that Dr. Pojasek's comments can be summarized in the following way: Even though accounting people may prefer figures given in dollars, it is acceptable to score the performance improvement expressed in figures. Dr. Pojasek's advice on performance scoring seems to reflect his experience at the EPA.

In environmental accounting, it is very important in the context of internal management in particular, that we pay attention to the metrics used in the evaluation of a particular environmental issue or management issue and how the evaluation of such metrics influences decision making. Environmental information often appears in the form of quantity, which usually makes it difficult to be utilized effectively in decision making. Exactly for this reason, Dr. Pojasek's systems approach and MFCA both have more practical appeal. Mr. Okajima and Mr. Kokuryo, do you have any comments on this point?

Okajima

As Dr. Pojasek pointed out, the environmental indicators may not be much help in making corporate management decisions. Quantity information cannot help decision making unless it is interpreted. Our trial implementation of MFCA is our first attempt to introduce a tool for converting quantity information into financial information or cost information.

I have a question for Dr. Pojasek about the performance scoring. What is the score that we should ultimately get? Should we continue to make efforts until we achieve the full score of 100 points? Or, is it acceptable if we score 80 points?

Kokubu

Yes. The question is about the criterion for judging

the score. Dr. Pojasek, could you respond to this point?

Pojasek

There are 6 criteria for scoring the performance. They are: Leadership; strategic planning; other interested party involvement, information and analysis, employee participation, and process management. The company using this performance metric must demonstrate that they are responding in positive fashion to questions in each of these categories. The answers can be scored by independent examiners using a scoring guide that is available on the Internet. The entire process is transparent. After the scoring is complete (this includes the score for the results), a feedback report is provided to the company to show them their strengths and where there are opportunities to improve. In a performance program, the company selects the areas it wants to improve in. The more that is done, the more points they can receive. This is quite different from a "conformance" program like ISO 14001. In ISO, the company must do everything, but only to a minimal level. There is no extra credit given for going beyond this level. There is a big difference between performance and conformance.

Kokubu

Thank you. Mr. Ando from Kobe University has a further question on the same topic, the criterion for judging the targets using financial figures or scores. Such financial figures or scores are meant to serve as metrics for measuring the process improvement. Dr. Pojasek, Mr. Ando wishes to know if you have seen any cases in which such scores are used in such an extensive way, that they may affect the assessment of the performance of managers in charge and the benefits they receive.

Pojasek

Performance measurement includes financial results as a component of what it measured. It is far more comprehensive using performance than if you restrict your analysis to financial information. Several companies in the United States (including Baxter International, Intel, Motorola, Eastman Chemical and Boeing), drive their operational excellence programs with the Baldrige performance model. Their managers are compensated on how much improvement they can make in the performance score. Environmental professionals have not always been involved in these operational excellence programs. However, after the success of the Green Zia Program (a Baldrige model aimed at measuring environmental excellence and sustainability) in the state of New Mexico, USA, many more companies are beginning to see how they can use a prevention-based environmental program to build value in a company.

Kokubu

Thank you. We are now discussing matters related to intra-organizational procedures. I would like to invite other panelists to speak on this subject.

Kokuryo

At Kanegasaki Factory, where we recently conducted a trial implementation of MFCA, we had a similar experience to the one mentioned by Dr. Pojasek. At that time, we had a project team that specialized in energy conservation; they went to various sections in the factory with requests for improvement. With goals given in this way, however, we could not make as much progress as we expected. So we changed our policy, we encouraged people at production sites to make their own proposals and implement changes. We rewarded them for their accomplishments with incentives, monetary awards, and a special award from the division manager.

