# B2B Cooperation on E2Commerce

**Report of the APO Forum on B2B Cooperation on "E2Commerce" (Electronic-Eco-Commerce)**

**Republic of China**
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# TABLE OF CONTENTS

# PART I

# INTEGRATED SUMMARY

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## BACKGROUND

This document is a compilation of papers presented at the Forum on B2B Cooperation on "E2Commerce" from November 20-24, 2001. Businessmen and representatives of business associations from the APO member countries met to discuss the emerging issues of e-commerce and to develop B2B cooperation on E2Commerce. The main aspects discussed during the forum are:

1. The concept of integrating environmental aspects into electronic commerce (e-commerce);
2. The mechanisms and infrastructure needed to successfully implement E2Commerce;
3. The issues, challenges and opportunities of E2Commerce.

## WHAT IS E2COMMERCE

Asian corporations are using ICT tools like business-to-business (B2B) e-commerce or e-business to vigorously meet the needs of their customers. APO realizes that this is an opportunity to strengthen Green Productivity (GP) in Asian businesses by including environmental aspects into e-commerce. Thus, the term "Electronic-Eco-Commerce" or "E2Commerce" was coined. As this term is a new buzzword, several presenters have shared their definition of E2Commerce.

E2Commerce refers to the continuous flow of information and the sharing of knowledge which should lead to GP. Leong Choong Cheng in his paper has defined E2Commerce as a marriage between e-commerce and green supply chain leading to Green Productivity. In short, it is part of an integrated green supply chain concept.

The paper by Dinesh Jain defines E2Commerce as "the buying, selling and delivery of goods and services, using electronic media so as to upkeep the totality of relations between humans and the natural environment". He also noted that the advent of e-business opens an opportunity to enhance the role of Green Productivity in greening the supply chain.

Being able to communicate in real time across the entire supply chain of a product system will result in better utilization of resources and energy. This will not only reduce cost but also to enhance the productivity, quality, and environmental performance through a continuous flow of information by the use of internet. Tak Hur also suggested that E2commerce is an extension of e-Commerce to include environmental aspects of a product or company for both inter- and intra-business applications.

## WHY B2B 2ECOMMERCE

The advent of e-commerce is linking all B2B stakeholders in a globalized marketplace. Environmental protection has to also keep up with the accelerated pace of the e-commerce. E2Commerce is a deliberate attempt to harness the power of e-commerce to achieve GP by facilitating the greening of the supply chain.

The first aspect of e-commerce is the potential rapid and integrated information-sharing within the supply chain. The second aspect is the potential decrease in resource utilization as e-commerce reduces the need for more traditional infrastructure and operation needs of commercial activities. Both of these aspects lead the way to E2Commerce.

The first aspect was featured in Leong Choong Cheng's paper which noted that just like Green Supply Chain, which is the synergy of GP and Supply Chain Management, E2Commerce will boost the information flow both on the inter and intra-enterprise level to enhance the continuous flow of information, technical assistance and support to cut cost and enhance competitiveness.

Tak Hur also concurs by describing the ability to communicate in real-time across the entire supply chain of a product system will be beneficial for productivity, quality control and environmental protection.

The second aspect of e-commerce was explained in Dinesh Jain paper which observed that e-commerce alone helped to reduce energy usage and waste.
B.G. Srinivas's also stated that e-business enabled companies to improve businesses by reducing costs, reducing transaction time and also by reducing the impact on the environment.

Most SMEs lack the technical expertise and information related to productivity and environmental issues, and hence one of the areas that will be greatly helpful to these SMEs is to make technical information and human resources easily available. This is a vital component in the implementation of the APO's Green Productivity (GP) program, as it would enhance the technical exchange and cooperation amongst its member countries.

Electronic networking amongst professionals and organizations for efficient communication and exchange of experiences – would be the most promising alternative in this regard. E2Commerce could be developed in parallel with this interest in e-commerce.

## WHAT IS NEEDED FOR B2B E2COMMERCE

What is needed for successful adoption of E2Commerce? The fundamental need is that there should be a demand for green products which leads to the greening of the supply chain. So a demand for green products has to occur first before there could be a need for E2Commerce. Yuji Yamada in his opening address emphasized on this crucial driving force.

One of the most effective incentives for green products is from government procurement as it forms nearly 15-20% of national spending in many developed countries. Ning Yu describes how the Taiwan experience shows that an earlier E2Commerce initiate faltered until the government took an active role in green procurement.

With increased demand for green products, inter-corporate or B2B purchasers will demand to know the environmental profile of the products and services. Environmental management tools such as environmental management system (EMS), environmental performance evaluation (EPE), life cycle assessment (LCA), extended producer responsibility (EPR) and eco-labeling will be utilized to fulfill the demand for green goods. Tak Hur, Ning Yu and Raymond Leung describe how e-commerce enhanced the role of these tools to create an enabling environment for E2Commerce.

An integrated supply chain approach is needed to complement the environmental management tools. Supply Chain Management (SCM) provides a framework to focus on the efficient use of material and energy throughout the entire supply chain. Tak Hur also describes how SCM helps companies to establish a continuous exchange of information and upgrade the environmental performance along the material flow continuum.

The paper by Dinesh Jain describes in detail the physical and intellectual infrastructure requirement to support E2Commerce. He also reminds us about the responsibilities of various stakeholders from individual to supra-national organization to make E2Commerce a success.

As Yuji Yamada pointed out, cooperation within the APO member countries is the vital for E2Commerce. More advanced and larger companies will need to help their SMEs in each other's countries to fully include environmental aspects into the supply chain with E2Commerce as the leverage.

## ISSUES AND CHALLENGES

The basic driving force is a critical level of demand for green products. This will lead to greening of the supply chain which will need E2Commerce as a key tool. The efforts to create more demand for green products and the greening of the supply chain are still in their infancy. Leong Choong Cheng in his paper explained why the less than integrated electronic SCM system and low adoption rate of EMS will be a challenge to E2Commerce. Ning Yu also pointed out that an initial E2Commerce business plan in Taiwan failed to attract initial investment because the lack of participation from the government.

Tak Hur explained that the adoption of E2Commerce need to be as painless as possible without requiring sweeping changes in a company's data structure. At the same time, Dinesh Jain cautioned that there are many infrastructure needs to that has to be developed before E2Commerce can be successful. All the stakeholders would also need to awaken to the opportunities that E2Commerce provides.

The panel discussion on "Issues and Opportunities for B2B and E2Commerce" summarized these issues and challenges;

- Creating awareness of the second "e" in E2Commerce;
- Ensuring all the stakeholders realize that E2Commerce is a win-win situation;
- Compatibility of business processes, systems and different cultures;
- Making the mindset change towards more transparency amongst all individuals who participate in this e-to-e commerce;
- Legal and security issues;
- Cost issues to ensure small and medium scale enterprises can participate in E2Commerce.

## CONCLUSION

B2B co-operation within the APO member countries is the cornerstone of the E2Commerce. Many large-scale, multi-national corporations have launched comprehensive and innovative environmental programs for their own establishments as well as their suppliers. This is so because most of the large corporations depend largely on their suppliers, which are characterized as SME's residing primarily in the APO member countries, and who constitute an integral part of their stakeholder group.

The large corporations use their purchasing power and require their supplier SMEs to meet certain environmental requirements in order to continue to be their suppliers. However, in addition to enforcing the requirements, the large corporations also provide assistance in effecting necessary improvements in the SMEs, so as to meet the additional environmental requirements imposed by the purchasing corporation. This is why E2Commerce is so vital within the framework of GP.

The key aspect in E2Commerce is seamless flow of information throughout the supply chain. It is this aspect that will help companies to evaluate the environmental performance of each element in the supply chain. E2Commerce's value would be to help in increasing efficiency and effectiveness of products and services.

The challenges come from the rapidly evolving nature of its two components of E2Commerce; e-commerce and environmental management of the supply chain. Both still rapidly evolving and the challenge are to develop them in parallel. Much work needs to be done to create the demand for green products, which will then require an effective E2Commerce architecture to exchange information and evaluate the supply chain.

The trend towards integration of the supply chain through e-commerce is progressing rapidly. It is critical that such rapid development be harnessed by incorporating the environment into e-commerce. Much work is needed to ensure E2Commerce fulfill its promise of a tool that has the potential to help businesses raise their productivity and green the supply chain.

E2Commerce combines the electronic and eco commerce and could greatly help the businesses in the APO member countries, in surviving and progressing in the global economy, and is thus directly linked with the improved profitability and environmental performance.

# PART II

# RESOURCE PAPERS

# 1. APO'S GREEN PRODUCTIVITY ACTIVITIES IN THE REGION

*Augustine Koh*
*Director, Environment Department*
*Asian Productivity Organization*

## BACKGROUND OF THE APO

The Asian Productivity Organization (APO) was established by convention in 1961 with the aim of propagating productivity consciousness. Its role is that of think tank: a formulator of new ideas; a catalyst to promote these ideas in the region; a regional advisor; an institution builder; and a clearinghouse for information on productivity. The main emphases are modern productivity skills, techniques and experiences in:

- industry;
- agriculture; and
- service sectors.

We have 18 governments listed as members[1] and are a non-political, non-profit, and non-discriminatory inter-governmental regional organization.

### Organization and activities

The APO Secretariat is based in Tokyo with a 25-member staff. In each member country, our main point of access is a designated National Productivity Organization (NPO).

Acting through the NPOs, the APO organizes forums, seminars, workshops, and study missions. The activities and exchanges frequently involve the sending of experts to member countries.

Any group wanting to link with the APO should first approach the NPO in their home country.

## INTEGRATION OF ENVIRONMENT AND PRODUCTIVITY

The global drive to integrate development and the environment was launched at the 1992 Earth Summit in Rio de Janeiro. In 1994, under a special Official Development Assistance grant from the Japanese Government, the APO set up a Special Program for the Environment (SPE) to develop a series of initiatives for small and medium enterprises (SMEs) based on the concept of Green Productivity (GP). Working within the framework of APO activities, the SPE's objective is to strengthen and upgrade the region's capabilities in addressing the environmental and productivity issues raised by the Rio Earth Summit. To avoid duplicating the work of other international organizations, the APO has identified and developed a niche area in GP. This concept is aimed at resolving the conflicting interests of economy, ecology and society to achieve a more sustainable growth path and competitive businesses.

[1] Lao People's Democratic Republic joined the APO in 2002 as the 19th member

In 1996, the APO World Conference on Green Productivity was held in Manila. The 600 delegates brainstormed ways to turn this concept into a reality. The result was the Manila Declaration, part of which reads: "Environmental protection should be promoted without sacrificing productivity". That remains the bottom line for APO in all its work.

## ISSUES OF CONCERN

For the APO, the key issues of Green Productivity are:

- change and speed;
- competitiveness through innovation;
- global environmental problems (global warming, deforestation, industrial pollution, urbanization etc.); and
- social fairness (poverty, disparity of development).

Today, the issues of environment and competitiveness are linked as never before.

## VISION STATEMENT

Our vision is twofold:

- to have a better quality of life for all people; and
- to accelerate sustainable socio-economic development through productivity enhancement.

To achieve that, our objectives are:

- to enhance productivity and environmental performance in the industry, agriculture and service sectors;
- to work in mutual cooperation with organizations in the Asia-Pacific region for economic growth, environmental protection, social progress, and overall competitiveness; and
- to create paradigm shifts among the stakeholders for productivity enhancement that is in harmony with the environment.

## GP STRATEGIC PLAN

Figure 1 shows how we would achieve our objectives. The three levels in the triangle represent different levels of development and the corresponding strategies that countries need to adopt. Developed nations need to focus on the issues at the top, such as E2, eco-design, environmental technology and good management systems. Other countries are still at the awareness stage and the strategy priority at this bottom level is Green Productivity Promotion Mission (GPPM). The APO uses GPPM to create awareness among countries: what opportunities does GP offer? How can these kind of opportunities be harnessed?

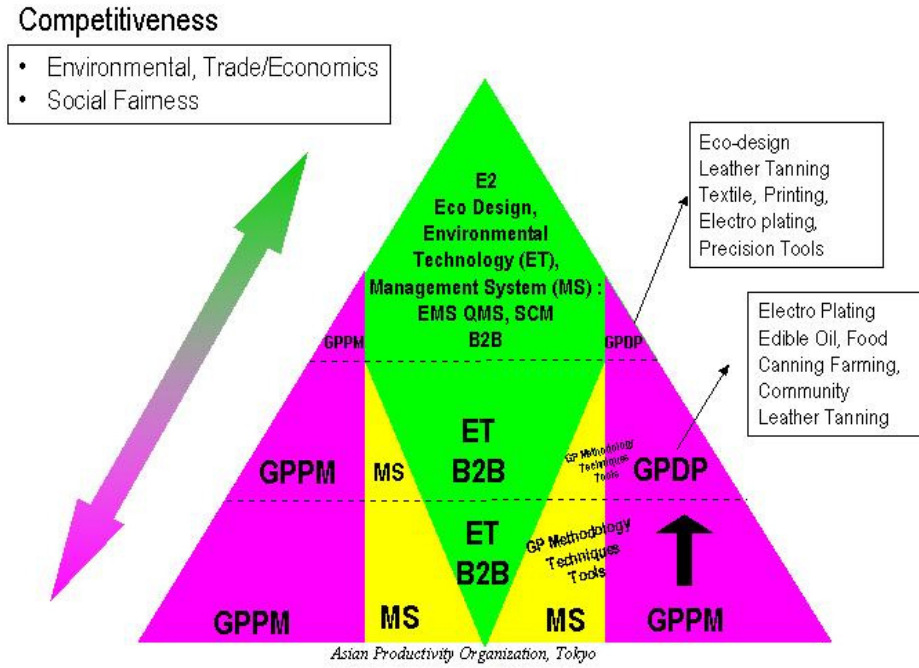


**Figure 1** GP Strategic Plan

There are also emphases on skills development, which we call GP Tools Methodology. The APO promotes these skills by establishing links between countries at different levels, including countries that are in-between; those that need more awareness but are also ready to initiate B2B, environmental technology or eco-designs. We bring together large corporations and SME suppliers and vendors in other Asian countries. Using the levels in Figure 1 as a starting point to develop strategy, the APO can work with NPOs to help companies and communities achieve Green Productivity.

In 1995, the APO initiated the Green Productivity Demonstration Program (GPDP) for member countries. The GPDP program aims to empirically substantiate that environmental protection and productivity improvement can be profitably harmonized, especially in small and medium businesses, and to help further promote the establishment of environment-friendly factories, communities and farms in the APO member countries. In determining the sustainability of the demonstration company, social, ecological and economic factors are all considered.

So far, the APO has implemented 29 GP demonstration projects in the following areas:

- Industry: Leather tannery (3), electro-plating (3), textile dye intermediaries, food canning, precision tools, printing, paint shop, machine tools, hospital, textiles, edible oils, and cement.
- Agriculture: Vegetable, poultry and pigs.
- Community: Eco-communities (10 villages).
- Eco-tourism and solid waste management (starting 2001).

## STRATEGIC APPROACH

In the first years after the GP movement started in 1994, the focus was on strategy and was necessarily APO-driven. From 2002, it is intended that the NPOs take the initiative. It is the practitioners, however, that ultimately realize the benefits or non-benefits of the program. Therefore, while the APO can facilitate in providing new ideas, eventually the movement should be driven by clients at the local level.

## WHAT IS GP?

We define Green Productivity (GP) as:

> a *strategy* for enhancing *productivity and environmental performance* for sustainable *socio-economic development*. It is the application of appropriate productivity and environmental management tools, techniques, and technologies to reduce the environmental impact of an organization in producing products and services.

The goal of integrating these two approaches is to ensure improved productivity, a better quality of life and a reduction in environmental impact. GP runs the twin wheels of *environmental protection* and *productivity enhancement* simultaneously. For GP to drive sustainable development, continuous improvement in productivity is essential.

Cost is an important concern for companies. Quality is another; while cost reduction is important, high quality is needed to sell products. In GP, we introduce the third component: the environment, or the ecology. But in doing so, we must safeguard product quality and ensure a balance of these three components.

The definition of GP takes into account three broad ways of dealing with pollution problems that already exist in the market place. The three are:

a. Individual, ad-hoc concepts that have emerged at different periods in the environmental movement. These include the end-of-pipe approach, pollution prevention and cleaner production processes.
b. An environmental management system is important in any organization. GP adopts both the Quality Management Systems (ISO 9000) and the Environmental Management Systems (ISO 14001) and attempts to integrate them into the existing production system. This provides flexibility and allows the company or organization to take advantage of the benefits of both GP and ISO systems.
c. Systemic approaches have been developed to take into account the various environmental problems faced by an individual to a number of companies. These would involve the concept of industrial ecology, the Natural Steps and eco-town.

The APO uses all these three approaches in determining how to implement GP at an organization, factory, or in a local area. We are not fixed to a single strategy or approach. What works best depends on the scale of the problem of the industry or

company. For example, if an industry is faced with social problems, we can offer an industrial ecology approach.

From an industrial production point of view, GP looks first at the input side (see Figure 2). How do you reduce your inputs and have less toxic materials in your production processes, maintain efficiency, and improve overall production? Because waste products are integral, the traditional concepts of reuse and recycling are important. The APO is trying to bring the traditional individual approaches into GP so that we can still aim for better profits and cost-reduction.

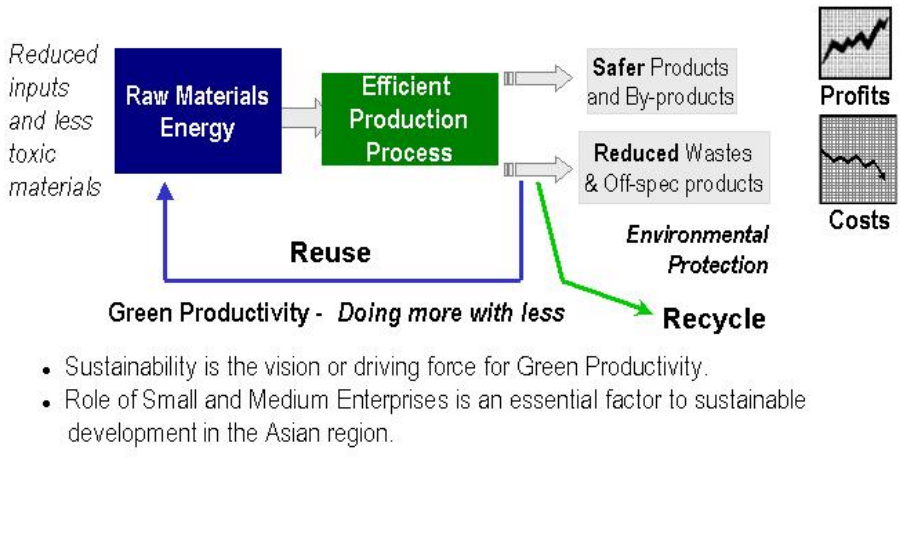


**Figure 2** Green Productivity

## GP PROMOTION AND ACTIVITIES

The APO uses a three-step approach to promote GP in the region:

1. GP promotion missions; i.e., working on awareness. These activities include in-country workshops; meetings with stakeholders; and development of new GP projects and opportunities.
2. Demonstration projects to show how GP can be implemented.
3. Disseminating information to member countries.

However, dissemination at the APO-level is not sufficient; we need international collaboration. We do this by sending experts to member countries to deal with these issues. For GP promotion missions, we help member countries organize in-country workshops. We also send missions to member countries to discuss how GP can be promoted and what opportunities GP offers.

Some of our demonstration projects, including one called the GP-ICD, have combined GP with Integrated Community Development (ICD). The purpose is to see

how communities can be incorporated into a GP area. This project was first attempted in Vietnam and has since expanded greatly.

To further disseminate the results of GPDP, the APO established the Green Productivity Dissemination Assistance (GPDA) scheme to assist NPOs spread the results and experiences of the demonstration projects among SMEs. It also serves to increase the capability and the capacity of the NPOs in performing GP consultancy. In the case of Vietnam, the local GPDP partner is implementing GP in the community in 20 other provinces. We have found that NPOs are able to provide better services to industry after their staff have concluded the work on GP and have been certified in Environmental Management Systems (EMS). Videos and technical material produced during demonstration projects are made available to all member countries. To further promote the findings of the GPDP to non-participating members and to evaluate progress, workshops, symposiums and study meetings are held throughout the year to share information. These channels of dissemination include:

- a generic five-day workshop on GP methodology;
- a training manual on GP using step-by-step methodology; and
- a five-week training workshop for trainers (to be implemented in February in Malaysia at the National Institute for Public Administration with the National Productivity Corporation) targeted at academies and universities.