With such new system, people involved in production were able to make changes introducing their own ideas. This allowed them to perform experiments freely, for example, in the area of solvent recovery. This process consumes a great amount of steam as people in the chemical industry might be familiar with. We were using much more steam than was necessary to remove impurities from the solvent and lower them to a desired level. As a result of experiment, the following tasks were identified: reducing the solvent reflux ratio decreasing the heat consumption, and ensuring the quality of synthesized product. To carry out these tasks, not only the team in charge of the solvent recovery facility but all concerned personnel including the experiment staff cooperated, achieving

a drastic energy conservation which had been difficult to achieve earlier.

Kokubu

Thank you for the very concrete example of your experience. Prof. Wagner, do you wish to add anything?

Wagner

May I just comment on this one? You asked for possible consequences on salaries. We have examples like a company, Hilti, producing world wide drilling machines and similar equipment; they evaluate the performance of managers by a set of indicators. Maybe ten, and these indicators are visualized in form of a cockpit chart. You can see ten indicators on one page. Out of the ten indicators, six are economical indicators for performance measurement, the other four are environmental indicators. The managers salaries are linked to all ten indicators. This is very new company managers to be judged and rewarded by their environmental performance. Like amount of waste or energy consumption and so forth. What is important about this, it's not very easy to have an objective measurement even by environmental indicators.

For example, we used environmental indicators for benchmarking between companies or between operational plants in companies. If you want to compare indicators, let's say energy consumption per square meter, you have to be very clear how you measure these indicators. For example, square meters can be measured completely different. Do you include the walls? Do you include the hallway into the measurement? You can get quite different results.

Or if you compare indicators per capita, how do you count "capita"? How do you count your personnel ? Do you include part time personnel? We had one company that had permanent staff of 200 people from IBM consulting for the whole year inside the company. Do you include those? How about the employees of the cleaning company, working every day in the company, consuming water, energy etc.? It's not very easy though it seems easy to count the number of employees.

If you want to do benchmarking, you have to be very clear on how you set up the basis for your indicators. We did this for example, for banks, in order to do benchmarking with environmental indicators between ten European banks. It took them about half a year of intensive work just to agree on how to measure single indicators, how to measure per capita, how to measure square meters and so forth. So before you do benchmarking, before you vary salaries by indicators, one has to be very clear how to measure environmental performance, what indicators you use and how they are defined. After measuring physical indicators if you continue with cost indicators, like waste cost per unit or energy costs per unit, transferring physical indicators into cost indicators, this is even more difficult. Before you start the cost indicators you have to be clear on your physical indicators.

Pojasek

The way you score your indicators, and the way you score your results, is in this program. The Japanese National Quality Award, they don't care what your results are. The results are just for you. Here's what they care about. They care about, "Do you track and trend your results?", "Can you show a graph of your results?" and "Do you know why they go up and why they go down in every case?" If you do not know that, your score is low. But if you can explain all of those things, your score is high.

The next thing they look at is "Did you benchmark your results against other people in your industry?" There are some people that are very proud of the fact that they had a 70 percent reduction in something and everybody in their industry had an 85 percent reduction. Seventy percent looked very good, but when you benchmarked it, it was average to poor.

So, it's very interesting how they grade. They don't care what your results are but you do in your company. They score your results based on how you collected them, how you trended them, how you explained them, how you benchmarked them and you have to show continuous improvement of the results too and that gets a grade.

Again, I can take 40 pages of results from your company and give it a single numeric score. By the way, of the 1000 points, about 400 of them are for your results. So results are still the most important thing but the model does not care what your results are. I just want to know, "Do you really understand your

results and can you explain them and can you explain them in the industry?" Then you get a good grade.

Kokubu

Thank you. Unfortunately, we are getting short on time.

Mr. Yamamoto from IBM Japan has asked for examples of the systems approach applied in the area of environmental management. I hope that this request has been addressed by the number of examples given by now during our discussion.

Mr. Hirayama from IGES has asked for information about the number of companies that have adopted the systems approach, and about the popularity of this approach in the USA. These questions have already been answered by Dr. Pojasek during our discussion.

There remain two questions that need to be addressed. Both are rather difficult questions about MFCA. The first question is from Ms. Niiya of Benesse Corporation, "Is MFCA applicable to the service industry?" The second question is from Mr. Ueno of Matsushita Electric Industrial, "Is MFCA applicable to life cycle analysis?" Both questions concern the application of MFCA. Prof. Wagner and Prof. Nakajima, does one of you wish to respond?

Wagner

Of course, for service industry, it's difficult to do material flow accounting because in some cases they don't have much material flows. But this is relative. For example, looking at the banks closely, we were surprised how many materials flow they had. For example, we had a big bank. They had tremendously high energy consumption for heating, cooling, for computers and other technical equipment. They had a complete printing facility causing a big paper flow. Then they had a big amount of technical equipment flowing through the company. For example: We had one bank suddenly having a flow of waste of five thousand computers which they had to handle. So, technically in the service industry MFCA is possible and necessary but information basis often is quite poor. So the answer is, what we usually do in service industries, is the second part which I mentioned, we start with the information flow improvement. Because there is not so much emphasis on material flow, we start with the second step, we go into information flow mapping.

We have done this for various kinds of projects in the service industry. Presently, we do it, you might be laughing, for a kindergarten. But this kindergarten has a sponsor and the sponsor asked them to be certified by ISO9000 and by ISO14001. So they asked, "How can we do an integrated version?" and we said, "Well, we can help you." The information mapping can be a very nice tool for integrating of the quality and the environmental approach. To get the various people who are in charge of it, talking and communicating along this information flow model. So, this is my answer. It can be very interesting to apply material and information flow mapping to service industries.

The next question was concerning life cycle analysis. As I told you, we are presently starting projects on supply chain management. In many respects supply chain analysis is nothing else, than life cycle analysis. But I have to say we don't have much experience yet. We are quite involved presently in doing material flow analysis properly inside the company. But as we proceed now and as we get better in this, we plan to extend this to a linkage between two or three or four companies. Each having done their own internal material flow accounting. If they are linked we get closer and closer to a supply chain, or life cycle analysis.

Life cycle analysis, to our experience, is a lot more difficult than generally expected. Because usually people are thinking of one product line, one material flow from cradle to grave. But if you start the life cycle analysis with an eco-balance, a mass balance in one company, you have 100 inputs maybe. These 100 inputs are a hundred flows coming from 100 suppliers. And each one of these hundred suppliers again has hundred suppliers. So in the next step along the supply chain you already have thousands of material flows and thousands of life cycle lines which you have to follow if you want to do a comprehensive life cycle analysis for all product materials. For all those thousand lines. So what you can do is you pick the most important ones.

But the whole notion of life cycle analysis is, when you get really close to it and you do it on the basis of a comprehensive mass balance gets very difficult,

by its methodology. There is not just one material line to follow from cradle to grave but thousands for a simple product. But I think the notion of the supply chain management, to link various companies doing material flow cost accounting, this will be a target of the future. It's very promising because the costs of material flows between companies are presently even less transparent than inside a company. Inside the company we find a lot of intransparency, so between companies it will be even more promising to find possibilities for improvement.

Kokubu

Thank you. Let us take five more minutes before we conclude the discussion. The subject of our current discussion involves a number of very difficult issues. Prof. Wagner speaks in the context of MFCA developed in Germany while Dr. Pojasek speaks in the context of systems approach developed in the USA.

What do these two methodologies have in common ? On what points are they different? Are they mutually complementary or substitutes each other? In addition to these questions, it is also very important that we think about how we shall introduce them to promote environmental management in Japan. Prof. Nakajima, I would appreciate your opinion about this.

Nakajima

Talking with Prof. Wagner and Dr. Pojasek in this discussion, I reaffirmed several points. As I study MFCA and work with companies implementing MFCA, I have learned that corporate people involved in the MFCA project are very aware, as they might have always been, of their need to change, but in some areas, not yet sure about how they can change or what they should do. I feel what two methodologies presented today have in common is their potentiality to serve as a solution to their need.