For greater impact and maximum utilization of the APO's financial resources for the SPE, importance is placed on forging links with similar international organizations.

*APO/UNEP Collaboration*

In 1997, the APO signed a Memorandum of Understanding with the Paris-based United Nations Environment Program (Industry and Environment) for cooperation in the areas of Cleaner Production (CP) and GP. This has led to the organization of joint workshops and meetings. The APO has participated in most of UNEP's High Level Forums on CP.

*Carl Duisberg Gesellschaft (CDG), Germany*

The APO/CDG jointly promoted GP in three industrial sectors – electro-plating, textile and tannery – in the four Asian countries of Thailand, Malaysia, Philippines and Indonesia.

*United States Environmental Protection Agency (US EPA)*

The APO and US EPA will jointly implement two workshops on green energy and one on sustainable forest management in 2001.

APO will jointly collaborate with other international organizations and regional/national Green Productivity Associations to promote GP.

Figure 3 shows how we try to apply the approaches mentioned earlier using the two-day training manual on GP. Specific focus areas include:

- hazardous / medical waste management;
- occupational health and safety;
- energy efficiency;
- forestry;
- industrial estates;
- eco-tourism; and
- natural farming.

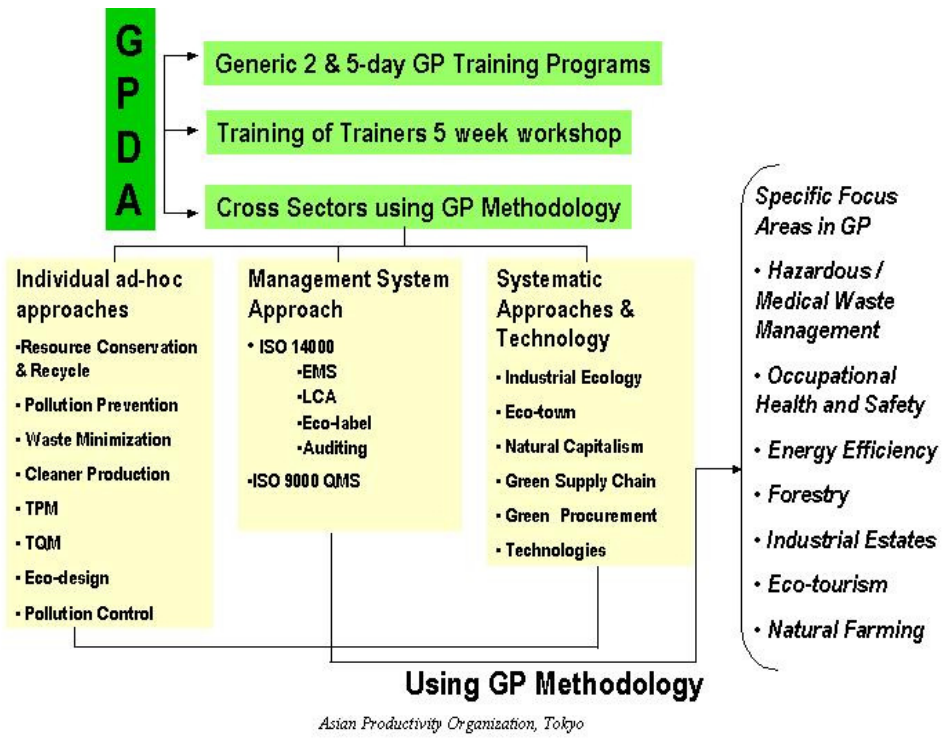


**Figure 3** Using GP methodology in GPDA

The purpose is to see how GP methodology can help to enhance a particular sector. The GP methodology is shown in Figure 4; it basically comprises *Plan*, *Do*, *Check*, *Action* or PDCA.

The GP promotion missions are explained in Figure 5 and examples of demonstration programs are given in Figure 6.

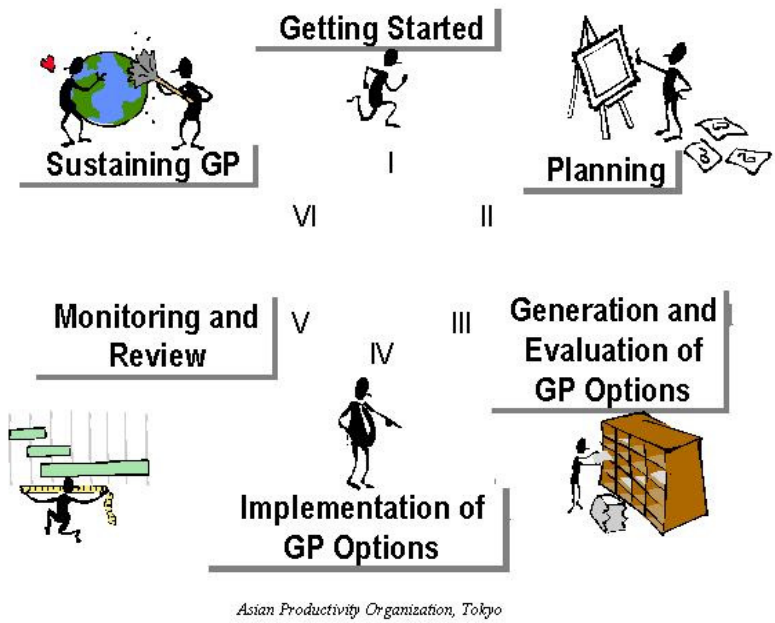


**Figure 4** GP methodology

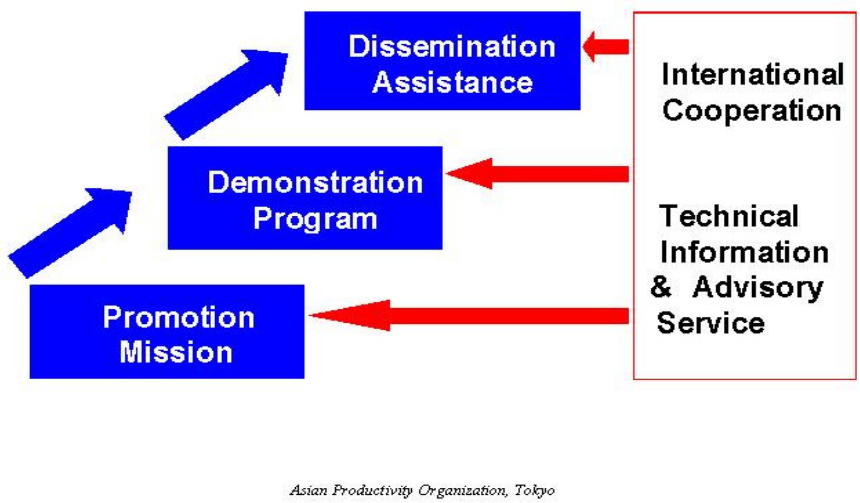


**Figure 5** APO GP programs

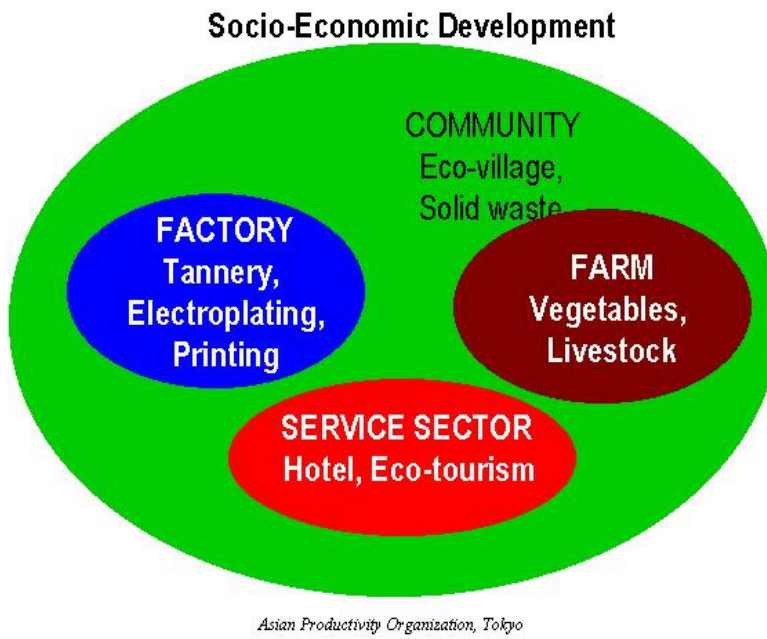


**Figure 6** APO GP Demonstration Projects

Environmental protection and improvement should be ingrained into the minds of people at all levels. Education to increase awareness of the need for a better environment should be introduced at every level of schooling, starting with primary education. Most NPOs do not have the technical capability to conduct environmental activities. The APO is playing a vital role in assisting NPOs to build the institutional capacity for environmental management.

To reiterate, the APO Secretariat and the NPOs can accomplish little working on their own. In order to promote GP, we believe the NPOs should forge ties with GP Associations, trade organizations, government agencies, NGOs and international bodies. In this way, GP will become NPO-driven and, eventually, client-driven.

## GP ACCOMPLISHMENTS

A summary of GP accomplishments follows:

- GP is gaining acceptance in APO member countries.
- NPOs are gearing up for GP promotion by establishing GP Cell / GP coordinators, GP Associations and International GP Associations.
- GP programs are expanding.
- Requests for GP experts have increased.
- Demonstration projects have been implemented.
- GP is being disseminated through seminars, workshops, publications, websites etc.

We think there are many more areas of work in this field, including:

- Inventory GP-related information and assess the impact of GP on global trade and environmental issues.
- Establish links between GP, the global environment and trade.
- Enhance B2B within and between member countries - in Supply Chain Management and Technology.
- Create formal links between NPOs and industry.Continue to disseminate generic GP training (emphasis on train-the-trainers and curriculum development).
- Continue to expand GP focus on the service sector (hotels, hospitals etc.) and communities.
- GP applications for urban environmental management.
- Focus on product design in addition to the manufacturing process.
- Focus on growing green consumer expectations.

# 2. GREEN PRODUCTIVITY, B2B AND E2 COMMERCE: CONCEPTS AND APPROACHES

***Takashi Kiuchi***
*Chairman*
*E-Square Inc & The Future 500, Japan*

The subject of our deliberations is Green Productivity-electronic, eco, and commerce are the keywords for this five-day forum. To start, I would like to consider what kind of era or generation we are in now. And let me point out three very significant differences from the previous 100 or 1000 years.

Number one: we are the first ever generation to think that future generations-those of our children and grandchildren-will not necessarily have a better society or improved living conditions. Until now, everybody thought that the future would always promise a better life and better living conditions. We are no longer sure about that-and we are the first generation to think that way.

Number two: we are the first ever generation to actually feel the limits of this planet. Until very recently, nobody talked about the limits of the earth; there was a feeling that there were no limits to growth and expansion. A good example is in Keynesian economics. When there was no work, people thought you could just dig a hole and fill it; even if it was unnecessary work it would create more employment through multiplier effects. Keynes never talked about the limits to work. But now we feel those limits.

A year ago, I spent 10 days in New Zealand-November and December-summertime. In Christchurch and further south, if you go out in short sleeves without covering your skin, in 7–10 minutes, you'll get sunburnt. New Zealanders say they didn't have that ten or even five years ago. The September 4th 2001 issue of *Time* magazine ran this story: American scientists were on a boat at the North Pole. And what did the scientists find? Not ice, not snow, but water. It was an ocean. The North Pole! In August!

Until recently, we talked about 1 degree Centigrade rise in temperature in 10,000 years. That was what we used to talk about, until say, ten years ago. But now if you compare the global average temperature in the year 1880 with 1980 or year 1890 with 1990, there has been a two degree Centigrade temperature rise. So, instead of 10,000 years, now we are talking about a two degree temperature rise in 100 years. Think about that. Difference is 200 times. You do a little arithmetic. Think about this: maybe we can walk at least 4 km in an hour. Now, 200 times of that 4 km multiplied by 200 makes 800 km. Speed of walking 4 km. Speed of 800 km like the speed of a jet airplane. That's global warming. If it is at the pace of our normal speed of walking, maybe we can ignore that. But now, it is the speed of a jet airplane. I start to worry. We are moving towards catastrophe with the speed of a jet airplane.

Number three: Think about the community, the living conditions of our children and grandchildren. I strongly believe - I have three grandchildren- I don't think they will reach old age. My three grandchildren, unfortunately I don't think they can reach their old age of 75 or 80 because of some other forces. My three grandchildren's lives will be cut short.

Now think about that and all the kinds of things happening. What I'm telling you is that the future is not the continuation of today. Maybe today is the continuation of yesterday, but the future is not the continuation of today. The future depends on what we do. The future is in our hands. We must start doing something.

I have the pleasure of knowing a lot of people in this field. Lester Brown of the WorldWatch Institute, he said about a year ago, "I've been doing this for the last 26 years telling you people through the *State of the World* report every year, and hundreds of talks and papers, but people don't do anything." He said: "I give up. I will step down and do something else. But I can tell you one thing, you guys have to wake up because of some dramatic wake up calls and I hope it won't be too dramatic or too devastating so that human beings can survive." I even think that the September 11th tragedy was one of the wake up calls.

A lot of people think that our current culture is not appropriate for us. There are two doctors, Paul Rey and Ruth Sherry Anderson. They have interviewed focus groups and hundreds of people in North America. They have published their findings in a book called *Cultural Creatives*. They posed 18 questions. They had came up with 18 questions and how many of you will say yes to these questions? Here are eight of them:

1. You love nature and you are deeply concerned about destruction.
2. You are totally aware of the problems of the whole planet and want to see more action on them, such as limiting economic growth.
3. You volunteer for one or more good causes.
4. You care, intensely, about both psychological and spiritual development.
5. You want more equality for women at work and more women leaders in business and politics.
6. You want politics and government spending to put more emphasis on children's education and well being, on rebuilding our neighborhoods and communities and on creating an ecologically sustainable future.
7. You want to be involved in creating a new and better way of life in our country.
8. You like people and places that are exotic and foreign and like experiencing and learning about their way of life.

These two doctors noticed that there must be at least 50 million people in North America who said 'yes' to at least 10 of these 18 questions.

Turning to Green Productivity, everyone is aware that it cannot be achieved without networking, or solidarity. The two key issues facing this society in 2001 are:

1. How to preserve this planet
2. Solidarity or networking

Let me give you three statistics on economic disparity that reveal the staggering scale of this problem:

1. The combined assets of the world's 250 wealthiest people (naturally, most of them live in the United States) are worth 1 trillion US dollars. This sum is equal to the annual income of 3 billion people, or roughly half the world's population.

2. Pick the three wealthiest people on this planet; it may be Bill Gates, the Sultan of Brunei and another businessman in the United States. The accumulated assets

of these three people are equal to the collective GDPs of the 48 poorest countries, i.e., 1 trillion dollars. (The United Nations has about 190 member countries).

3. If 200 of the wealthiest people would be willing to donate 3.5 per cent - one thirtieth - of their annual income, it would provide the basic needs of those in poverty.

Whether we like it or not, that is the kind of society we have created.

I think what we are talking about in this forum is this: A lot of people, including a lot of Japanese, have been trying to create economic empires. Let's shift our gear so we can focus more on *living* not economic empires. Instead, let's think about how we can create a living empire.

I can talk on and on but one thing before I switch to another angle: What had been misleading about this concept GDP, we must change this. We need a new yardstick to measure our activities or our living condition, our wealth or our happiness. GDP - Simon Kuznets, American economist created a yardstick GDP or GNP so that they could brag about the industrial power of the United States. And they try to be more superior to what Germany has. GDP-'P' stands for products. How do you think *products* can measure happiness, living standards? We don't even question that. All that we talk about is if we have two to four percent growth in GDP, everybody will be happy. That is not true.

What does all this mean for business? I can identify only four significant business theories to emerge over the past 100 years. In the first, Scientific Management, Frederick Taylor proposed that businesses are like machines. The lesson drawn was that businesses should be run scientifically.

In the second, Edward Deming put forward the idea of Quality Management. Business is like a learning community, he said, and it is quality improvement that is important.

Next came the concept of Re-engineering: Business should be run like your own garden. You have spring, summer, fall and winter – the four seasons. After spring, you trim the trees. But this concept did not last too long.

But a stronger theory that now prevails in most of the business world is Core Value Management. I trust that you are familiar with the book *Built to Last,* written by Jim Collins and Jerry Porras a few years ago. Their argument is that in order to survive, a business has to have leadership. Most of the pages - it's not a thick book - are spent on the leadership issue.

I can identify at least three ingredients in leadership.

Number one, a leader has to be 'attractive'. He or she has to have magnetism to attract people, to draw people. Unless you have that characteristic you cannot be a good leader.

Number two is 'Take Responsibility'. Don't run away. A lot of people say a lot of things but when it comes close to that date, when you have to execute, people don't know where they are. One of my personal mottos is "Say It, Do It". And if you say that for a number of years, then people will say, that guy is serious, be careful, he will do it, even the small things. One time, after I had skydived-it was in California-we went on a rather long journey and there we saw a very tall mountain covered with snow. It was Mount Whitney, the tallest mountain in the United States continent. So, I said,

let's go up there at summer time and everybody agreed. In order to climb Mt Whitney, you have to have permission, a permit. So I got that and when the week came, one dropped out, two dropped out. Only three showed up. All those people escaped from their promise. No leadership quality. No leadership. My point is: the small things matter, "say it, do it".

Number three is 'Foresight'. Vision. If you are in a leadership position, you have to be free to create your own vision so you can tell your people what to become in five years' time, eight years' time, ten years' time.

Let us talk about 'foresight'. I started off this little talk by saying that we are in a generation that is very unique. That time will come very soon. What bothers me is this. I remember the British weekly magazine *Economist* used this phrase in its August 1999 issue. What this article said, there are over 126 million Japanese-and they are "Untaught People". This terminology was new to me. This is an important message. What the article says is that the Japanese people are not informed. They don't know. But, the other side of the coin is we don't have the willingness to learn. You know Japan has a lot of problems-all of you know. It's mainly a leadership issue. We don't have leaders. And the level of commonsense of these 126 million Japanese is very low. That's why democracy based on the majority of votes doesn't work. We are not informed, we don't know and we don't have the willingness to know.

Awareness. Sensitivity. Motivation. And Willingness. Unless you have those traits, every day whether you are driving a car, on a subway or on a train, or commuting, you should think: do I have enough awareness? Is my sensitivity clear or sharp? Am I motivated with myself? Do I have a willingness to do this or that?

Now, E-commerce in the digitized information age-we use quite a lot of that but people say that e-commerce is short-lived. It will not last too long.

Ecology is not profitable. It cannot produce profit but if e-commerce and ecology are combined, we may prosper. I'm not so much motivated by making money but we can be meaningful to society. My partner and I created a new company over a year ago. We call it $E^2$: standing for Ecology and E-commerce. But, at the same time, square suggests a 'place', a square so that people can get together from all over the world, from 18 APO member countries plus Europe, North America to talk and discuss interactively.

We need a square. So this $E^2$, ecology and e-commerce, is exactly where you come and present yourself.

Two days ago, our speaker was Dr Paul Cox who founded seacology. Seacologists identify small islands where they find some tradition and culture that should be preserved. On the Samoa Islands, they found local people cutting down the rainforest. The trees were being felled to build a school. Dr. Cox's team said they would give them money if they stopped cutting down the trees. That's the way they got started and since then, they have identified eight or nine islands. So that is what this square is all about. It provides a place we can mingle with important people; people of substance, who have something meaningful to talk about.

In closing, what I would like to say is this. I talked about solidarity, I talked about networking. Everyone knows we have B2B, we have B2C. What we need is B2S. 'S' stands for society. We came up with this concept two months' ago. And I have been talking about this on many occasions. We started a little organization called The Future 500 in Colorado six years ago in 1995. Our mission is to create a network to share our

technology, our expertise, our know-how, to the society, so that our children have a community to live in.

# 3. E2 COMMERCE: TECHNOLOGY-LED BUSINESS TRANSFORMATION

***B.G. Srinivas***
*Associate Vice President & Head – Enterprise Solutions*
*Infosys Technologies Limited, India*

*One of the greatest contributions of the dot com bust was the reduction of the letter "e" to its place as just the 5th letter of the alphabet!*

- Anonymous, Silicon Valley

*Technology doesn't usually save companies time or money but in a competitive world, it often keeps them in business*

- Anonymous

This paper discusses the role of technology in Green Productivity: how technology enables business and helps businesses to improve productivity while at the same time protect the environment. The discussion is organized around the following topics:

- Costs of economic development
- Green productivity and the supply chain *et al.*
- A balancing act
- Looking in, Looking out
- Advantageous technology
- 'E' reborn
- Cases
- Food for thought: The consortium model

## COSTS OF ECONOMIC DEVELOPMENT

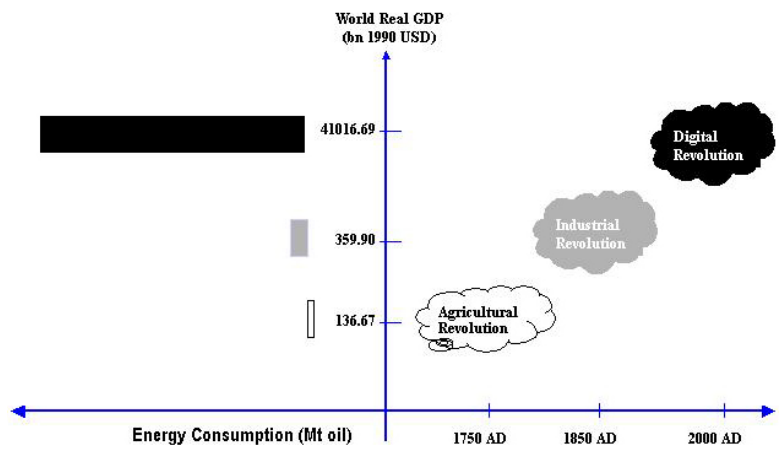


**Figure 1** Correlation of economic development and environmental impacts at different times in history
*Source:* Gerhard Rempel (http://mars.wnec.edu/~grempel/courses/wc2/lectures

/industrialrev.html);
J. Bradford DeLong, UCB (http://www.j-bradford-delong.net/TCEH/1998_Draft/World_GDP/Estimating_World_GDP.html)
J. R McNeill "Something New Under the Sun" (2000) (http://www.seafriends.org.nz/ issues/cons/resource.htm)

Economic development is usually measured by the GDP. As shown in Figure 1, the past 50 years have seen a tremendous leap in GDP growth. But the environmental impact of that growth, such as in terms of oil consumption (see the left side of the chart), does not normally appear in GDP accounting. 13 million metric tonnes of oil is consumed in order to achieve what we today call economic development. This kind of growth cannot continue indefinitely without irreversibly degrading the planet.

**GREEN PRODUCTIVITY**

Green productivity is a business strategy that aims for sustainable development through the co-existence of an improvement in overall productivity and environmental conservation. It is a means to harmonize environmental protection and economic development. I would argue that it is the key to sustainable development for enhancing quality of life. Ultimately, it is an approach where the goals of productivity are pursued with a minimal cost of environmental degradation.

Obviously there are multiple factors that affect Green Productivity, such as:

- People
- Machines
- Knowledge
- Environment
- Communication mechanism
- Finance
- Technology
- Mindset
- The relations of big corporations with SMEs
- Verification Agencies

Governments also have an important role to play in policy formulation and "green" institutions like NPO play a critical role in shaping the factors that affect Green Productivity.

## FACTORS IN THE SUPPLY CHAIN

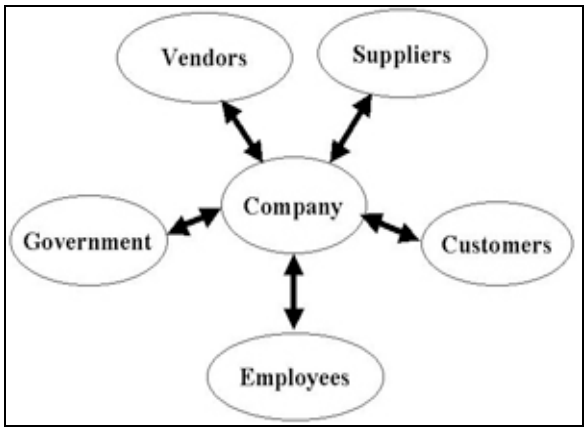


**Figure 2** Green supply chain

Figure 2 shows some of the constituent stakeholders in the green supply chain. All have an equally important role to play in addressing environmental concerns. The most influential player is undoubtedly the government. The following examines each of these stakeholders in turn.

**The perspective of organizations**

The compositions of SMEs need to be in touch globally with the latest laws across multiple countries and ways to achieve the "prescribed" green levels. Large companies need to quickly locate "green" SME vendors. There needs to be a common forum for companies to share experiences. We are also looking at how these enterprises are trying to educate the masses.

**The perspective of customers**

There is a demonstrable increase in purchasing goods from the so-called "green certified" companies.

**The perspective of a government**

Across the world there is an increasing number of laws and policies promoting a green environment, i.e. trying to control the impact or adverse impact of organizations or industries on the ecology. There could also be moves from the government in terms of trying to encourage or introduce those companies that are more eco-friendly. There is a trade-off between supporting local industries as well as making them eco-competitive, with eco-friendly companies being given subsidies or tax holidays until the time their product becomes cost effective.

**The perspective of employees and/or organizations**

Companies have to focus on two major factors: *eco-efficiency* (improving the products) and *eco-effectiveness* (making a better product). For example, automobile companies definitely show a move towards improving emission levels and trying to reduce adverse impacts on the environment. Relatedly, there are also moves to make the

product better, independent of any question whether companies can aim towards zero emissions.

## A BALANCING ACT

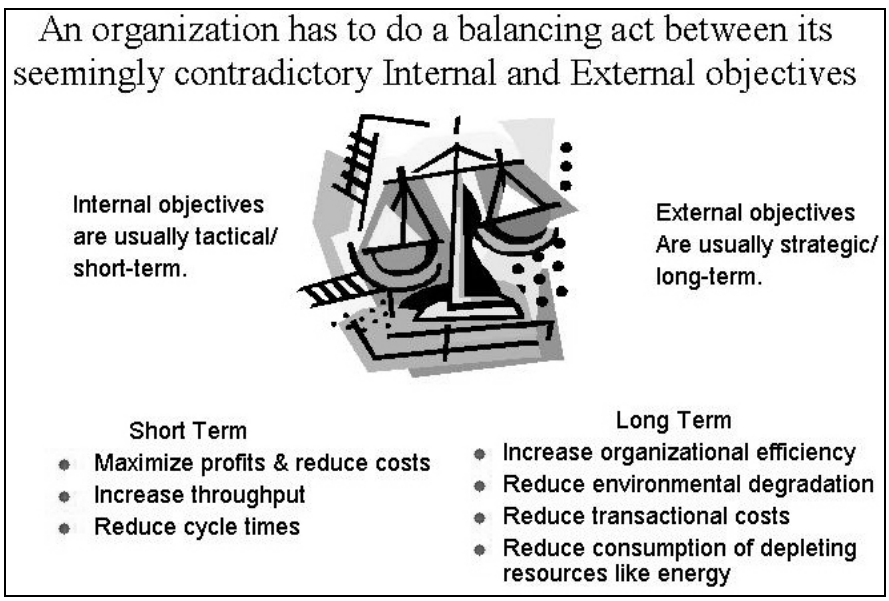


**Figure 3** The balancing act of organizations

Organizations, as mentioned in the beginning, are trying to balance multiple objectives (see Figure 3). One obstacle in achieving Green Productivity are the short-term objectives of maximising profits and reducing costs. The problem is how to reduce cycle times. Over the long term, many organizations are looking at the overall concerns of reduced energy consumption, reduced transactional costs, and so on. Most organizations that tried to balance this have also found that there is some kind of a trade-off. They are looking for some kind of tool, some kind of technology that will enable them to operate and balance these different dimensions.

## LOOKING IN, LOOKING OUT

Organizations need to be outward-looking but to address customers' needs; they must be inward-looking. They must also look laterally at their partners. Technology can bridge the gap between the two contradictory objectives, leading to long-term reduction in costs and maximization of profits.

## ADVANTAGEOUS TECHNOLOGIES

Table 1 below shows a list of some technologies that enable companies to address both these perspectives:

**Table 1** Enabling Technologies

| External | Internal |
|---|---|
| • EDI/XML<br>• CRM (Customer Relationship Management) • SRM (Supply Relationship Management)<br>• SCM (Supply Chain Management)<br>• Exchange<br>• Market Place<br>• m-Commerce<br>• Embedded Systems<br>• Multi-media<br>• Portals | • EDI /XML<br>• ERP (Enterprise Resource Planning)<br>• SCM<br>• m-Commerce<br>• Embedded Systems<br>• Multi-media<br>• Portals |

As the left column shows, companies have leveraged technologies and networking, linking up with partners who are internal to the organization with technologies in trying to address transactional issues, increase speed and reduce paperwork. Some of the advantages gained from the above technologies are listed in Table 2.

**Table 2** Advantageous technologies

| Technologies | | Advantageous benefits |
|---|---|---|
| EDI/XML | → | Paperless transactions |
| ERP | → | Transactional efficiency |
| CRM | → | Low customer retention costs |
| SRM | → | Economical procurement |
| SCM | → | Efficient logistics |
| Market Place | → | Transactional efficiency |
| m-Commerce | → | Transactional efficiency |
| Embedded Systems | → | Increased efficiency |
| Multimedia | → | Lower operational costs |
| Portals | → | Information dissemination |

Consider as an example the first one-the area in EDI/XML linkages that most companies in the West deploy in order to speed transactions, be it to place the purchase order or addressing a customer's need. Most of these transactions happen in a paperless mode. This happens in real time and in an environment where companies are transparent to each other in terms of information-sharing.

If you look at package solutions like ERP, that plays a very dominant role between the enterprise in trying to address transactions across various business constituencies, address issues that need to be done on a daily basis, again in real time, the transaction takes place between different departments and capture information in real time to enable management to take effective decisions.

The technologies that address customer needs in terms of various packages come in packages that address the supply chain needs in terms of optimizing and thereby controlling the distribution costs. We will be taking a little bit more in detail about market places – how these have become useful in terms of addressing the overall

transactional efficiencies, in terms of reducing procurement costs on a global basis.

Some of the other technologies like multimedia enable people to cut down on meeting-related travels. Meetings can be done effectively through videoconferencing or even net conferences, thus reducing operational costs. Obviously there are a lot of portals that could be useful even to forums like APO, thus promoting effective information dissemination globally and in real time.

**'E' REBORN**

E2 has definitely played a significant role in electronic commerce but there is a need to redesignate this. 'E' should stand for "Environment." E-business is all about doing business more efficiently. Efficiency could go hand-in-hand with improvement in energy and resource efficiency. Environmental opportunities would include the following: *virtualization*, *B2B e-commerce*, *re-engineering supply chains through B2B exchanges*, and *centralizing procurement/ e-procurement*.

In considering how companies have been trying to leverage e-business in terms of improving efficiency, some of the case studies examined below show not only that e-business or technology has enabled companies to reduce costs in terms of reducing cycle time, but they have also become a source for having a positive impact on the environment.

A key example here would be the 36-volume *Encyclopedia Britannica*. Imagine the amount of paper consumed for this and how many trees are felled to publish these volumes. Today, the information is available on a CD. This is one way of trying to have a positive impact by using technology effectively. Not only does virtualization make information accessible to people globally, it has a bearing on the ecology.

Companies have effectively leveraged their supply chain and reengineered their supply chain in trying to bring down costs. At the same time, they have consciously impacted the environment by reducing transportation between various partners. The centralizing of procurement has had, again, a positive impact, both on costs as well as the environment.

**E-marketplace**

We have seen some of the marketplaces that have failed. At the same time, some marketplaces are showing success because companies have seen that this is a technology that can be operated on a global basis. This is a technology that enables vendors to transact business over the web in an effective manner. But it would also mean a lot of preparation that these companies have to go through in order to effectively leverage this technology. What I'm trying to stress here is: the same technology we could try and leverage to ensure that there is a lot of focus on environmental issues. This is about making technical information easily available to all concerned parties or member countries. It involves strategic partnering between buyers and suppliers to enable Green Procurement, thus leading to easy outsourcing for buyers and exchange of ideas and experiences. Organizations like the APO could also participate in these market places to try and come out with some uniform standards on environmental laws that could make it easy for SME segments to try and standardize their processes. Definitely, certification bodies like ISO14000 play an important role, but then today this information can definitely put on portals and marketplaces to make it globally accessible. To do this, we need to conduct and encourage relevant research.

**Benefits**

Phillips and Meeker (2000) list the following benefits of E-marketplace:

- up-to-date information in seconds
- lower cost of information dissemination
- reduced wastage
- faster resolution of problems/issues
- no slip-up due to mis-communication/ mis-understanding
- market transparency
- substitute information for inventory
- micro markets will proliferate; specialized markets can survive
- domain expertise will be key
- equity sharing with customers
- contractors will be critical participants in exchanges; they have important relationships and valuable domain expertise.

There is a trust and understanding between various partners who try and use these marketplaces for an overall advantage of the ecosystem.

We are also talking about equity sharing with customers. How partners are, today, ready to share profits and share information between various vendors and definitely intermediaries or contractors would also play a very dominant role in trying to bring these different parties together to come out with certain standardization in these marketplaces, where these marketplaces would be addressing certain aspects in terms of either steel, automobile or plastics.

**Issues specific to industry sponsored e-Exchanges**

Issues we need to also be looking at to make this kind of technology successful include the following. We need to ensure there is a win-win situation for all partners who are participating in these marketplaces. We have to also ensure that the supplier doesn't feel that his product becomes some kind of an obsolete product where there is no value for his brand. Definitely there is a need to also move from a transaction-based commerce to a more collaborative one. Buyers must have uniform, predictable pricing with real-time information on availability. Suppliers, because they will be in real time touch with the demands in the market, can definitely leverage on these kinds of technologies to more intelligently plan production, reduce wastage and optimize inventory, customize promotions for buyers, and lower their order processing costs.

**Business challenges**

The businesses challenges we also need to look at include playing the balancing act of trying to satisfy different dimensions of quality, cost, ecology and productivity. There is a trade-off between compliance to environmental standards and productivity. When we address this we are looking at mindset changes by organizations and individuals in the organizations. There has to be a lot of giving because information has to be unselfishly shared. Gone are the days where people felt that keeping knowledge to oneself has its own competitive edge.

We are also looking at different geographical rules when we work on a global basis. Different governments could have different rules for compliance. Obviously, when we are talking of global systems, technology itself has its own challenges because

there are so many platforms on which these technologies operate and the inter-operative systems itself is a key challenge.

There has to be an acceptance by most of the players in terms of trying to address performance issues, scalability, and data consistency problems. Integration with SMEs as well as large players has to be part of the solution if we aim to have a successful model. In terms of content management, there has to be some kind of standardization on the content of the information that you put on the Web. Security considerations are also very demanding in terms of each player in this marketplace would want that his information is shared with a specific set of vendors. When we are talking about collaborative commerce there is the challenge of ensuring that geographical variation is accounted for, so that the different languages and cultural issues of multiple countries are addressed. Collaborative electronic commerce is vital to the survival of small as well as large players.

## CASE STUDIES

Turning now to case studies, in the following discussion we will examine how these companies have leveraged technology in trying to address productivity and also, either directly or indirectly, impacting the environment.

### Case study 1: Electric City-Technology and logistics[2]

This is B2B, B2C parcel delivery company located in central London. They have effectively tried to address both the concerns of improved productivity as well as trying to be eco-friendly.

| | |
|---|---|
| **Problem** | to find a cost-effective and environmentally-sound energy for its electric van |
| **Solution** | purchase of electricity from "green" electric supplier (www.ecotricity.co.uk) and is 100% renewable |
| **Benefits** | using small, silent, electric vans leads to less congestion, less noise and less pollution; electric vans have zero emissions; they can plan optimum delivery routes and time using the internet |

This company has thus leveraged technology to try and directly access their partners' and customers' database in trying to access real-time information concerning pick-up and delivery times. By having this information in real-time, they have been able to effectively use different software in trying to optimize their vehicle movement. In trying to reduce vehicle movement, they therefore conserve energy. At the same time, the vehicles that this company deploy are electric cars, and they have gone to the extent of even purchasing this electricity from a green electric supplier. This is one of the benchmark companies that has gone to a great extent in trying to be very eco-friendly but at the same time remain profitable in business.

### Case study II: Amazon.com-Re-engineering supply chains[3]

[2] Source: Digital Future (www.digitalfutures.org.uk )
[3] Source: Digital Future (www.digitalfutures.org.uk )

This company's mission is to transform book buying into the fastest, easiest, and the most enjoyable shopping experience possible.

**Problem** high transportation cost, warehousing cost, and wastage.
**Solution** online sale of goods via internet and centralized purchase
**Benefits** efficient & effective planning; less warehousing cost; less transportation; less wastage overall

A book sold through a conventional book shop uses 15 times more energy than one sold online through Amazon.com. I would say this company has a positive environmental impact: in terms of energy-saving, for the same transaction (in US dollars), the energy cost per hundred-dollar sale is less than ten times the cost that would be required when you go through a traditional sale at a bookstore.

**Case study III: Royal & Sun Insurance Alliances-E-procurement**[4]

This is one of the world's largest multinational insurance groups with operations in over 50 countries and the ability to transact business in over 130.

**Problem** high cost of procurement
**Solution** e-procurement
**Benefits** reduction in paperwork and administrative costs-they have even quantified that they save 1.2 million sheets of paper annually by simply going on electronic commerce and by totally doing away with paperwork; ability to negotiate more favorable contract terms through access to electronic marketplaces/purchasing information.

**Case study IV: Long Island Power Authority-LIPAEdge-E-procurement**[5]

This company supplies power to most parts of New York and Long Island. It has uniquely leveraged technology in addressing their issues on energy.

**Problem** New York would be short of meeting energy-reserve requirements during summer 2001 without more power plants. The company had no way to control or regulate the thermostats across the board in trying to see whether everybody has been using the air-conditioning optimally.
**Solution** an embedded device installed in each of the air-conditioners, which can be remotely monitored and controlled to optimize temperature settings and reduce the peak load.
**Benefits** more users can be serviced *without* new plants, but obtain better grid control; better control over peak/normal energy requirements; save on actual A/C running costs

**Case study V: Ranstad, the Netherlands-E-logistics**[6]

The Netherlands is one of the most densely populated countries in the world;

[4] Source: Digital Future (www.digitalfutures.org.uk )
[5] Source: Green-eComm
[6] Source: Hens Runhaar, Delft University of Technology

Ranstad's problem is the type of traffic congestion characteristic of a large metropolis.

| | |
|---|---|
| **Problem** | by 2005, congestion expected to increase because of growth in passenger/goods transport by road. Due to its small land area, the city would be unable to build new roads. Need for technology that would help them optimize goods movement between cities and in and out of cities by trying to optimize traffic flow through consolidation; i.e. technological packages that could optimize logistics rather than road area |
| **Solution** | though e-distribution might generate more traffic than traditional distribution costs, e-logistics specialized in distribution by internet will increase logistical efficiency and hence reduce traffic flows. |
| **Benefits** | more traffic does *not* necessarily mean more roads; existing infrastructure can be "tweaked" to ensure greater productivity. |

**Case study VI: E-Supply chain**[7]

This is a leading hi-tech electronics/ semiconductors company in Japan.

| | |
|---|---|
| **Problem** | a typical problem for most global organizations: order visibility into supply chain of "company's" customers including order status tracking & visibility into shipment status; how to optimise delivery to customers across the globe, picking up from different warehouses |
| **Solution** | design and development of web application and integration with ERP backend, which gives them a global reach |
| **Benefits** | increased internal productivity by integrating company's system with those of external partners. A customer, sitting in any part of the world, could access this information and pick it out-when product would be delivered and where it would be delivered from |

**FOOD FOR THOUGHT: THE CONSORTIUM MODEL**

To conclude, this paper will introduce a consortium model that is coming into vogue today; it has gained momentum in its ability to address the needs of many companies, including SMEs, that do not have the capacity to invest a lot in technology.

These are platforms to build marketplaces: hosted platforms that small and medium enterprises can subscribe to and leverage the best of technologies. Among these are 'MySAP' (a portal); I2 Trade Matrix, Microsoft.NET (a portal where enterprises can subscribe to these technologies); and the newly formed Workadia LLC (a combination of four different companies that have come together to put up a portal). The next section elaborates on the Workadia portal.

**Workadia LLC**

This is a new company formed by American Express, TIBCO Software (a software product company), Infosys Technologies, and WestBridge Capital Partners (an investment company that funded this work area) to provide hosted intranet applications to businesses through a single, easy-to-use portal interface.

[7] Source: Infosys Technologies Limited

The new company combines the unique expertise of each company:

| | |
|---|---|
| American Express | Knowledge of business domain |
| TIBCO Software | B2B infrastructure software |
| Infosys Technologies | Systems integration expertise |
| WestBridge | Assistance with startup activities |

The Workadia portal serves the infrastructure needs of companies. Employees can seek information on company advancements, industry news, email and share calendars. The portal can be used to manage human resources, intranet collaboration, financial reporting and even sales tracking. This is a model that most SME segments would find attractive because it is a cost-saving measure: companies need only subscribe to the technology and need not buy it. At the same time, they benefit from the latest technology in terms of advantages and use this effectively to interact internally, between their enterprises and also externally with their customers.