Another common point between these approaches is that they offer solutions based on practical methodology as reflected in questions on the practical side of these approaches raised in today's discussion .

When I look at the differences between approaches of Prof. Wagner, Dr. Pojasek and myself, they seem to lie in how we would be able to implement these approaches based on the information provided under a new body (new management and organization). This mechanism might be unique to the corporate culture of each company, and in a larger scale, unique to the culture of each region or each country.

Still, in the two case studies of Japanese companies, it seems to be common that we are not yet able to make full use of computerized 'information systems' as ERP though we have been using the term on a daily basis. Some parts of data collection and processing still involve some kind of work by hand.

In this respect, it is essential to integrate and share experiences in the three countries by enhancing communication as we explore valid means for making computerized information systems more useful for corporate management, in hope of developing them into management information systems.

Another point I would like to make here is that there is an implicit understanding in Japan that corporate activities include environmental conservation activities as one of the main roles, therefore it must protect environment in an effort to reduce environmental load. For a company to exist, however, it must make profits while being environmentally-conscious. Profits are the basis of a company's existence, without which it will not be able to continue its activities to reduce environmental load. I feel that future development of corporations should be directed toward making more profit while achieving environmental load reduction.

Kokubu

Thank you.

Although we have already run out of time, let us take a few more minutes to review the theme of our symposium today, "Cutting Edge of Environmental Accounting for Corporate Management and Environmental Conservation."

Among many environmental symposiums and seminars I have attended, this symposium has distinguishing characteristics from all the others held earlier in Japan. While attaching importance on environmental conservation, we covered in particular, corporate environmental management and discussed in detail.

Prof. Wagner from Germany, an invited speaker today, was originally a specialist in environmental conservation. His study about mass balance has led him into the development of MFCA, a concept that

can serve as the basis for an information system supporting a major corporate management system.

Dr. Pojasek is the pioneer of the systems approach. He has successfully applied the system approach to pollution prevention programs sponsored by Environmental Protection Agency (EPA) in the USA. In his speech today, he spoke of the systems approach as a valid method not only for the pollution prevention but also for the improvement of all types of processes.

In Japan, when we discuss the environmental responsibility of a company, environmental accounting or environmental management, we tend to emphasize the importance of environmental conservation and corporate responsibilities from a normative point of view. However, a company operates on logic that is not compatible with environmental ethics at certain points. It may be because of this incompatibility or dilemma that we must emphasize the importance of environmental conservation so much. I guess that some of the audience feel the same way on this point.

Toward solving this problem, I suggest renovating corporate management in its entirety from environmental standpoint. As I understand, this is a core message of today's symposium.

I deeply thank you for attending our program today for so many hours since this morning. I also thank you for the number of questions you supplied; I regret that we did not have enough time to address them all. I regard this symposium as an opportunity to discover new issues and to go further, rather than an opportunity to conclude. In the morning session, we discussed the environmental disclosure as well. Our next challenge may be the use of MFCA or process mapping for better environmental disclosure. In this respect, I hope this symposium has provided you with some sort of hint in one way or another.

Thank you for being with us today. Guest speakers and other panelists, thank you for your contribution.

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Rapporteur's Summary

Rapporteur's Summary

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.

8

Poster Session

Poster Session

At an adjoining venue, a poster session was held in conjunction with the International Symposium on Environmental Accounting 2003.

At this poster session, environmental reports of corporations were distributed as a product of corporate environmental activities, and materials related to environmental accounting were also displayed. The participating organizations introduced their efforts toward environmental conservation respectively. With entries from 14 organizations including Matsushita Electric Industrial Co.,Ltd., opinions and views were actively exchanged between these organizations and participants of the symposium.