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# 4. CHALLENGES IN E2 COMMERCE

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*Co-founder and Vice-President*
*Business Development ECNET, Singapore*

This discussion is organized around the following topics:

- Definitions of E2Commerce
- B2B E-commerce from the supply chain management perspective: how an e-supply chain can enhance productivity, which is a very important part of Green Productivity
- Challenges in E2Commerce both from the IT (information technology) angle and also from the implementations of the EMS (Environment Management Systems)
- Integrated eSupply chain: case studies on how an e-supply chain can be made possible
- Summary

## DEFINITIONS OF E2-COMMERCE

Green Productivity comprises the following elements:

Electronic-Eco-Commerce = E-Commerce + Green Supply Chain

As Hwa and Koh elaborate:

> The synergy of Green Productivity (GP) and Supply Chain Management (SCM) provides an opportunity for the supply chain to assist organizations particularly SMEs, to enhance their productivity, quality, and environmental performance through *continuous flow of information*, technical assistance and support *and the sharing of knowledge*. GP and SCM creates a win-win situation for the organizations since they have strong advantages in the global market with cost reduction and enhanced competitiveness. (emphasis added; source: "Green Productivity, Supply Chain Management, and Their Promotion Mechanism" by Tay Joo Hwa and Augustine Koh)

The key issues of interest to E2Commerce are "continuous flow of information" and "the sharing of knowledge" and these generate better GP as an end result. The objective is to create a situation where there is cost reduction and competitiveness is enhanced. Fundamentally, E2Commerce is a marriage between e-commerce and green supply chain, resulting in e-green productivity. In more detail, it is like an integrated green supply chain concept.

## B2B E-COMMERCE FROM THE SUPPLY CHAIN MANAGEMENT PERSPECTIVE

How the internet enables the supply chain can help a corporation improve their productivity and enhance the quality of their product? To maintain a supply chain is very much a linear process whereby people are parting information from one point to the other point (see Figure 1). For example the wholesaler has no visibility on what customer is doing, or the supplier in return has no visibility on what wholesaler is doing. Accordingly, the chain is hardwired, even if their link-up is a one-to-one relationship rather than one-to-many or many-to-many.

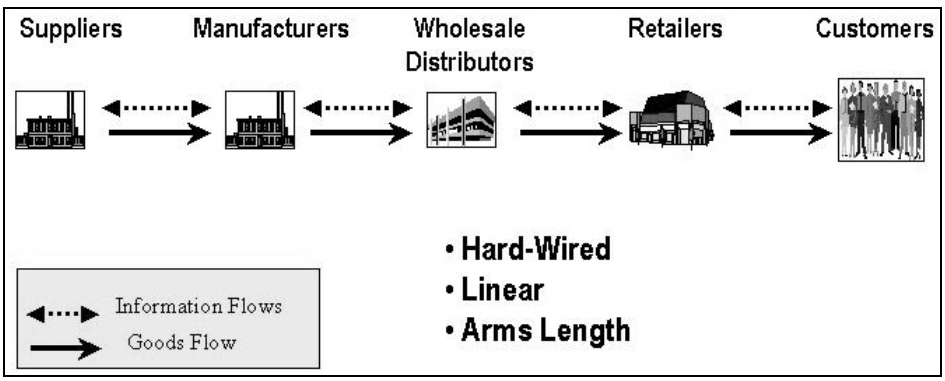



**Figure 1** The traditional supply chain

In contrast, an internet-enabled supply chain is very complex: it is dynamic, customer-centric, and collaborative in nature (see Figure 2). The traditional linear can never meet the challenges of today' world, with globalization and outsourcing being key elements of the manufacturing process.

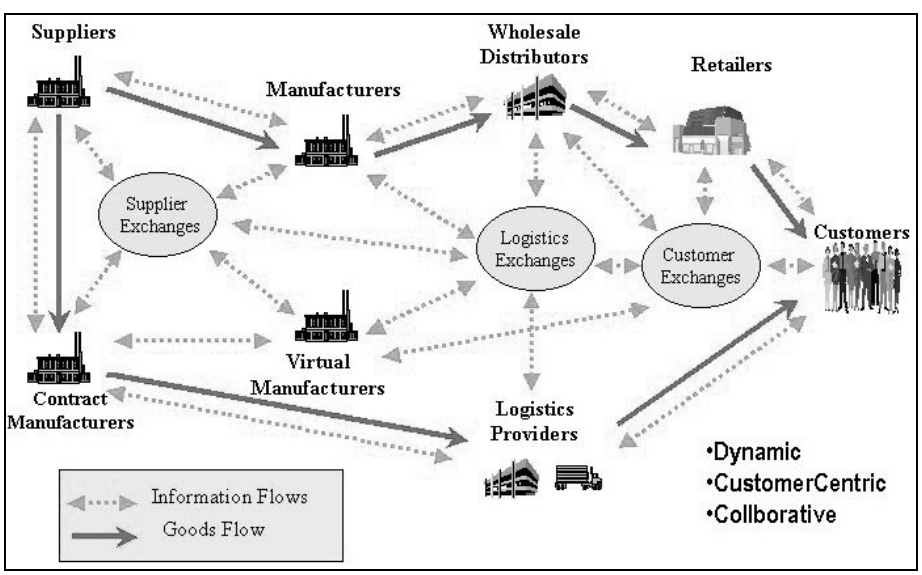



**Figure 2** Internet-enabled supply chain

**Supply chain improved benefits**

Mackenzie conducted a survey of year 2000 of US offices. They discovered that for hi-tech industries, optimizing supply chain activities can generate up to 125 billion dollars of trade to them in two components-in the cost saving component and the increased revenue component. Based on the 125 billion dollars total benefits to the whole industry, almost 80 per cent are from cost savings and 20 per cent is revenue increase. So for any optimization of the supply chain, the most direct effect is on cost savings in terms of lower inventory, in terms of market and product development.

To elaborate, Table 1 is from PRMT, an American institute; it quantifies benefits accruing from an integrated supply chain.

**Table 1** Typical quantified benefits from an integrated supply chain

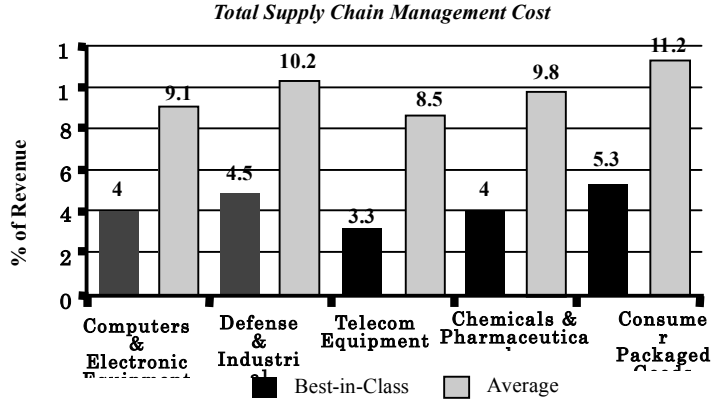
| **Benefits** | **Improvements ( per cent)** |
|---|---|
| Delivery performance | 16–28 |
| Inventory reduction | 25–60 |
| Fulfillment cycle time | 30–50 |
| Forecast accuracy | 25–80 |
| Overall productivity | 10–16 |
| Lower supply–chain costs | 25–50 |
| Fill rates | 20–30 |
| Improved capacity realization | 10–20 |

*Source*: PRMT Integrated Supply Chain Benchmarking Study, 1997

As the table shows, a typical quantified benefit of an integrated supply chain of the delivery performance is up to 20 per cent, inventory reduction up to 60 per cent.

**Supply chain management costs**

Figure 3 shows the results of a benchmarking study performed by the Supply Chain Council, of which ECnet is a member. It contrasts the performance by industry of the typical performer versus the average of the best-in-class performers. How, for example, does an average company perform compared to a best of crust?

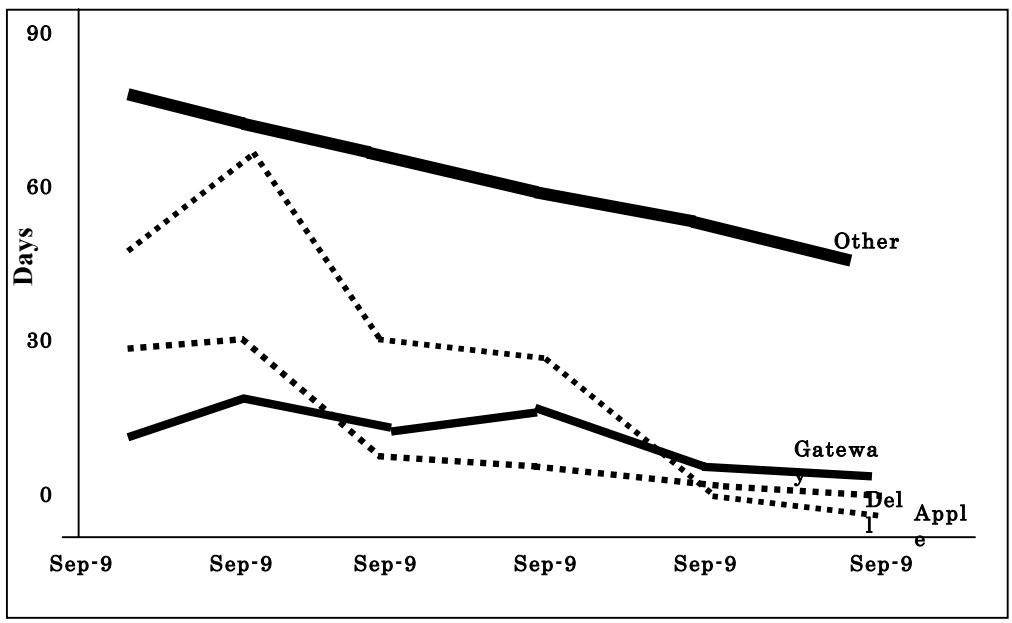



*Source*: PMG's Supply Chain Management Benchmarking Series

**Figure 3** Superior performers achieve lower SCM costs

As the figure shows, best-in-class companies have an advantage in total supply-chain management costs (5–6 per cent less in revenue). For a company in the best of crust category, the percentage of the total supply chain cost is only four per cent of the revenue. In contrast, for an average company the comparable figure is nine per cent. If two such companies were to compete for, say computers, the best of crust company would be able to reduce prices and still profit.

**Inventory reduction**

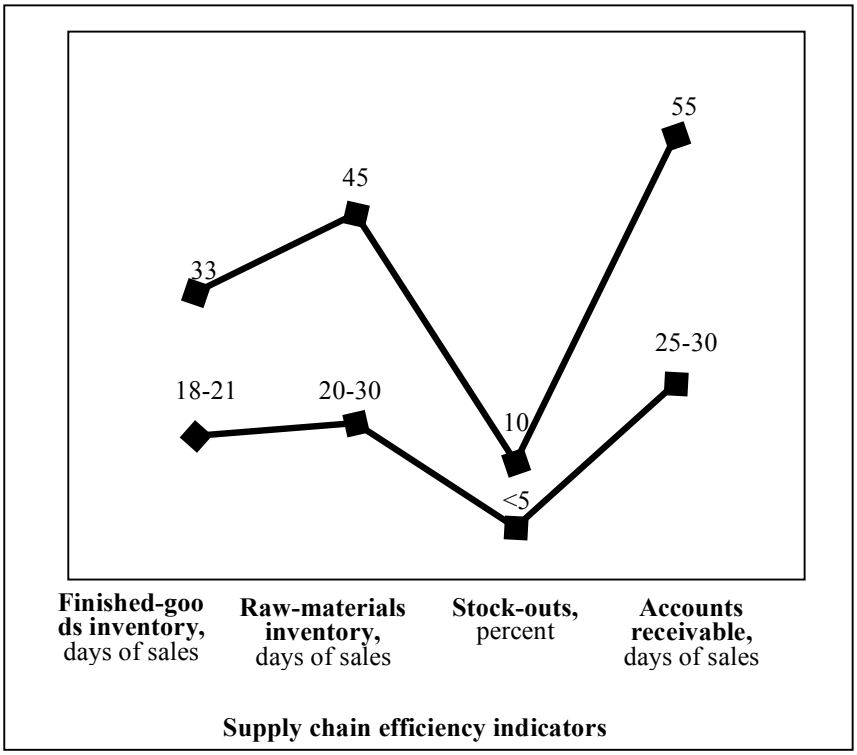



*Source*: Mercer Management Consulting, Compustat

**Figure 4** PC industry benchmarks: Days' supply of inventory

To elaborate on the importance of inventory reduction, Figure 4 shows some benchmarks from the PC industry. In this industry, inventory supply reduction is measured in days. With reduced inventory, holding costs are lower and there is more working capital. Thus, the fewer inventories a company has the better shape it is in. As we see from Figure 4, the length of time for average companies is around 60 days' inventory while top-performing companies like Apple, Dell, and Gateway have less than 15 days. Dell and Apple hold less than five days of inventory and are therefore in a better state.

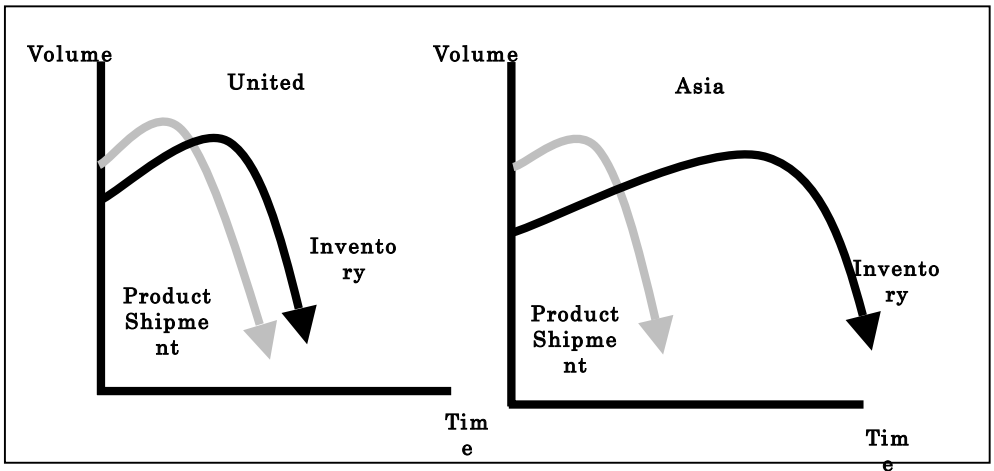
**The Asian supply chain**




*Source*: Centre for Monitoring Indian Economy (Prowess); McKinsey Analysis

**Figure 5** Asian supply chain compared to industry benchmarks

As shown in Figure 5, the Asian supply chain is still lagging behind. What happens is that on the finished goods inventory, the benchmark which is usually for the US and the more advanced countries' manufacturers, the finished goods inventory is 18 to 21 in one day; the comparable figure for Asia is 33 days. For "Accounts Receivable", it is 55 days for Asia versus 25-30 days in more advanced countries. Essentially, companies in Asia have a cost disadvantage although the cost of labor is cheaper. In the long-term, labor will become less and less important in the total cost of any manufacturer.




*Source*: Strategic Intelligence 2001

**Figure 6** Time gap between fall-offs in shipments and corresponding reductions in inventory levels, generic model

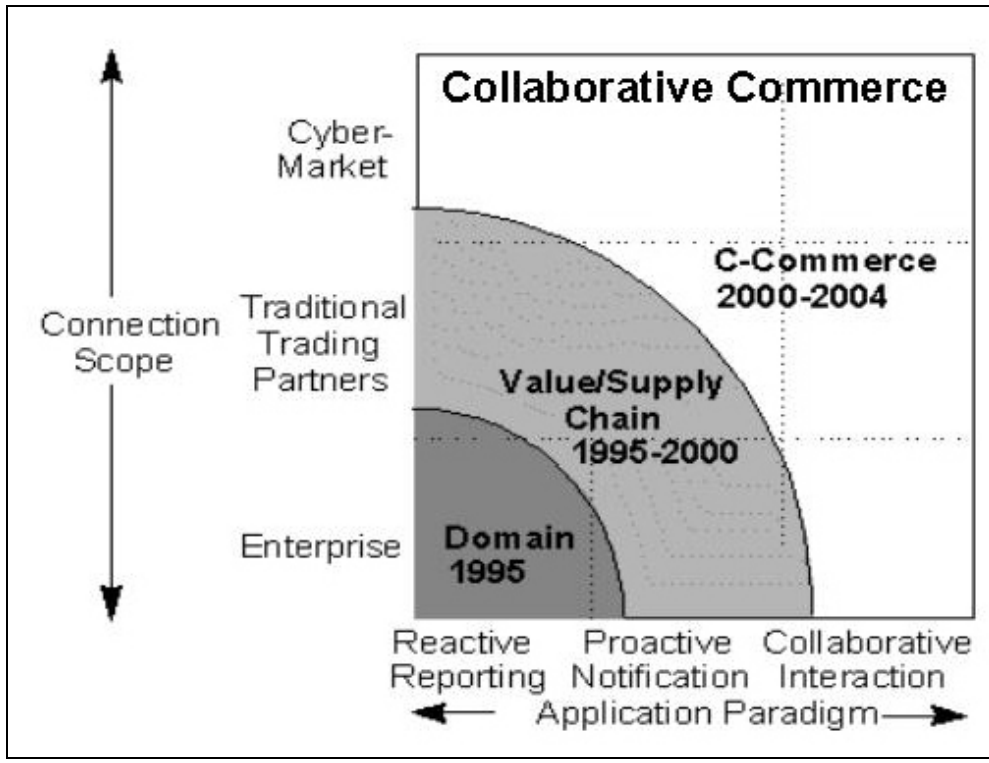
Figure 6 concerns flexibility-the ability to react to changes in market conditions. Electronic industries are currently working at full capacity. However, for about three months at the start of the year there is usually a sudden downturn: cancellation of orders and sudden drop in demand. As Figure 6 shows, In the US when the product shipment drops, the inventory correspondingly drops rather rapidly. This is an indicator that companies can react very fast to fluctuations in demand. The Asia-Pacific graph shows that when product shipment drops suddenly, there is a delay in the corresponding fall in inventory. What this means is that many companies, especially contract manufacturers or suppliers, are sitting on piles of inventory. In the hi-tech industries, inventory depreciates by the day due to rapid obsolescence. Without an efficient supply chain, this pattern will continue and thus hinder achieving GP.

**Optimising the supply chain**

The main challenges faced in optimizing the supply chain are the following:

- Complex business processes cannot be handled
- Partner to partner integration of business processes and technologies, especially for SMEs
- Lack of visibility in the supply chain. As mentioned, those operating in the linear supply chain model have a distinct disadvantage. For example, when a customer cancels his order, the supplier lacks visibility, is still producing and buying raw materials, and therefore will be stuck with a lot of inventory.
- Addressing concerns about security and privacy
- Failures to convince, enroll, and integrate trading partners. For example, some multinationals fail to convince their local trading partners or supplier to join the system, like adopting certain types of software that enable parties to “talk” to each other using the internet.
- Difficulty in convincing partners to use standard capabilities and relinquish current advantage

Having said that, the forces of change may be too strong to resist (see Figure 7).

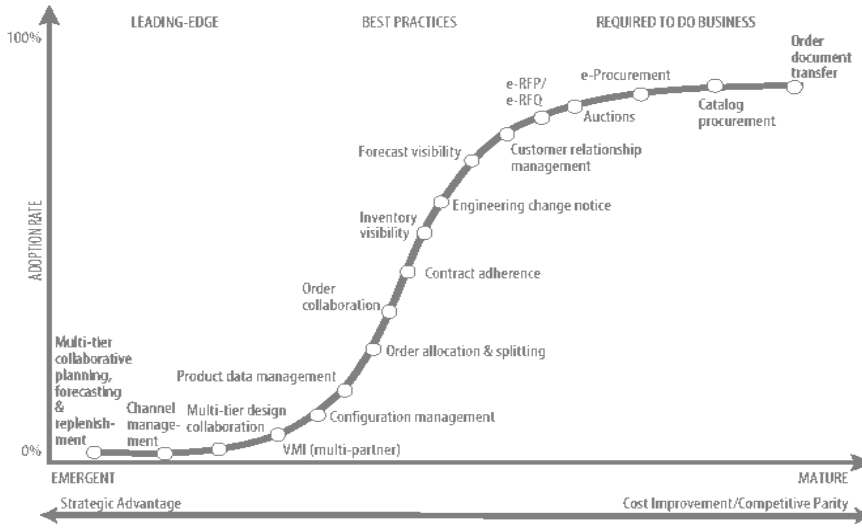



*Source*: Gartner Group

**Figure 7** C-commerce: The next stage in supply chain evolution?

Before 1995, information was largely kept in-house. What is called the ERP movement (Enterprise Resource Management systems) are now in place. Those companies in the West that have got their "house" in order are now moving towards Value Chain concepts whereby they try to allow their partners to access company information and are able do some form of transaction with them. Following that is the Cyber Market model where not only are companies creating a private system to deal with their partners but they also allow outside participation

This is the trend as companies are moving into more sophisticated systems. For the company that asks: how do these new technologies translate into my day-to-day company working, Figure 8 shows an interesting trend.




*Source*: Deloitte Consulting

**Figure 8** Competitive advantage through E-commerce

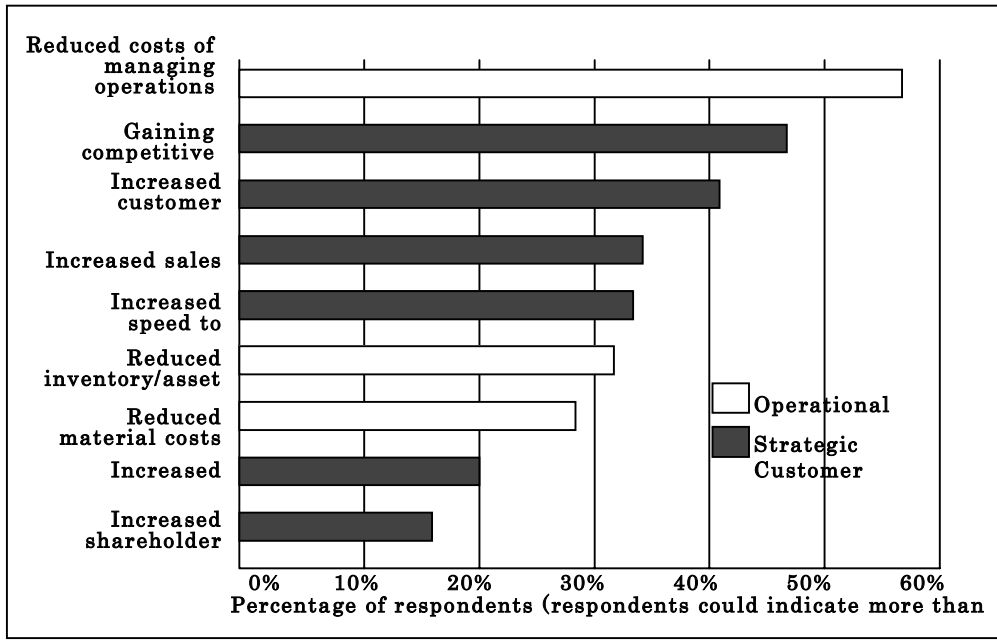
If we look at the Adoption Rate in Figure 8 (Y-axis), the higher it is the more practitioners there are. The X-axis shows the maturity level of a particular technology. It started from things like order management, something that is now quite common (sending a PO online, viewing a catalogue online, online procurement). As we look down the chain we find technologies like forecast visibility, allowing stakeholders in the value chain to look at inventory status, multi-tier collaboration, and collaborative planning, forecasting and replenishment which are called, in short, CPFR. As we move down the curve, we find more practitioners.

**Strategic and operational advantages through collaborative e-commerce**

Some of the strategic and operation advantage through a collaborative e-commerce is shown in Figure 9.

As we see from the figure, the grey-coloured bars show "operational focus," which are techniques to reduce cost, inventory, and material costs. The dark-coloured bars are focused on "strategic and customer" bases, like gaining competitive advantage. Essentially, then, collaborative e-commerce can be approached from the strategic and operational point of view.

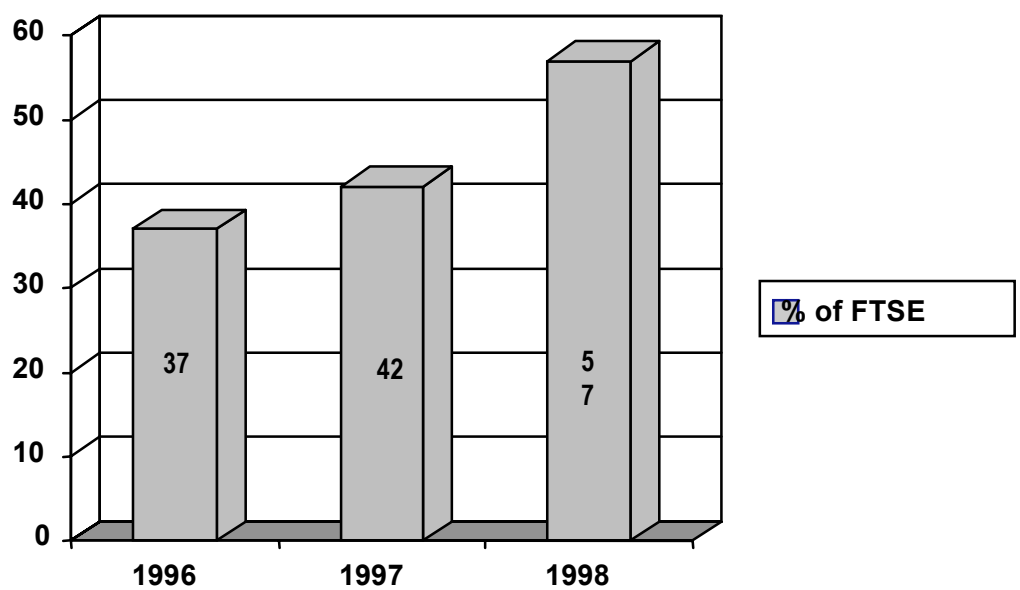
As we see from Figure 10, 100 companies engage in supply link focus, environmental activities have increased from the 37 to 57 per cent in 1998. In other words, there is an upward trend and companies are engaging suppliers on environmental initiatives.




*Source*: Deloitte Consulting

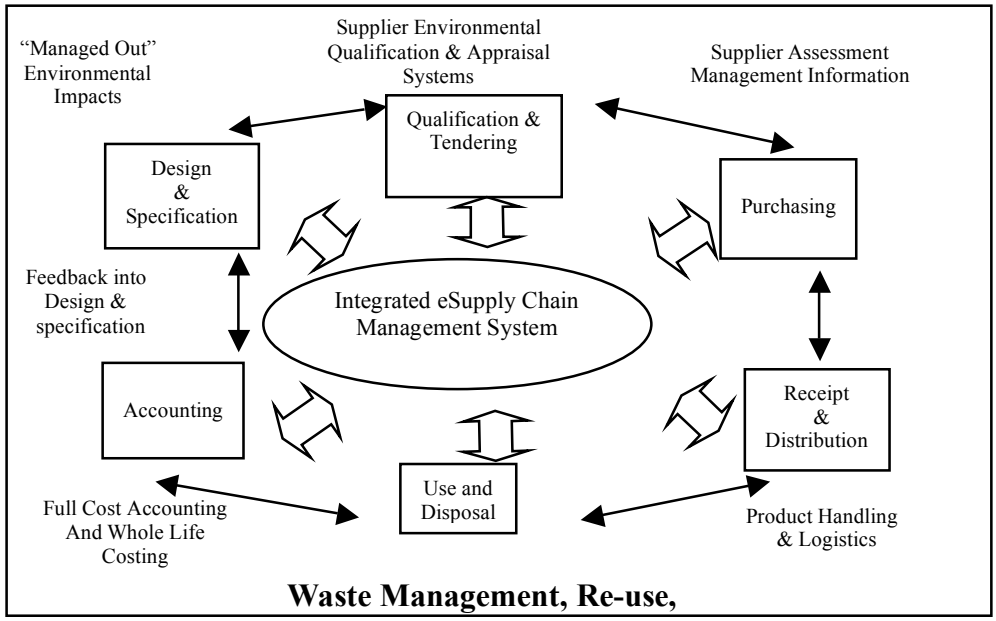
**Figure 9** Strategic and operational advantages through collaborative e-commerce

**Trends in green supply chain adoption**




*Source*: BIE Index Report 1999

**Figure 10** Percentage of FTSE 100 companies engaging in supplier focused environmental initiatives




*Concept adopted from*: "Purchasing and Environmental Management: Interactions, Policies and Opportunities by Ken Green, Barbara Morton and Steve New

**Figure 11** Integrated e-supply chain: A green perspective

As shown in Figure 11, the process of supply chain activities goes as follows:

- start at the *design and specification* level. The objective is to ensure that the design incorporates GP considerations
- followed with *qualification and tendering* (supplier environmental qualification and appraisal systems to ensure that all the environmental issues are being taken into account when qualifying suppliers)
- purchasing (conduct supplier assessment to see whether they have ISO4000, make sure that they are, for example, complying with international standards)
- *receipt and distribution* (product handling and logistics should be done efficiently to curb wastage)
- *use and disposal* (includes waste management, reuse and recycling)
- *accounting* (try to take the full cost of accounting and life cycle costing). This will in turn feedback into *design and specifications*.
- having adopted all the various steps in this e-supply chain, what is needed is an information system-*Integrated E-Supply Chain Management System*-that enables this to be shared within the company and with partners.

**Barriers to E2Commerce**

I term these barriers Integrated E-Supply Chain Management. Two barriers are: (a) currently most of the supply chain is not integrated or integrated only weakly. This means there is no visibility leading to problems collaborating online with all the participants on GP initiatives and (b) there is low adoption rate of environmental management systems, especially by SMEs.

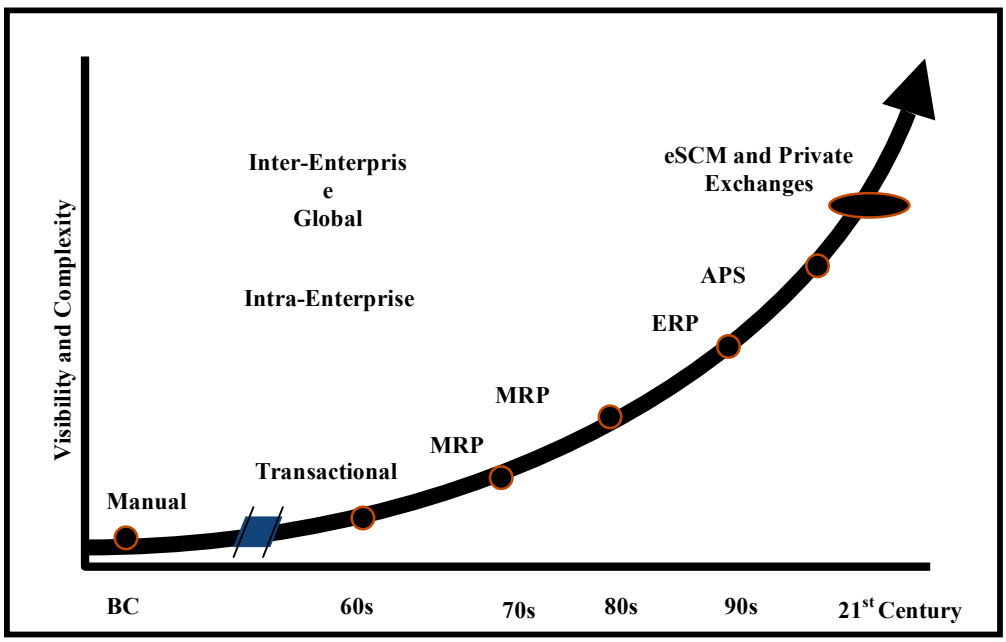



**Figure 12** eSCM implementation complexity

From the integrated e-supply chain angle, to implement the ECM is fairly complex (see Figure 12). Complexity will go up as you move up to different layers, from transactional MRP, ERP advance planning, and scheduling which are within the company all the way up to collaborating online with partners and participation in both private and public exchange. Complexity is a big challenge for a lot of companies in Asia. Figure 13 illustrates complexity with regard to connectivity and integration.

Complexity is due to, firstly, point-to-point solution, replication of partners' management activities and the like. In connecting with partners online, there is a need to have different kinds of software for different kinds of partners.

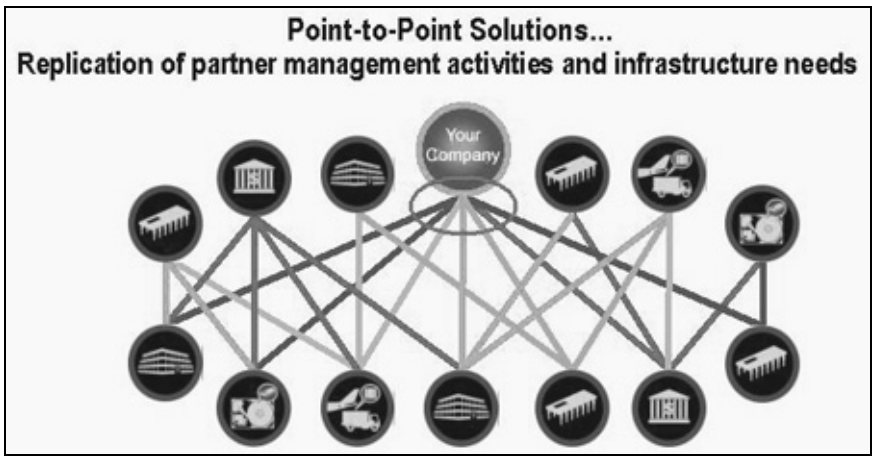
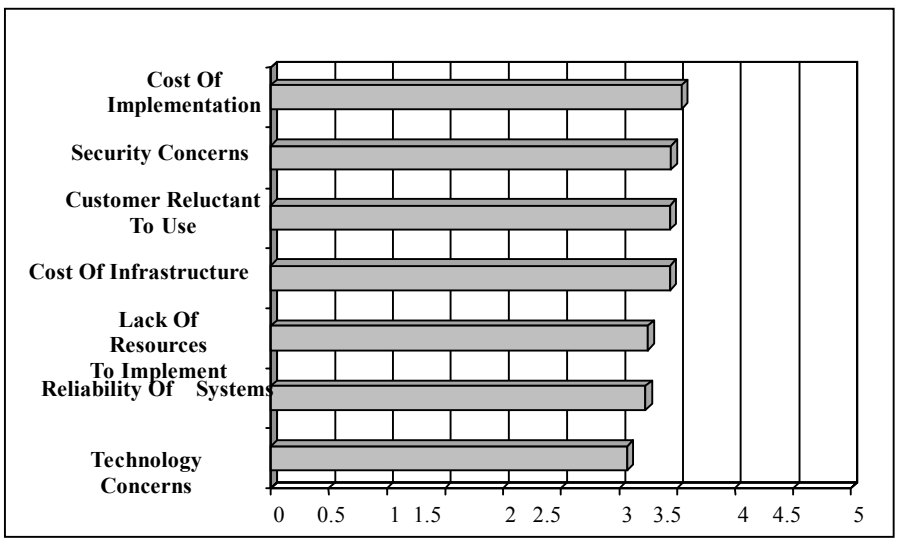



**Figure 13** Connectivity and integration




*Source*: Line 56

**Figure 14** Survey results: Barriers to business integration

Another barrier is identified by this survey (see Figure 14). As it shows, the most significant barrier for Asian companies is the *cost of implementation*.

To summarize, the barriers to eSCM implementation are:

- Prohibitive up front capital cost for turnkey solutions
- Risk of obsolescence and software/hardware maintenance cost
- Network security on direct linkage with trading partners
- Complexities of integrating ERP systems
- High cost and unavailability of IT personnel
- Integrity and quality of data collection
- Complex processes and user interface in very fragmented markets
- Managing diverse trading partners and suppliers around the globe
- Staying competitive in tough market

- Limited global e-supply chain operations expertise.

As Sanjeev Varma of the Gartner Group has pointed out: "In the past, companies have *integrated data*. Now we are seeing the *integration of applications*. Above and beyond that, we will move to the *integration of processes*. ERP and CRM applications have some element of workflow. The larger challenge is to integrate those applications with other applications outside the enterprise" (emphasis added).

**Environmental Management Systems (EMS)**

Some reasons why EMS has been adopted:

- to improve corporate image
- gaining competitiveness in marketplace
- to satisfy contractual requirements
- to manage, measure, audit, monitor and improve the environmental performance and standards; manage environmental risks
- to satisfy legislative requirements
- driving internal improvement by reducing operation cost through the prevention of pollution and improvement of resource efficiency

Some of the internal barriers to adoption of EMS:

- Lack of awareness of EMS
- Lack of trained professionals and up-to-date technology
- Lack of support and buy-in from top management and employee-resistant attitudes and human behavior
- Financial constraints and hard to determine Return-On-Investment.
- Difficulties in identifying environmental impacts

Some of the external barriers to adoption of EMS:

- Insufficient public and legislative pressure
- Insufficient drivers among the various stakeholders in the value chain e.g. customers
- Lack of proper guidelines
- Lack of competent consultants
- High cost associated with ISO implementation an ongoing certification process
- No financial or fiscal incentives from government

**INTEGRATED ESUPPLY CHAIN-MAKING E2 COMMERCE A REALITY?**

Can E2Commerce be achieved, is it being implemented currently? The e-supply chain must support business processes that enable the key business processes to be monitored, notified, controlled, simulated and measured while at the same time create global visibility or visibility over the whole e-supply chain.

- Domain customizable Supply Chain solutions. The solution adopted cannot be uniform across the board
- Identify the main drivers
- Customized solution for each issue
- Trading Partners' participation is key

- Business requirements is main consideration, technology as an enabler

There are six key considerations for a typical eSCM implementation:

- organization
- SCM strategy
- supply chain processes
- technology
- trading partners
- solution design (like implementation approach and assessing the project risk)

## CASE STUDIES FOR INTEGRATED eSCM

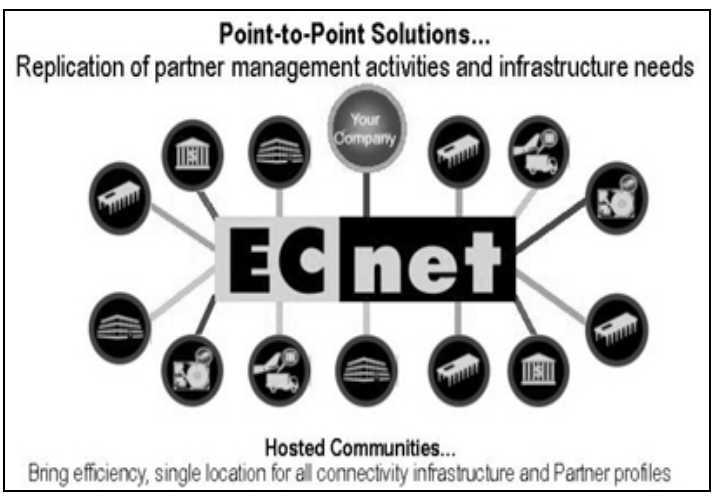



**Figure 15** ECNet's point-to-point solutions

The system that Ecnet is using replicates partner management activities and infrastructure needs to enable efficiency and create a single location for all connectivity infrastructure and partner profiles (see Figure 15).

The objective is to provide a platform to allow companies participating in this system to talk to different people without worrying about what system and what format their partners are using.

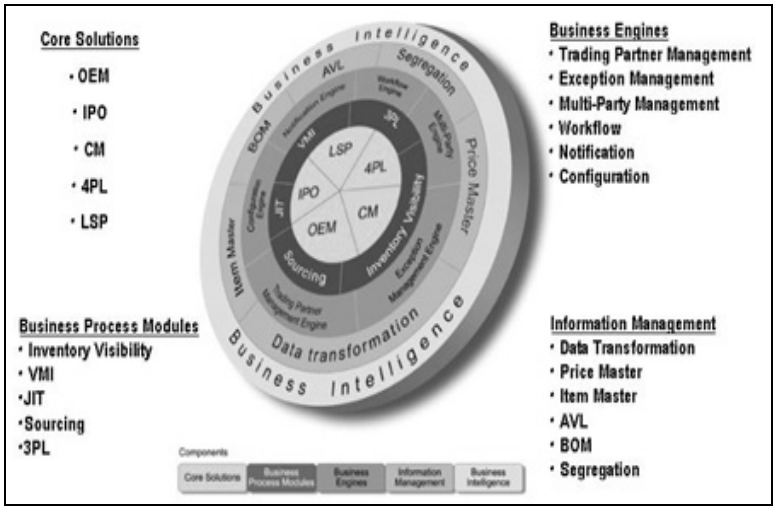



**Figure 16** ECnet 3.0 eSCM Solutions

Figure 16 shows what an e-supply chain management system looks like. The components are:

- core solutions (for Ecnet, core solutions targeted for hi-tech manufacturing in the area of contract manufacturing, international procurement offices, original equipment makers and some others like logistics providers)
- business process modules that allow for inventory visibility, vendor management inventory
- business engines like Just in Time sourcing, trading partner management, Exception Management
- information management: like Price Master, Approved Vendor List

With the above components in place, then companies can perform what is called Business Intelligence. For example, a company can track supplier performance: how accurately they deliver, whether they deliver on time, whether the right type of qualities is obtained.