In addition to Nippon Paint Co.,Ltd. and Shionogi & Co.,Ltd., who reported on their Material Flow Cost Accounting (MFCA) projects at the second session of the symposium, Tanabe Seiyaku Co., Ltd. also introduced their MFCA project sponsored by the Ministry of Economy, Trade and Industry (METI).

(List of participating organizations in numerical order)

1 Tanabe Seiyaku Co.,Ltd.

We displayed a poster titled 'Tanabe's effort for environmental management - challenge for reducing cost and environmental load', and brochure of the poster and environmental reports were distributed at the booth.

The display included our efforts to clarify cost and benefit of our environmental conservation activities by introducing environmental accounting, and some analysis using an environmental effectiveness index. Further, our latest activities toward more effective utilization of environmental accounting by introducing material flow cost accounting were also shown in the poster.

In addition, as a result of collaborative project on material flow cost accounting under the Ministry of Economy, Trade and Industry (METI), we presented our three strategic steps for improving recognized problems, which have turned out to have an annual economic effect of 80 million Japanese yen.

2 Shionogi & Co., Ltd.

We displayed material flow cost chart of the products which have been studied about mass balance and cost at Kanegasaki Factory, especially regarding whole process flow of drug substance as well as one part of the flow, in order to provide clearer picture of the case study. In addition, we put a SHIONOGI's slogan(SONG for you) poster and posters of 'different materials used for a tray' and 'Shionogi's OTC products' which showed Shionogi's eco-friendliness. Environmental reports 2002 both in Japanese and English were distributed to those who dropped in at our booth.

3 Nippon Paint Co., Ltd.

Nippon Paint has a series of environment-friendly products, 'Fineness' series, panits for building that are easily recycled and effective for waste reduction. Among Fineness series, our display included:

- 'Eco-flat' series, water-based frosting paint for indoor use, which are low in odor and in VOC
- 'Nippe Hi-CR Eco' whose raw materials include recycled PET and vegetable fat
- 'E-Carry' system and its container, which are pioneering products in the paint industry that are made based on the idea of 'recyclable', not 'disposable'.

'E-Carry' system has many merits in realizing zero-emission, improving working condition and working efficiency, and reducing unnecessary residual paint and so forth. Efficient recycle by introducing this system will promote more effective use of resource and energy.

4 Kobe Steel, Ltd.

Kobe Steel (KOBELCO) aspires to becoming an 'environmentally advanced company' and we have intended to improve corporate value. At the booth, new KOBELCO was introduced who aims at creating more impulsive force. Our display included our efforts toward environmental creation such as thorough activities for environmental conservation, efforts toward developing environmental technology and applying it into practice at various production sites, and providing society with such technology, products and service. Also, 'environmental report 2002' and 'KOBELCO guidebook on environmental business' were distributed to the participants.

5 Osaka Gas Co., Ltd.

Our display included 'eco-action of Osaka Gas' and 'valuating environmental conservation effectiveness of environmental accounting'.

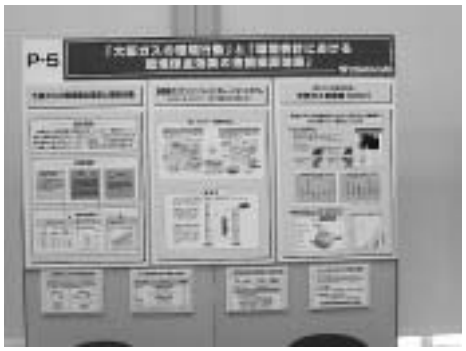
Concerning 'eco-action', (1) basic philosophy on environmental and eco-action was explained using such examples as

1) Large reduction of CO2 emission per $1m^3$ of gas sales,
2) Excavation control of soil and promotion of recycling excavated soil, and
3) Estimated value of controlling CO2 emission using gas cogeneration

In addition, panels relating (2) cogeneration of gas engine for domestic use and (3) natural gas automobiles were displayed to show examples.