**Nat Steel Electronics: Forecast, PO, Logistics and Financial Management**

This company was formerly the fifth largest electronic contract manufacturer in the world; they are now bought over by Selectron, the first or second largest contract manufacturer in the world. The system Ecnet designed for them was done in 1999. The objective was to implement an online system to allow them to forecast, purchase order, logistics and financial management, increase active supplier participation.

According to a study conducted for Nat Steel by Deloitte Consulting:

- there was increased active suppliers participation by 76 per cent in less than 8 months versus nine per cent with EDI-VAN
- Reduction in lead time for ordering by 2-3 days
- Productivity improved at least 30 per cent
- Cost savings in processing orders reduced by 50 per cent

- Over 30 per cent improvement in staff productivity in the accounts payable department
- Quantifiable savings was US$500,000 for a one-year period

**Seagate**

ECnet implemented a Vendor Inventory Management (VIM) solution that includes the following: Blanket PO, buyer created Invoice, Price Master, inventory visibility, consumption report, forecast management. This was integrated to their 3PL warehouse and implemented in seven plants across four countries (mainly Singapore, Malaysia, Thailand and China). Reduce Days Sales Order are still outstanding (DSO). We improve inventory turnover by three to four times. Reduced cash-to-cash cycle for suppliers.

**SUMMARY: SEVEN STEPS TO E2 COMMERCE**

1. Get on the EMS bandwagon
2. Get connected to the Internet
3. Get integrated: IT System and Business Processes
4. Start communication with partners
5. Get all-round commitment
6. Get managed, coordinated, monitored and audited
7. Start eSupply Chain collaboration

# 5. INFRASTRUCTURE REQUIREMENTS OF E2 COMMERCE

***Dinesh Jain***
*Director-Asia Pacific*
*iS3C Consultancy Services Ltd, USA*

## DEFINITION OF E2COMMERCE

The relevant meanings of the three words in the Merriam Webster dictionary are as follows:

- *Electronic*: of, relating to, or utilizing devices constructed or working by the methods or principles of electronics; *also***:** implemented on or by means of a computer, like *electronic* food stamps, *electronic* banking
- *Ecology*: the totality or pattern of relations between organisms and their environment
- *Commerce*: the exchange or buying and selling of commodities on a large scale involving transportation from place to place

By E2Commerce, we mean "the buying, selling and delivery of goods and services using electronic media so as to up keep the totality of relations between humans and the natural environment."

## IMPORTANCE OF E AND E

'E' stands for "environment." Since ancient times Asians have worshipped environmental phenomena such as mountains, rivers, trees, forests, animals; this has been an eco concept. The ancient Jain religion talked about it in the clearest way. Jainnism's fundamental principle (in Sanskrit) is *paras paro gahojivanam*, which roughly translates as "that all living beings are interdependent". Just as a person cannot live alone, in the same way the human species cannot survive by itself; humans have to coexist with all other living beings by preserving the natural environment

What are the eco aspects of e-commerce? Some aspects are:

- reduction in paper usage
- reduction in travel & infrastructure usage for exchange of goods and services
- reduction in energy usage and waste due to efficient production and usage by
    - intelligent design of products
    - intelligent production processes
    - intelligent operation of products and
- efficient delivery
- reduced urban expansions due to decentralization of business

The significance of e-commerce is articulated in the following quotes:

"eCommerce offers the potential of improving the environmental efficiency-by using efficient delivery mechanism and cutting waste"

(Braden R. Allenby, Professor at Columbia University and Vice-President of AT&T)

"The capabilities of IT are needed to ensure that economic growth is achieved through reduced use of energy & other natural resources and an improved environment " (Henry Kelly, Office of Science and Technology Policy of the White House, USA)

As these show, IT is necessary for environmental protection. Many environmentalists do not make this connection; rather they only see the adverse impacts of IT. Most of the time they think that IT is going to, in fact, harm the environment. My plea is that it is not.

Globalization is inevitable. E-commerce is the sensor for global progress. Humanity must keep the ecosystems intact for its own survival.

## TECHNOLOGIES AND SYSTEMS

Current technologies of Web and Internet are:

- *B2B exchanges*
- *portals and vortals*. An example is the WARP project of Toyota whereby it is integrating two or three levels of suppliers. I.e. the suppliers of the suppliers will be integrated into the system
- *eProcurement*. An example is the procurement-oriented eKomatsu of the Komatsu company (manufacturers of heavy equipment)
- *eMarketplaces*. These are market places where you can electronically exchange your goods and services and obtain information. An example is the Steel Exchange in India which involves all the steel companies
- *web malls*. One example is 121ware.com, created by our company for a large electronics manufacturer that sells PCs in Japan

Technologies must also serve the remote and rural areas where incomes tend to be low. There are areas connected by certain wireless and local loop technologies. An upcoming technology that goes beyond the Web is dubbed The Grid. Originally from Europe, this is a grid of several internets combined and is in current usage. We anticipate that this will be very popular in the world eventually. Examples of current technologies empowering rural and scattered communities with E2Commerce are: Midas Communications (www.midas.com) and Technology and Action for Rural Advancement (www.TARAhaat.com). These are both Indian companies. Midas found a way to use simple devices in order to create exchanges that can incorporate internet and telephone connections for a small rural community. Technology and Action for Rural Advancement (TARA) is a profit-oriented NGO. Their tarahaat.com operates in Punjab and Madhrapradesh. It provides touch-based services to remote villages, which helps preliterate peoples. A voice-over on the website will provide information, like the rate of a kg of grain in the nearby market.

Figure 1 further illustrates what are the currently available technologies.

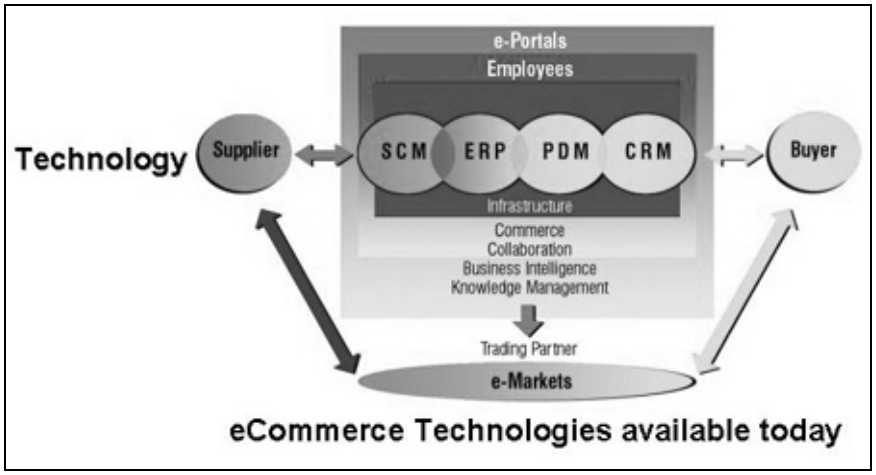



**Figure 1** E-commerce technologies available today

**INFRASTRUCTURE**

There are two types of infrastructure needs: physical infrastructure (tangible materials like hardware) and intellectual (intangible qualities like software or processes).

**Physical infrastructure**

Some examples of challenges to overcome are:

- computers, network systems and other necessary hardware and equipment
- logistics and shipping: these need to be regrouped, rearranged, and redeployed for E2Commerce purposes
- communication bandwidth: these too need to be fixed
- suitable changes to packaging industry: the traditional packaging industry is geared towards selling at retailers, the mall and other physical places. With the move into internet-based shopping, the industry will need to be re-packaged; for example, the traditional way of displaying goods would create much wastage in energy usage for e-commerce
- skilled human resources: the need for education
- connecting global communities with necessary equipments and skills: currently this situation is biased against the have-nots

**Intellectual infrastructure**

The challenges for the intellectual infrastructure are higher than for physical ones. Some include:

- determining common standards for E2Commerce: we need to understand what is E2Commerce, then fuse ISO14000 standards which are like the green standards along with e-commerce standards in order to create E2Commerce standards
- huge software systems and databases

- communications' security systems (see Leong, this volume)
- new financial systems and their integration with legacy
- new legal systems for E2Commerce policing
- new governmental regulations of (for example) customs and taxations
- new auditing mechanisms for E2Commerce compliance
- grading systems a la ISO; for eco organizations and their products and services.
- new labeling standards with green alternatives; i.e. consumers need a way to determine whether a certain product conforms to environmental standards
- incentives and disincentives for producers and consumers

## ACTION PLAN FOR STAKEHOLDERS

A list of stakeholders would go:

- national governments
- world bodies like the United Nations, World Bank, International Monetary Fund, World Trade Organization
- NGOs
- large global corporations
- SMEs
- common people
- IT industry

### Action plan: national governments

- taxation and legal policies and frameworks
- setting and combining eco and e-commerce standards for creating E2Commerce national standards
- eco-audit systems for organizations and their products and services. Organizations, products, and services need to be audited
- create systems
- E2Commerce physical and intellectual infrastructure (see above)

### Action plan: world bodies

The United Nations, World Bank, IMF, WTO and other such World bodies must:

- set global E2Commerce standards
- lobby actively for E2Commerce technology transfers to have-not nations
- include E2Commerce aspects in national rankings like the Human Development Index
- declare important and fragile ecosystems as World Heritage and reserved areas
- set up World Ecological Funds
- incentive and disincentives to nations for compliance

### Action plan: NGOs

- lobby with world bodies
- lobby with national governments

- police non compliance by organizations
- identify fragile ecosystems
- promote E2Commerce awareness among the masses

**Action plan: global corporations**

- actively promote E2Commerce internally and externally
- set up of E2Commerce physical infrastructure
- comply with E2Commerce standards
- enforce E2Commerce to supplier
- educate employees and customers
- audit internal divisions and subsidiaries
- incentive mechanism for internal and external compliance
- transfer technologies to have-nots
- fund research and development and tertiary-level education for E2Commerce technology and awareness

**Action plan: SMEs**

- set up E2Commerce physical infrastructures
- comply with E2Commerce standards
- incentives and disincentives for employees
- educate employees
- lobby large corporations and national governments

**Action plan: common people**

Each individual in his/her personal capacity must do all or at least some of the following:

- be proactive in knowing, using, propagating and lobbying for environmental issues
- as far as possible, use goods and services compliant with E2Commerce standards only
- invest in personal eCommerce infrastructure
- buy goods and services using eCommerce
- promote E2Commerce awareness among family, friends and colleagues

**Action plan: IT industry**

- bring out 'better, faster and cheaper' technologies and products for E2Commerce
- adhere to E2Commerce standards
- invest more in E2Commerce research and development
- focus on environmental concerns by developing technologies and products consuming less energy and having reusable components
- lobby governments and world bodies for development of E2Commerce

**CONCLUSION**

E2Commerce is the way ahead. The integration of the E of "Environmentalism" and the E of eCommerce to create E2Commerce is the way for the progress and survival of humanity: progress through e-commerce, survival through environmentalism. All the stakeholders need to act upon it, to fulfill the requirements of both the physical and

intellectual infrastructure.

**APPENDIX**

For further information on E2Commerce, see the websites of:

- http://Green-ecommerce.com An organization dedicated to connect people, groups and organizations for E2Commerce http://www.digitaldividend.org An organization dedicated to bring the benefits of the digital economy for the betterment of the environment http://earthtrends.wri.org The World Resource Institute's environmental arm
- http://www.cisp.org/imp Information Impact Magazine
- http://www.ecommerce.gov US Government site for promoting eCommercehttp://europa.eu.int/ISPO/ecommerce EU site for promoting eCommerce and, among other issues, the environment

# 6. THE CURRENT STATUS OF E-INDUSTRY IN TAIWAN

*Li-chuan Chu*
*Deputy Executive Secretary*
*Science & Technology Advisory Group*
*Executive Yuan of the Republic of China*

## BACKGROUND

The *industrial Automation & electronic Business* (iAeB) program was approved by the Executive Yuan on June 3rd, 1999. The program promotes and improves e-Commerce technologies and various applications for target industries, such as producing, warehousing, marketing, and delivering. The *National Information & Communication Initiatives* (NICI) was established by combining the formerly three overlapping programs National Information Infrastructure (NII), National Program Promoting Office (program office for information particularly for the government sector), and the IAEP. The iAeB program remains to be executed under NICI. Once fully formed the NICI will have three major components: e-government, e-society, and e-industry.

E-government comprises national programs. The objective is to outsource as much as possible of government business, including education and business development. There are so-called flagship projects that have been newly developed to this end. The e-society component aims to reduce the digital difference within society. The following discussion focuses entirely on the third component, e-industry.

## VISION & GOALS

### Vision

Through assisting industries to integrate supply chains and demand chains via automation and Internet-related technologies, the long-term vision is to improve competitiveness and to enrich the foundation of sustainable economic growth so that the industrial foundation of a knowledge-based economy in Taiwan can be established.

### Goals

By the end of 2004:

- to integrate 50,000 enterprises (80 per cent are SMEs) into 200 or more supply chains
- to implement B2B e-Commerce in IT industry as a pilot project and then extend to other industries
- to develop *producing*, *warehousing*, *marketing* and *distribution* modules for targeted industries, and to establish 40 demonstration sites; assist 2,000 companies to improve automation capability for *manufacture*, *commerce*, *agriculture*, *construction* and *government* sectors.

## PROMOTION STRUCTURE

The problem faced by this program was how to implement it and therefore enhance Taiwan's competitiveness. The IT industry was selected as a pilot project for

two reasons: this industry already had a good foundation; by working with this industry, we could anticipate immediate results, as IBM had already planned to establish a procurement centre in Taiwan.

The main purpose of the project is to enhance Taiwan's competitiveness. To do so, we needed more product orders from the IT companies, particularly the major computer firms. The objectives of this pilot project were to assist 2,500 enterprises in building up B2B capability and to integrate them into 20–30 supply chains. The IT industry would be a pilot project, with plans to extend eventually to other industries. Currently there are two types of projects:

- Type A projects: consists of the major foreign companies invited to Taiwan, IBM, Compaq, and HP, to build up supply chains in Taiwan and promote IT products procurement. These companies were invited to submit applications. The government's role in turn is to provide some financial support or subsidy, and to establish the supply chain in Taiwan. The companies would include local office people into the global chain of their company business so that locals can be trained, at home, and learn about the operations in the global wise of that particular large company. More than 40 local suppliers have joined the projects.

- Type B projects: to provide a local supply chain for foreign companies like IBM. 18 local companies representing the major ones in Taiwan were selected at the start; 15 projects are granted; around 2,900 local suppliers are listed in the alliances of the projects. Type B companies are asked to propose their objectives, like the number of suppliers they connect to in order to build up their supply chain. Originally we proposed that in the second phase, these companies would help to train those other companies that are not their current suppliers. However, this part has been dropped as the companies are too busy just training their own suppliers.

Type A companies usually claim to deliver (say) 95 per cent of their orders within five days. The Taiwanese manufacturers in the Type B companies are now prepared to deliver 98 per cent of the order in two days. This has totally changed the industrial structure. When the cost of industrial production is reduced tremendously, the industry will come to make the largest contribution to a country's economic growth. However, we are aware of the problem of over-supply; economic growth alone cannot create more demand.

The above are still in progress. There are plans to follow-up later with Types C, D, and E projects. RosettaNet has been introduced as data exchange standards for enterprises. Another objective of the Type A and Type B projects is to establish an ASP (Application Services Providers) industry. With more than 20 ASPs involved now, the projects will accelerate the growth of ASPs. There are now 160 ASPs.

**CURRENT STATUS**

The following discussion briefly reviews the current status of the various sectors of the IT pilot project:

- manufacturing
- commerce
- financial
- agricultural
- construction
- government
- related measures (infrastructure)

**Manufacturing sector**

*Objectives* Promoting more than 70 supply chains for manufacturing sectors to apply EC technologies and to upgrade the competitiveness and capability of the industry. These companies will work with the Department of Commerce, to help suppliers, retail stores and chains to change the way they do their daily business.

Establishing 20 demo sites and assisting 500 manufacturers to build industry automation capability. The government subsidises some of the cost of hardware purchase.

*Current status* Establishing e-Business service assistance project for 18 industrial systems (including supply chains and demand chains, such as vehicle, petrochemical, and textile industries.)

Organizing e-business service teams and setting e-business standards for eight major industries in this sector

**Commercial sector**

*Objectives* Assisting 2,000 business units (SMEs) in establishing capability of B2B practices.

We are establishing 15 demo systems by integrating in inventory, delivery and sales and 1,000 business units with e-business automation capability.

*Current status* Information service system for distribution business as well as information system for commodity flow have both been planned and installed. There are 39 companies and 239 supermarkets using the supermarket information system. Six chains and 120 convenience stores use the convenient store information system.

Provided consultation to material flow companies (100 companies per session) and trained material flow experts (348 person per session).

Developed XML standards for key IT application operation to set up a

common standard model of e-business.

**Financial sector**

*Objectives* Facilitating financial organizations/institutes to provide various services, electronic transaction, and information service, etc.

Assisting financial institutes in establishing e-financial automation and internet banking capability.

*Current status* Providing simple electronic monetary flow and financial services between enterprises and financial institutes.

Establishing internet fund transfer, payment, and inquiry services with value-added network services.

Developing demonstration supply chain system and organize service teams to promote EB/EC.

**Agricultural sector**

*Objectives* Establishing 12 farming supply chains

Establishing 200 demo sites and assisting 500 companies to expand with automation capability.

*Current status* Building an "e-Farmer" environment so that infrastructure, supporting applications, and management technology can be applied to the agriculture sector.

Government-planning of a proper system and environment, encouraging applications of the Internet and e-business technologies in the private sector, built to serve the public and to raise incomes of farmers.

Setting up six demo sites of e-business for agriculture transportation and distribution; setting up transaction organizations for transportation and distribution of agriculture products.

**Construction sector**

*Objectives* Assisting 1,000 SMEs in establishing e-construction capability and integrating into 20 supply chains.

Assisting 500 companies in building construction automation capability.

*Current status* Encompassing domains of planning and designing experts (architect, technical experts, engineering consultants), general or special construction business, construction investment business, etc.

Providing assistance in technologies, such as: SCM (among enterprises), ERP (within enterprise), and key construction automation technologies.

Establishing 200 demo cases for automation and promoting / assisting 500 industries to set up automation capability.

**Government sector**

*Objectives* Facilitate government e-procurement

Promote at least 10,000 businesses to use the Internet to participate in the government's procurement processes.

*Current status* Starting from small-amount and routine e-procurement cases. Selecting organizations with better IT capability to practice e-procurement first then extend to others.

Starting development of information systems and installing management systems of operating including: procurement announcement, vendor catalogues, pricing, inquiry, ordering, payment, and CA mechanism, etc.

**Related measures (infrastructure): Status of progress**

*Regulations*

23 items of legislations and 14 executive orders need to be amended. The electronic signature law has been approved by the Executive Yuan and is currently being reviewed by the Legislative Yuan. Electronic invoices are being drafted.

*Standards*

The e-Industry in Taiwan is expected to be promoted via integrating standards of electronic data exchanges by the benchmark IT industry. (RosettaNet's standard is considered to be the common).

*Monetary flow security*

The Ministry of Finance stance on technology is neutral. The banking business has regulated various security mechanisms on the Internet by themselves.

*Industries investment*

Through tax credits and special loans on investment, encouraging industries to be involved in building up infrastructure.

*Skills training*

Utilize "Scientific and Technological Skills Training and Application Program" and "Enforcing Software Talents Training Program" to cultivate the manpower needed for implementing the iAeB program.

*Promotion plan*

"E-Business White Paper" has been published in English and Chinese versions. There are efforts to promote and gather ideas by organizing various fora and seminars.

## CONCLUSION

*Strategies*
Need to find out what are the objectives and goals, then to develop a business strategy; need to identify resources and single-mindedly focus them on only one purpose, the achievement of company goals.

*Implementation*
During the implementation period, need to set up an index to assess and evaluate effectiveness and efficiency. Follow through on a continuous cycle of modifying goals, fine tuning strategies and possibly the index.

*Future for Taiwan*
We will continue to work along these lines but with plans for expansion. Already, the program is extended to other industrial sectors. The long-term plan is to cover as many industrial sectors as possible.