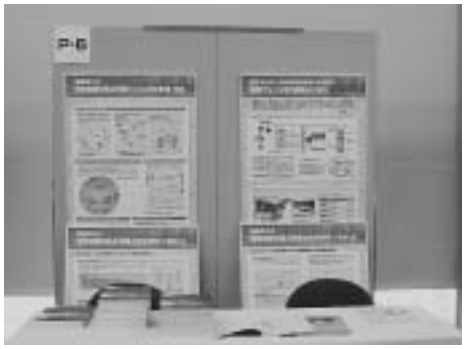
Regarding 'valuation', four steps of valuation was explained:

1) Environmental conservation effectiveness of environmental accounting,
2) Detail of social effect which worth 2,000million JPN,
3) Background of valuation and valuated items, and
4) Writing and analyzing a scenario using CVM



6 The Kansai Electric Power Co., Inc.

The Kansai Electric Power (KEPCO) has long perceived global environmental problems as critical management issues. Our goal is 'creating a better environment' and we have worked on environmental problems in community and conversion to recycled society in addition to global warming. We have introduced environmental accounting since fiscal year 1999 with an aim to measure our efforts on regular basis, and to promote effective environmental conservation activities. For the further promotion of environmental management, we have introduced 'environmental effectiveness measurement' since fiscal year 2001, which is an integrated index of result of environmental conservation activities and its economic value.



7 J-POWER/ Electric Power Development Co., Ltd.

J-POWER perceives global warming as one of the important management issues to work on.

We introduced our basic philosophy toward environmental problems and features of our management using posters. In addition, we explained our efforts toward environmental conservation with environmental reports. As a site report, we included a very rare environmental report published by an institution who constructs hydraulic power plant.

Also, as good practices of effective use of waste, we displayed a case of gardening fertilizer developed by our group business, which is made of coal ash residue out of thermal power generation, a charcoal made of driftwoods in a dam of hydraulic power plant, and cosmetics made out of wood vinegar extracted from these driftwoods.

8 Deloitte Touche Tohmatsu

Our display included effective tools for corporate management such as:

- supporting tool for publishing environmental reports
- supporting tool for introducing environmental accounting
- third verification of environmental report
- supporting tool for obtaining ISO 14001, 9001, and BS7799/ISO 17799
- related training program at ISO Tohmatsu Training Center (ITOC)
- other materials relevant to the above topics

9 Asahi & Co.

Asahi & Co. displayed panels and rendered verbal explanation on such main services provided by Sustainable Management Division of the company as follows:

- support service for building environmental management system
- support service for introducing environmental accounting
- support service for creating environmental reports
- independent review on the environmental reports/environmental accounting
- verification on the amount of greenhouse gas emissions
- support service for introducing the personnel evaluation system in terms of environmental performance
- support service for sustainable management strategies

Also, books on sustainable management published by the company along with magazine articles on environmental accounting written by the company were displayed while explaining details to interested participants at the booth.

10 ChuoAoyama Audit Corp.

ChuoAoyama PwC Sustainability Research Institute Co.Ltd., "CSRI" (a subsidiary of ChuoAoyama Audit Corp) http://www.chuoaoyama.or.jp/

In addition to the materials on environmental accounting, our display covered our corporate activities related to environmental report, emission trading, LCA and so forth:

- Displayed a poster of mapped tool for environmental accounting
- Showed the report of trail seminar on emission trade on screen
- Introduced LCA software
- Introduced overall corporate activities on panel
- Displayed our publications for sale, sample of books related to local government, reports and environmental accounting
- Displayed and distributed corporate brochure etc.

11 Shin Nihon & Co.

- 'ENASUS (Environmental Accounting Supporting System)' software for introducing environmental accounting -

Shin Nihon & Co. displayed a series of materials related to the software, 'ENASUS' developed by environmental auditing section of our company.

This software has been developed on the basis of environmental management with the concept of being user friendly. It provides reliable environmental accounting data so that users can disclose information both internally and externally.