# 7. EMS: ISSUES, OPPORTUNITIES IN B2B COOPERATION

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**Abstract**

Environmental management system (EMS) is an environmental wave started in 1990s and the leading ISO 14000 standard that has spread across the industries of the world since 1996. Today, there are more than 30,000 organizations/companies in the world that have got ISO 14001 certified, with the European countries leading.

Is EMS a good tool for managing a company's environmental problems or is ISO 14001 standard a condition that is just imposed on the marketplace? EMS for sure has certain benefits such as enhancing company image, better compliance with government regulations, internal cost savings on material and energy, and gaining competitive advantage in the market place.

However, there are many controversial issues about EMS. ISO 14001 certification says nothing about an organization's actual environmental performance. Also, EMS and ISO 14001 are not synonymous. Implementing EMS will encounter many difficulties and barriers which may include insufficient financial resources, difficulty in identifying environmental aspects and environmental significance, insufficient external drivers, etc.

Yet some companies with leading environmental stewardship are going for it. IBM has all its 28 manufacturing and developing locations registered under one single ISO 14001 worldwide as they found that their market units want to respond to customer inquiries under one system. Multinational Asian companies found that they could afford it and ISO 14001 is important to their business.

Like all other ISO standards, ISO 14001 may become a business condition. With a certified EMS, there would be potential for business opportunities and cooperation and the successful Taiwan story: the Cheng Loong Corporation may be a good demonstration.

**The EMS Wave** The year 2002 will mark the tenth anniversary of the Rio Earth Summit held in 1992. What has happened over these last ten years and what will be the hot issues at next year's earth summit? Over the last 40 years, environmental protection movements have evolved from end-of-pipe (EOP) treatment in the 1960s to waste minimization (WM) in the 1970s to cleaner production (CP) in the 1980s and finally to environmental management systems (EMS) in the 1990s.

**Definition of EMS** According to ISO 14001 standard, the definition of an EMS of an organization is part of the overall management structure of that organization that addresses the immediate and long term impact of the company's products, services, operations and processes on the environment.

**ISO 14001** ISO 14001 has clearly become an environmental wave,

and the overwhelming interest even before the formal announcement of the first standard was only the start. The number of companies in the world, especially in Asia, that have obtained ISO 14001 certification has increased exponentially every year since the release of the standard in 1996. Up to June 2001, more than 30,000 companies/organizations in the world have got ISO 14001 certification and the European countries are leading. ISO 14000 embodies an alternative strategy to government regulation – the use of self-regulation that allows companies to manage environmental affairs on their own terms. The implementation of an environmental management system (EMS, ISO 14001 and 14004 standards) is the starting point, followed by regular evaluation of the EMS through environmental audits (ISO 14010 standards series), and monitoring of performance through the use of carefully chosen indicators (ISO 14030 standards series).

**EMS Issues** Why EMS can be so popular, especially among industries, and yet also facing a lot of controversy? Let us review the EMS issues that have evolved in the last five years including:

- EMS related developments in the last five years (1995-2000)
- The benefits of ISO 14001
- The controversial issues
- Barriers and difficulties of implementing EMS, especially in small and medium industries (SMIs) or enterprises (SMEs)
- Internal cost savings
- Examples in business to business (B2B) opportunities or cooperation

**EMS Related Developments 1995-2000** In 1992-93, UK developed BS7750, a standard on EMS, following the development of the quality standard. This immediately aroused the interests of ISO to develop the 14000 series of standards and EU to develop the Environmental Management Accreditation System (EMAS). EMS only establishes the framework to address environmental aspects, but it does not specify the requirements on environmental performance, automatically publish the environmental report, generate tools for analyzing product design, perform cost analysis, identify and assess technical options, etc.

In the last five years, EMS related developments such as environmental performance indicator (EPI), corporate environmental report (CER), environmental cost accounting (ECA), life cycle analysis (LCA) or management (LCM), eco-labeling, green procurement, greening of supply chain, design for environment (DfE) or eco-design evolved to supplement or complement EMS. During the 9$^{th}$ plenary meeting of ISO/TC207 meeting at Kuala Lumpur in July 2001, the members recommended that a review on how ISO 14000 standard series has contributed to the achievements of the Rio 1992 Agenda as well as ISO competence and readiness to respond to new developments should be conducted. An update and modified version of ISO 14001 is expected to come up in 2002.

**The Benefits** There are many reasons that a company might be interested in establishing EMS and seeking certification under ISO 14001, including: (1) fulfilling legal requirements; (2) driving internal improvements; (3) addressing regulatory and legal risks; (4) satisfying contractual requirements; (5) reducing the need for multiple assessments on the different pollution media or internal management

systems (i.e. ISO 9000); and (6) gaining competitive advantage in the marketplace.

**The Controversial Issues** Is ISO 14001 standard a useful new tool for environmental management or is it a condition that will be imposed on the marketplace? This is a timely and crucial question, particularly in Asia among SMEs. A survey consisted of interviews by telephone, fax, and mail of environmental managers and executives at thirty major global companies, representing more than USD650 billions in annual revenues, indicated that these companies have formulated strategic positions on ISO 14001 in case it becomes a market condition.

In practice, the environmental managers are taking out the "smart parts" for implementation, but they are less interested in certification which requires resources that should be justified by return from business, the public and regulators. On the other hand, a study by Morrison (2001) of the Pacific Institute for Studies in Development, Environment & Security concluded that ISO 14001 could prove to be "a dangerous misleading indicator or a company's environmental stewardship". The study pointed out that the downside of EMS is even conforming procedures can still have major pollutions. ISO 14001 certification denotes only that an organization has established an EMS and says nothing about an organization's actual environmental performance.

**EMS and ISO 14001 Are Not Synonymous** Many global firms have EMS in place before they consider going for ISO 14001 certification. In some countries with developed environmental infrastructures, complying with government regulations requires some form of EMS. Furthermore, many companies submit nonpublic environmental reports such as to industrial associations (e.g. Responsible Care) release their environmental performance data. However, firms that incorporate ISO 14001 are mainly because of market reasons and business implications. ISO 14001 can be treated as EMS revolution, the preferred instrument for globalization, a customized EMS and a potential market issue, but EMS and ISO 14001 are not synonymous.

**Barriers** Many companies, especially SMEs, experience difficulties in understanding and adopting an EMS. Based on results of surveys in Europe and Asia, the primary barriers are summarized below.

**Barriers Identified in Asia** Drawing on the results of a training project covering five countries (the Philippines, Thailand, Indonesia, Malaysia, and Vietnam) and three industries (textiles, electroplating, and food processing), the primary *internal barriers* that prevent SMEs from implementing an EMS include: (1) lack of awareness of the value of an EMS; (2) insufficient professional expertise and lack of up-to-date technology; (3) lack of top management and organizational commitment; (4) insufficient financial resources; (5) lack of support for an EMS among workers; (6) difficulties in determining how best to assign responsibilities internally for EMS implementation; (7) difficulties in changing employees' attitudes and behavior; and (8) difficulties in identifying environmental aspects and impacts.

The *external barriers* for SMEs in implementing an EMS include: (1) lack of strong demand from the public for companies to adopt EMS; (2) lack of proper guidelines from related organizations and institutions; (3) customer indifference to whether or not suppliers have an EMS; (4) insufficient drivers to motivate SMEs to

adopt an EMS; (5) no incentives from government; (6) shortage of competent consultants; and (6) the high registration, audit and consultancy costs associated with the ISO process.

**Barriers Identified in Europe** Based on the results of 33 studies between 1994 and 1999, internal barriers pose more significant challenges than external barriers in Europe. The major findings of the studies are summarized below:

*Barriers to EMS Adoption:* (1) insufficient human resources; (2) EMS implementation is often an interrupted process in SMEs; (3) difficulty in identifying environmental aspects and assessing significance; (4) inconsistencies from the certification bodies and associated high costs; (5) insufficient external drivers and general uncertainty among SMEs about the market benefits; and (6) lack of access to adequate guidance and support.

*Barriers to Addressing Environmental Issues:* (1) employees' attitudes; (2) SMEs' failure to sufficiently understand their environmental impact; (3) environmental performance is not a core business issue for SMEs; and (4) customer indifference to suppliers' environmental performance.

**Internal Cost Savings** In spite of the difficulties and barriers experienced by companies in implementing EMS, many enjoyed the added value (the smart parts) of implementing EMS, especially the internal cost savings. The Asian and European experiences have been quite similar. Some of the key findings from implementing EMS are listed below:

- Significant resource savings, including energy, water, raw materials, and chemical inputs
- Increased productivity due to more streamlined operations and better control procedures
- Numerous organizational improvements and increased efficiency overall
- Cost savings and payback periods experienced by SMEs have been as diverse as the sector itself
- Improvements in internal communications, and the overall skill base, knowledge, and attitude of the employees
- Improved overall environmental performance

**B2B Opportunity and Cooperation** Supply-chain environmental management is an emerging environmental issue. Various firms, industry sectors (automobiles, chemicals, apparel and computers) and group of firms have taken a lead on this. Most ISO standards have in the past become market conditions, similarly, ISO 14001 will be imposed by global customers on their global suppliers.

Leading Japanese firms such as Hitachi, Showa Denko, Fujifilm, Mitsubishi Corporation, Toyota, etc. have started to impose environmental conditions on the products and processes of their suppliers in order to mitigate risk in the face of increasing environmental regulations and liability issues. In US, multinational firms such as Apple Computers, Kodak Corporation, Polaroid, Xerox Corporation, IBM, etc. are working with their key suppliers to achieve the requisite environmental levels.

This increasingly sound business practice and EMS or ISO 14001 is often used to secure and strengthen customer-supplier relationships.

**Still Wait and See** The USAEP's study and Regional Institute of Environmental Technology (RIET) of Singapore's Asia environmental review indicated that there are still many "wait and see" in the setting of environmental conditions for suppliers. Some of the interesting findings include:

- Most US international firms have a "wait and see" attitude, many US global firms already have EMS, but currently do not see a sufficient return on the investment to make certification worthwhile
- The large Asian multinationals can afford certification, but still vulnerable to the risks of environmental performance
- No manufacturers will insist 100% to require ISO 14001 certification from their suppliers
- 40% of the respondents expressed interest in imposing ISO 14001 EMS on suppliers
- 60% of the respondents expressed interest in evaluating the environmental performance of suppliers, vendors and contractors
- The most common current environmental requirements relates to packaging, recycled paper and ozone-depleting chemicals
- Governments can induce significant greening of the production/supply chain

**Successful Story** IBM has maintained a strong EMS for over 25 years. However, at IBM, ISO 14001 did point out some areas in which they could improve the effectiveness and efficiency of their system and further integrate environmental considerations throughout the business. ISO 14001 also provided IBM an opportunity to increase their focus on a common framework with common solutions. This is why IBM has decided to pursue a single worldwide ISO 14001 registration of their manufacturing and development sites (altogether 28 locations). IBM market units want to respond to customer inquiries with a single registration around the world. Starting with 5 sites received registration to ISO 14001 in 1996, IBM successfully completed the audit and registration process of the remaining sites in 1998.

**B2B Opportunity – The Taiwan Case** The paper industry is one of Taiwan's traditional manufacturing sectors and has prospered as the country's economy has grown. Paper production increased from 12,000 metric tons in 1947 to a peak of 4.5 million tons in 1997. Manufacturing technology has undergone a dramatic change from using straw, bagasse, bamboo, and wood to utilizing distinctive kraft pulp and waste paper. A total of 23 paper manufacturing factories (which account for half of the industry's total production in Taiwan today) have been ISO 14001 certified.

With 2,670 employees, 3 paper mills, 7 corrugated container plants, and a tissue paper division, Cheng Loong Corporation had net sales of NT$13.83 million in 1999. Cheng Loong's experience as a concrete example of sustainable industrial strategy, and discusses the company's achievements in quality control, environmental management, and health and safety operation. Having won more than 25 design awards including the "Star of the World" award from the World Packaging Organization, Cheng Loong has several products that have carried Taiwan's Green Mark (the national eco-label) since 1994. The company was certified under ISO 9002

in 1995, ISO 14001 in 1997, and started introducing OHS 18000 in 1999.

The primary emphasis of Cheng Loong's quality, environmental, and health and safety (EHS) policies are as follows:

- *Quality Policy*: quality management and customer satisfaction
- *Environmental Policy*: treasuring natural resources and protecting the environment
- *Health and Safety Policy*: safety as top priority and zero accidents

To coordinate EHS efforts and track the company's performance in EHS and quality control, Cheng Loong has established an Environmental, Health and Safety Department at its headquarters, and ISO 9000 and ISO 14000 committees at each factory. The committees in the factory are chaired by the factory mangers, and all involve full participation by the staff. The EHS Department plays an important role in providing guidance to all of Cheng Loong's subsidiaries on achieving compliance with government regulations, waste minimization, resource recovery technologies, energy conservation, and end-of-pipe pollution treatment. The results of the company's waste minimization efforts from 1996 to 1999 are summarized in the following table.

Results of Industrial-Waste Minimization

| | Number of Projects | | | | Cost savings (NT $ 1,000/year) | | | |
|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 |
| Pan-Chiao plant | 16 | 13 | 20 | 22 | 5,110 | 8,512 | 3,245 | 9,138 |
| Ta-Yuan mill | 20 | 42 | 43 | 47 | 19,353 | 37,735 | 52,210 | 44,293 |
| Ta-Yuan plant | 16 | 20 | 22 | 23 | 3,783 | 11,059 | 7,536 | 8,630 |
| Hsin-Chu plant | 22 | 31 | 20 | 22 | 11,848 | 9,517 | 10,003 | 27,181 |
| Miao-Li plant | 29 | 16 | 36 | 12 | 4,580 | 3,982 | 14,704 | 7,171 |
| Hou-Li mill | 32 | 118 | 48 | 57 | 29,911 | 77,232 | 20,472 | 26,357 |
| Ta-Lin plant | 16 | 12 | 6 | 14 | 16,782 | 6,164 | 1,150 | 5,724 |
| Yen-Chao plant | 18 | 23 | 10 | 26 | 4,042 | 3,707 | 3,393 | 26,784 |
| Total | 169 | 275 | 205 | 223 | 95,409 | 157,908 | 112,713 | 155,278 |

Currently waste paper accounts for approximately 90% of the raw materials used in Cheng Loong's paper manufacturing. As part of the company's goal to implement cleaner production strategies, Cheng Loong has eliminated several highly polluting processes and has made a substantial effort to install advanced manufacturing technologies over the past ten years. Taiwan's paper industry is currently the world leader in the use of waste paper in the manufacturing process.

The average volume of water consumed per ton of paper manufactured at Cheng Loong's plants in 1999 was 11.4 $m^3$, which was a 60% reduction compared to water use in 1989. Energy consumption and $CO_2$ emissions per ton of paper manufactured were 1,689 Mcal and 678.6 kg respectively in 1998, which entitled all of Cheng Loong's paper mills to receive the "Excellent Achievements in Energy Conservation Award" from the Ministry of Economic Affairs. Effluent discharge and air emissions from Cheng Loong's plants are all well below the government standards.

As a result of Cheng Loong's successful EHS programs, it has been selected as a Demonstration Factory on ISO 14001 Implementation. Program results are shared

with other industry members and the general public. To broaden the impact of its EHS program, Cheng Loong launched a "corporate synergy system" to help its upstream suppliers and downstream contractors implement waste minimization programs in their operations. Corporate synergy systems are programs implemented in cooperation with IDB whereby large companies assist their suppliers in developing waste minimization programs.

The aggressive implementation of waste minimization and the ISO 14000 series of standards has been key to Cheng Loong's success in paper manufacturing. Implementation of the government's Voluntary Protection Program in all Cheng Loong's factories has allowed the firm to purchase insurance at preferential rates. In addition, Cheng Loong was also awarded a major contract with Nike due to its strong EHS performance. Winning a major contract over all other Asian competitors is a concrete example of how implementation of the ISO 14000 standards has given Cheng Loong a competitive advantage in the marketplace.

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# 8. APPLICATIONS OF CORPORATE SYNERGY SYSTEMS FOR PROMOTING GREEN PRODUCTIVITY IN SMALL AND MEDIUM ENTERPRISES IN TAIWAN

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**Abstract**

*Corporate Synergy System (CSS) is a management mechanism through which a group of manufacturing companies work together to achieve certain production or management goals. Established among firms in supply chains, a CSS usually consists of central firms and its satellite manufacturing suppliers. The system is being adopted in Taiwan as the key mechanism for promoting Green Productivity (GP) in small and medium enterprises. In this paper, the background and concept of CSS-GP are presented first, followed by a brief description of Taiwan's CSS-GP program thus far. Finally, observations and suggestions are provided to conclude the paper.*

## 1. Background

As with many developing Asian economies, Taiwan has a large segment of industrial production that comes from small- and medium-sized firms. Among approximately 95,000 firms in Taiwan, more than 96 percent are SMEs -- those with a capital investment of less than US $1.5 million, total assets less than US $4.5 million, or, employees less than 200. These firms together generate about 50 percent of the gross production of the entire business enterprises in Taiwan. Although small on a per-facility basis, the gross amount of wastes from SMEs is substantial. Moreover, as many of the SMEs are scattered in commercial and residential areas, the environmental and health impact of these firms on the public at large is especially severe.

Small and medium-sized enterprises are limited in their capabilities to do well in environmental performance. These firms in general have little financial, technical, and manpower capability to implement adequate environmental measures. Furthermore, the public at large exerts substantially less pressure on SMEs than on large firms in the environmental, health and safety issues. As a consequence, SMEs are comparatively less active in environmental programs. To attract SMEs to practice GP measures to improve their environmental performance, the corporate synergy systems have been used for several years.

## 2. Corporate Synergy Systems in Taiwan

Corporate Synergy System is a management mechanism that involves forming partnerships among business organizations to achieve specific goals. Usually established within supply chains, CSSs are initiated under the leadership of large companies, where the up-stream suppliers and down-stream buyers in the chains are organized to work together to achieve certain goals common to member organizations.

The CSS approach has been actively promoted by the Government in Taiwan for many years to enhance cooperation among businesses to meet the needs of country's economical development. Under the funding support of Industrial Development Bureau (IDB) of the Ministry of Economic Affairs (MOEA), the Corporate Synergy Development (CSD) Center, a non-profit organization, was established in 1984 to coordinate CSS promotion efforts. Thus far, more than 300 CSSs have been organized in manufacturing industries that produce one-third of Taiwan's total industrial output. The main objective of these CSSs has been to assist each participating firms to enhance their productivity, technological capability and management efficiency.

In any CSS, central firms play a key role in initiation, organization and maintenance of the system. Many large companies take up the role of central firms in a CSS because of a desire to improve their position in competitive markets. The globalization of economic activities and ensuing fierce international competition mean that companies must improve the quality of their product and public image while simultaneously containing their cost of production. To accomplish this, they must take great care in selecting their suppliers. Thus, under the leadership of large companies, supply chains are becoming more integrated in terms of decision making and planning with greater exchange of information among chain members. In addition to cost containment and quality assurance, many large firms have begun to work with upstream suppliers and downstream buyers to reduce their environmental responsibilities.

To understand why satellite firms would join an CSS, one must be aware of the basic characteristics of these firms. Generally, these firms are SMEs with relatively small staff and capitalization. They are engaged in certain manufacturing activities involving relatively simple technologies. Their profit margins are generally small due to tough market competition, easily acquired technologies, and relatively transparent cost accounting. A key approach for SMEs to marketing their products is through existing business network and by reference of current buyers. In order to make some profits or just to survive, these firms must be extremely flexible to meet the demands of its buyers. Thus, when a large company wants its suppliers to participate in its CSS, these suppliers would generally go along with the request. In return, the central firm(s) of a CSS could reward the suppliers by providing special credit treatment, free staff training, and/or relaxed performance audit requirements. Eventually, through the operation of CSS, large companies could use a variety of parameters, including product quality, financial strength, and environmental performance to rank their suppliers. The "good" suppliers could be given preference over others whilst pressure is put on poorly operating and unranked suppliers to improve their performance. More detailed information on the characteristics of SMEs in Taiwan can be found in a paper by Syytu[1].

## 3. Difficulties of Promoting Green Productivity in SMEs

Green productivity is defined as those technical and management activities that are capable of reducing or preventing generation of pollutants from their sources. These activities include in-process recycling and conservation that reduce the use of materials and energy, substitution of environmentally benign material for hazardous ones, improving process design and operation to prevent pollutants from leaving the process systems, and implementation of life cycle design to reduce wastage and improve material utilization. Green productivity is considered to be a double edge sword that could lead to a win-win situation of improving production efficiency and

environmental quality. As GP generally involves process and product changes, regulatory agencies rarely setup rules to require industry to implement GP. Rather, regulators have hoped that firms would adopt GP measures voluntarily when they realize the efficiency and benefit gains as a result of having gone through the implementation processes.