The features of this software include:

(1) providing more reliable data with minimum work
(2) compling with MoE guidelines for environmental accounting
(3) providing useful data for internal management

This software has been adopted in many companies which are preparing environmental data for Fiscal Year 2002. We received a considerable number of inquiries and requests for a brochure at the poster session.

12 SAP Japan Co., Ltd.

The most effective way for collecting highly reliable data for Material Flow Cost Accounting (MCFA) such as material flow data and cost data is to extract existing data from the enterprise backbone system.

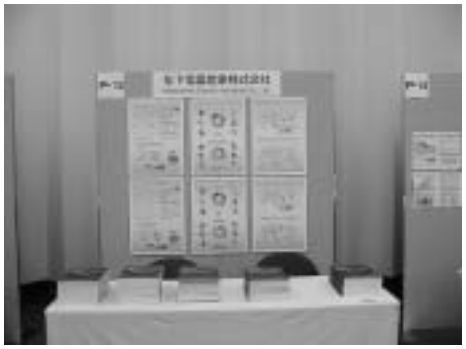
SAP ERP system and data warehouse system enable to make good use of transactional data acquired from daily business. This also enables companies to evaluate the effectiveness of their activities and environmental impacts in real time.

With these systems, companies do not need to set up specific system for data collection or analysis, or to organize full-time section for MFCA.

At SAP booth, we introduced a concept for realizing MCFA based on oversea cases.

13 Matsushita Electric Industrial Co., Ltd.

Matsushita group has disclosed environmental information every fiscal year since 1998. Complying with MoE guidelines, initially the items for disclosure were limited to 3 items:'environmental conservation costs (monetary value)', 'environmental conservation effects (in quantities)' and 'corporate economic effects (monetary value)'. However, since fiscal year 2001, two more items have been added: 'calculation of environmental conservation effects (monetary value)' and 'customers' economic effects'. Disclosing these 5 items has shown our new concepts of environmental accounting. Even though monetary valuation of the two added items is still in the process of a trial calculation, we will continue working on cost effectiveness of environmental accounting out of these 5 items.



14 Ministry of the Environment

Ministry of the Environment provides companies with supporting tools and guidelines for environmental conservation such as environmental reports, environmental accounting and environmental performance indicators. In addition, with an aim of encouraging more small and medium-sized companies to work on environmental conservation, a program for evaluating environmental activities ("Eco Action 21") is also available as a simpler measurement.

At the poster session, guidelines for these measurements and database of environmental reports were displayed and distributed, most of which are available on our web site:http://www.env.go.jp/hpolicy/j-hiroba/04.html .

Institute for Global Environmental Strategies (IGES)

Established in response to recommendations made in January 1995 by the Japanese Prime Ministers Ad Hoc Commission on Global Environment in the Twenty-First Century, IGES is an international research institution engaged in developing and formulating innovative policy instruments and environmental strategies for sustainable development ("Strategic Research").

IGES commenced its initial research activities in April 1998. IGES plans to conduct the following research activities in the second stage (FY2001-2003): Climate Policy, Urban Environmental Management, Forest Conservation, Environmental Education, Business and the Environment (Kansai Research Center), Long-Term Perspective and Policy Integration, Freshwater Resources, Environmental Industry, and Capacity Building. In 1999, a Technical Support Unit for the IPCC National Greenhouse Gas Inventories was located within IGES.

IGES's activities are being carried out at the headquarters in Shonan Village, Kanagawa Prefecture; the Tokyo Office in Uchisaiwal-cho, Chiyoda-ku, Tokyo: the Kitakyushu Office: and since June 2001, the Kansai Research Center in Kobe New Eastern City Center.

International Symposium on Environmental Accounting 2003

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Cutting Edge of Environmental Accounting for Corporate Management and Environmental Conservation

～Environmental Accounting in Japanese Corporate Management and Potentialities of Material Flow Cost Accounting～

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