Although GP has many benefits, a number of factors may actually inhibit putting such program into effect. These factors fall mainly into two categories: technical and financial. Technical barriers work to impede the ability of a company to develop, evaluate and implement GP programs. These barriers include limited awareness of pollution management issues at company's decision-making level, lack of in-house expertise on GP, and the absence of readily available GP technologies that can be adopted directly. In addition, attitude toward changing established industrial processes or practices may be negative, and such attitude tends to block new ways of preventing pollution. Pollutant generators may be reluctant to take risks with new, unproved technologies or to compromise other business goals and practices; they may also distrust alternative processes or simply be uninterested in changing their habitual ways of doing business. The unavailability of capital for plant modernization often becomes a significant obstacle to implementing GP even though GP measures may lead to cost savings. Major companies may have capital to upgrade inefficient processes, but the small and medium firms often do not. Other obstacles for SMEs in Taiwan to implementing GP include:

- Lack of cost accounting system to identify costs of environmental control and benefits of source reduction.
- Substantial portion of SMEs currently running without proper registration and licensing, resulting in lack of authority from government to deal with environmental issues associated with these firms.
- Lack of aggressive enforcement of pollution control regulations in the country; industries are thus less likely to invest in GP if they are allowed to illegally dispose of wastes.
- Usually consisting of a small staff, SMEs are generally lack of manpower to acquire for new technical and management skill required for GP implementation.

## 4. Green Productivity Promotion in Taiwan

Green productivity is not a brand new concept in Taiwan. If fact, information on technical aspect of GP technologies is abundant and can be easily obtained. The most difficult problem, however, is to design promotion programs to effectively influence the majority of industrial firms, especially SMEs, to start implementing, and continually improve the extent of the GP implementation program.

As in many developed and developing countries, both government and industry in Taiwan are actively involved in promoting GP. The role of government agencies in promoting GP is to provide incentives that help overcome technical and financial barriers to GP. These incentives can be divided into two categories: technical and economic assistance mechanisms, and regulatory enforcement mechanisms. Government agencies that provide technical and financial incentives to industrial

development are contributing to promoting GP by performing research and development of new technologies, providing technical assistance and disseminating relevant information. Regulatory enforcement agencies are promoting GP by imposing stringent but flexible technical and environmental requirements to encourage businesses to operate responsibly by developing products and manufacturing methods that reduce or prevent pollutants at their source.

In Taiwan, the official program to provide technical assistance and financial incentives to promote GP started in 1989 when an executive order by the Premier, Executive Yuan was declared that industrial waste minimization (IWM) should be adopted as a key approach to the solution of the environmental problems. Following this executive order, Ministry of Economic Affairs (MOEA) and Environmental Protection Administration (EPA) together established the Joint Waste Reduction Task Force (JWRTF) that is delegated with overall responsibility of promoting IWM in the country. The first task accomplished by the JWRTF was to formulate and implement the first 5-year (from 1991 to 1995) plan to promote IWM in Taiwan. The second 5-year plan to promote IWM was implemented from 1995 to 1999. It was during the second 5-year plan that CSS was promoted to encourage SMEs in Taiwan to practice IWM.

CSS was added to the IWM promotion program during the second 5-year plan because the 1st 5-year plan failed to attract SMEs into the program. It was assessed that, in general, IWM program succeeded in raising the awareness in Green Productivity in the country. Instead of solely depending on end-of-pipe (EOP) treatment, many firms in the country would consider source reduction as a viable option for solving their environmental problems. In spite of these impressive results, the impact of IWM program on SMEs is still far from satisfactory. For example, though more than 200 firms have received in-depth technical assistance to implement IWM measures by 1995, less than 20 percent of these firms were SMEs. In an attempt to ratify the situation, Industrial Development Bureau took an initiative in 1995 to adopt the CSS mechanism to promote GP in SMEs.

## 5. Approaches to Implementing CSS-GP Programs

A successful CSS-GP program relies on securing the commitment and general consensus of top decision makers of each satellite firm to follow the methodology and schedule set by the group. The program implementation methodology generally follows a framework with specific roles properly assigned to, and performed by the central firms, satellite firms, consultants, and government agency. The entire framework would involve government agencies to provide incentives and support to the program, and funding and supervision to consultants who would assist central firms to promote the ideas and coordinate the efforts including working group meetings, and technical assistance to plan and implement the GP program. The central firms could promise adequate incentives to participating satellite firms. Assisted by consultants, they would also organize a team to take charge of overall responsibility to conduct plant inspections, process audits, program reviews, and sometime perform technology demonstration for the participating firms.

The success of any CSS-GP program depends on close collaboration among four major parties: government, consultants, central firms, and participating satellite

firms. Specific roles to be performed by these organizations are listed in Table 1. While the roles of government agencies, and central and satellite firms have been described earlier; the consulting firms are responsible of bringing all parties together and to provide expertise needed to make the program running. Under a contract with Industrial Development Bureau, Foundation of Taiwan Industry Service (FTIS) presently serves as a consultant to help CSS-GP program. FTIS's expertise on GP has been cumulated from many projects over years as one of the government contractors to provide technical assistance to industry to practice IWM and implement environmental management systems under ISO 14000.

**Table 1** Roles of Organizations Involved in CSS-GP Programs

| Organization | Roles |
|---|---|
| Government Agencies | ✧ Provide encouragement and support |
| Consulting Firms | ✧ Provide staff training programs<br>✧ Assist in establishing GP teams<br>✧ Assist in plant audits<br>✧ Assist in identification and feasibility analysis of GP options<br>✧ Assist firms to compile pertinent data<br>✧ Call regular meeting to track progress<br>✧ Supply pertinent information |
| Central Firms | ✧ Top management commitment and support<br>✧ Play as a role model<br>✧ CSS system audit and reviews<br>✧ Provide assistance and incentives to participating satellite firms |
| Satellite Firms | ✧ Top management commitment<br>✧ Establish GP teams<br>✧ Carry out GP implementation |

### 5.1 Selection of Central Firms

To establish a CSS-GP program, the first step involves commitment of large companies to becoming central firms. At this stage, most CSS-GP programs in Taiwan are initiated by government agencies, especially IDB. At the beginning of each fiscal year in Taiwan, IDB would publish bulletins soliciting companies to serve as central firms in new CSSs in the country. Large companies who have had experience in implementing GP programs are naturally good candidates to become central firms of CSSs. To qualify for a central firm, a company should have commitment from its top management to provide necessary resources to run the CSS-GP program, and sufficient number of its suppliers that could potentially join the program.

When an enterprise is considering to serve as a central firm in a CSS group, its top management should realize that the company is required to invest substantial manpower and resources into the program. The key persons assigned to implement the CSS-GP task also need to realize that they have to commit efforts to make the program a success. This is very important as there could be many unexpected problems to

encounter during the course of CSS program. The unexpected problems may include the coordination among satellite-firms and the shortage of manpower, budgets, time, and technologies. To assist a company to determine whether it is ready to establish CSS among its satellite firms, FTIS has formulated a set of self-evaluation criteria given in Table 2. If a company scores more than 30 points, the company is ready for implementing the program. If a company scores less than 20 points, the company is not ready for the program and should improve itself in accordance with the factors in Table 2 before the next self-evaluation.

**Table 2** Self-Evaluation Criteria for a Firm to Decide Whether to Establish Corporate Synergy System among its Satellite Firms

| Question | Score | | |
|---|---|---|---|
| 1. Does company's top management fully understand and support the CSS establishment? Are they willing to invest money and manpower? | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 2. Does the department in charge of establishing the CSS agree with the assignment? | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 3. Does the company have a role to influence the performance of, and the quality of the products by, the satellite firms? | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 4. Has the company practiced the IWM concept? | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 5. Will the company continue to practice IWM? | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 6. Does the department in charge of CSS sufficiently capable to do the job? (Minimum: at least 3 persons each with more than 5 years working experience to guide the satellite firms) | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 7. Are departments within the company well coordinated well? Would the department in charge of CSS program authorized to call for coordination meetings? | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 8. Has the company established or planned to establish ISO9001/9002? | Yes, 2 | No, 0 | Planning, 1 |
| 9. Has the company established or planned to establish ISO140001? | Yes, 2 | No, 0 | Planning, 1 |
| 10. Has the company frequently participated in environmental activities such as workshops or governmental assisted programs | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 11. Will the company regularly call for coordination meetings among satellite firms? | Yes, 2 | No, 0 | Uncertain, 0.5 |

| | | | |
|---|---|---|---|
| 12. Will the company provide incentives to encourage merited CSS plants? (e.g., increase purchase quota, better discount rate or cash award) | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 13. Does the company have good relationship with its satellite firms? | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 14. Will the company guide the satellite firms during the CSS development? | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 15. Does the company have a assessment system to evaluate the satellite firms? | Yes, 2 | No, 0 | Uncertain, 0.5 |
| 16. Will the company require the participating plants to obtain ISO9000 certificate within the next 2 years? | Yes, 2 | No, 0 | Planning, 1 |
| 17. Will the company require the participating plants to obtain ISO14000 certificate within the next 2 years | Yes, 2 | No, 0 | Planning, 1 |
| 18. Has the company applied for environmental labels, practiced life cycle design and/or design for environment concept? | Yes, 2 | No, 0 | Planning, 1 |

### 5.2 Selection of Satellite Firms

After self-evaluation, if a company is ready to take a lead for establishing a CSS program, its key personnel should begin to design a master CSS plan. At the beginning of the program, in order to start the program smoothly and to save manpower and costs, careful selection of satellite-firms is very important. The central firm(s) would go through the list of its suppliers and make preliminary selection of firms who could be benefited by GP measures. A seminar then would be organized to explain the basics of CSS: what is GP, how CSS-GP works, the roles and responsibilities of participating firms, and the program schedule. Following the seminar, satellite firms would be asked to register and provide pertinent information and indications of top management commitment. These firms would then go through a final qualification procedure before formally being accepted into the system. To make the system relatively easy to handle, the CSS program is suggested to start with approximately 10 satellite-firms in no more than four business types and to schedule for one-year cycle. The key factors a satellite-firm to be selected generally include: (1) located in convenient and reachable distances, (2) willing to participate in the program, (3) a major supplier, (4) with promising results of Green Productivity. Once the system is successfully in operation for one year, it can be expanded to include more satellite-firms and/or more business types at a later stage.

### 5.3 Steps for Implementation of a CSS

CSS-GP programs are generally carried out in the seven steps briefly described below.

**Step 1.** Get the program started by providing training to the staff of each participating firm. Two training courses could be designed for different personnel. The awareness classes are basically for management personnel and to include introduction to GP concept, benefits and barriers, general approaches, and industrial environmental, health and safety. The technical classes, designed for process and operation staff, would include plant audit procedures, GP opportunity assessment methodology, and available GP measures and practices.

**Step 2.** A GP team in each participating firm is established to take charge of the program and to coordinate the efforts of the plant. Management leads the team while the employees are required to participate through proposing and implementing GP measures.

**Step 3.** Plant audits are conducted for each participating firm to examine in detail the plant operations to determine the sources of waste generation and to prioritize waste streams.

**Step 4.** Through numerous sources, such as literature, personal contacts, and most importantly, brainstorming of employees, potential GP options of the facilities are identified.

**Step 5.** For the high priority waste streams, select the best GP options for the company and implement these options.

**Step 6.** Following the implementation of selected GP options, the progress of GP program on a company- and CSS-wide basis is evaluated.

**Step 7.** Actions are taken to maintain and sustaining the GP program of each firm and entire CSS for continued growth and expanded benefits.

The CSS-GP programs in Taiwan are conducted in yearly cycle. During the period, meetings are held periodically in each participating firm to provide staff training, to assess the plant operations, to solicit participation and ideas from employees, to review the progress, and to identify the obstacles and approaches to overcome obstacles to GP implementation. In addition to separate meetings at individual firms, meetings are organized where consultants and representatives from participating firms are gathered to exchange ideas and assess the progress of the CSS-GP program. At the end of fiscal year, actions are taken to assess the results of the program, and to identify additional GP measures for implementation in next fiscal year.

### 5.4 Roles of Central Firms

A central-firm may encounter some difficulties during the establishment and operation of CSS. The following summarizes the potential difficulties and the items that require special attentions by the central firms.

**As a role-model for satellite firms**. The central-firm should serve as the role-model for satellite-firms. This means that the company should emphasize thorough

implementation, continuous improvement, and timely execution of various GP activities. If central-firms have previous GP experiences, the experiences will undoubtedly help them establish and carry out the CSS programs smoothly and effectively; otherwise, it may take extra efforts to achieve the goal.

**Emphasis internal education and participation.** Once a central-firm has decided to establish a CSS program, several key items need to be done immediately. The items include announcing the CSS establishment commitment from corporate decision-makers, training its employees to thoroughly understand GP, educating seed personnel for assisting satellite-firms, encouraging employees to engage in IWM in their daily activities, developing incentive programs to stimulate employees' participation, and evaluating the progress of the CSS program.

**Providing guidance to satellite firms.** At the early stage of CSS development, satellite-firms may use various excuses for fully participating in the CSS program. The excuses may include shortage of manpower, insufficient time and a lack of funds. In this situation, the central-firm would need to analyze the problems and to guide the satellite-firm to solve the problems. For a small satellite-firm, the owner or top manager's commitment is most critical. For a larger satellite-firm, certain management approaches can be quite effective.

Building employees' confidence and establishing procedures to monitor the program progress have been found to be effective in improving the CSS program. In order to effectively guide the satellite firms, the central-firm should prepare for the investment of manpower and budgets and should assure the objective of each site visit and meeting. The central-firm is suggested to call for a general meeting to review satellite-firm’s project progress after each site visit.

The first review meeting can be held after listing all potential items for waste minimization. The objective is to establish the base line progress schedule, to identify the potential area for waste reduction, and to complete the organization structure and responsibility distribution at each satellite-firm. The objective of the second review meeting is to set up GP program goals, target items, and implementation approaches. If necessary, every satellite-firm may propose incentives to encourage employees' participation. The objective of the third review meeting is to discuss difficulties encountered, program status, and quantitative achievements. The central-firm may arrange plant visits and training activities at a proper time. The sequence of executing the above-mentioned items is summarized in Table 3.

**Table 3** Milestones and Job Items for Operation of CSS-GP in a 12-Month Cycle

| Schedule | Milestone | Central-firm’s focus | Satellite-firms' job items |
|---|---|---|---|
| Month 1 | Planning meeting | • Have satellite-firms' decision-makers commit to the CSS program<br>• Explain implementation approach | |
| Months | First plant visit | • Introduce IWM concept | • Commit to join |

| | | | |
|---|---|---|---|
| 2-3 | to satellite firms | and method<br>• Conduct plant IWM inventory | CSS program |
| Month 4 | First progress meeting | • Report IWM inventory progress<br>• Exchange information | • Complete process and waste inventory |
| Months 5-6 | Second plant visit | • Discuss IWM options and plants<br>• Arrange plant training, if needed | • Set IWM goals and target items<br>• Establish mutual understaning between central and satellite firms |
| Month 7 | Second progress meeting | • Report progress from all plants<br>• Exchange information | • Establish IWM implementation approach |
| Months 8-9 | Third plant visit | • Discuss IWM progress<br>• Arrange plant training, if needed | • Develop incentive program |
| Month 10 | Third progress meeting | • Announce evaluation approaches and rules for selection of high achievers<br>• Report progress from all plants | • Accomplish solid results |
| Month 11 | Reinforcement to laggards | • Strengthening guidance for those who are behind the schedule | |
| Month 12 | Evaluation and promotion | • Conduct evaluation; compliment high achievers<br>• Plan for next year's activities | • Deliver IWM reports |

## 6. CSS-GP Program Results

In FY1995, the first CSS-GP program was established in Taiwan to promote GP in supply chains. TECO Electric and Machinery Co., Ltd., one of the largest electrical equipment manufacturers in the country, initiated the system. Prior to initiation of CSS-GP, several TECO's plants had implemented GP programs and realized the financial and environmental benefits of the concept. TECO's top management was convinced that further substantial gains could only be realized if its suppliers join to adopt GP measures through CSS-GP effort. At the first stage of CSS-GP organization, however, many of TECO's suppliers were either not interested or only passively participating in the program. It was only after TECO's general manager openly threatened to discontinue business that its suppliers began to seriously take part in the CSS-GP program.

The TECO CSS-GP system consists of four TECO's electric equipment assembly plants serving as the central firms[2], and 12 suppliers serving as satellite firms.

An Environmental Safety Promotion Team (ESPT) was organized among all these firms to run the CSS-GP program, with technical assistance provided by FTIS. The satellite firms represent suppliers of data processing equipment, printed circuit boards, parts molding, etc. More than 60 percent of participating firms are SMEs. During FY 1995, the participating firms in the system implemented a total of 2,119 GP options. Based on an incomplete data, these options required a capital investment of US$453,000, and resulted in a benefit realized in FY1995 of US $5 million. The TECO CSS-GP system has been expanded to include 32 firms, many of them have reported greater than 20% reduction of production cost as a result of practicing GP measures.

Cheng-Loong Paper Manufacturing Company organized the second CSS-GP program in Taiwan[3]. Established in July 1996 and with Cheng-Loong's Tayuan Paper Mill and Hsinchu Paper Mill as central firms, the CSS consists of 10 up-stream suppliers that provide waste paper, machinery, chemicals, energy, and transportation services, and 3 downstream buyers who are paper container manufacturers. With greater than 90 percent of participating firms as SMEs, the Cheng-Loong system in one-year period from July 1996 to June 1997 implemented 868 GP options. These participating firms invested a sum of US $991,000 in GP measures, resulting in a benefit of US $3.5 million in FY1996.

The positive results in FY95 and FY96 provided a strong incentive for furtherance of CSS-GP program in Taiwan. During FY97 and FY98, five additional CSS-GP systems were organized under the technical assistance provided by FTIS and CTCI under the sponsorship of IDB. As of November 2001, a total of 28 CSS-GP systems are operating in Taiwan. A majority of these systems are established by central firms in the business of manufacturing computers, electronic equipment, electric appliances and automobiles. In addition to IWM, several CSS have expanded their scope to include ISO 14000, OSAS 18000 and design for environment of their products. Table 4 provides a list of CSS-GP, indicating the central firms, type of business and number of firms included in the systems. Under the current government program, an increment of 5 to 7 CSS-GP systems per year is expected in Taiwan.

**Table 4** A List of CSS-GP Systems in Taiwan

| **Name of Central Firm** | **Business Type** | **Number of Firms in CSS** | **Name of Central Firm** | **Business Type** | **Number of Firms in CSS** |
|---|---|---|---|---|---|
| TECO | Appliances | 32 | Philips | Electronics | 12 |
| SAMPO | Appliances | 15 | Compal Electronics | Computers | 11 |
| Chunghsin Electric | Appliances | 15 | Acer | Computers | 16 |
| Sangyang | Automobiles | 15 | Fentay | Shoes | 13 |
| Ford | Automobiles | 13 | President-Pepsi | Food | 11 |
| Macronix International | Electronics | 20 | Cheng-loong | Paper | 13 |
| United Micro-electronics | Electronics | 15 | Supertex | Textile | 14 |

## 7. Summary and Conclusion

As in many other countries, small and medium enterprises in Taiwan are slow in implementing GP. These firms are in general less capable financially and technically to acquire more advanced technologies to improve their environmental performance. In an attempt to induce a change, the CSS approach was adopted by the Government in Taiwan in 1995 to attract more SMEs to practice GP. The results thus far clearly indicate that the CSS approach is effective in promoting GP in SMEs. Facing the fierce competition in global markets and newly developed international environmental requirements, many large companies are willing to take the initiatives to form CSSs to promote GP in their supply chains. Driven by the incentives from its buyers (or, in some cases, suppliers), many SMEs would join CSSs and learn how to practice, and realize the benefits of, GP.

Since program inception in FY95, fourteen systems have been established under firms that represent manufacturers of electrical appliances, electronic equipment, automobiles, paper products, food processing, shoes, and textile products. At the beginning stage following the establishment of each CSS-GP, relatively simple GP-measures (or, "low-hanging fruits") were implemented. The results based on cost and benefits analysis of implemented options are quite positive, with average investment pay off in less than 4 months. The evidence that CSSs could effectively attract SMEs who would be otherwise left out of the GP promotion program is most encouraging. To attract more firms to establish CSS-GP, IDB recently decided that priority of technical assistance under the GP promotion program should be given to CSSs. In other words, those firms forming CSSs would receive preference treatment, and those applying technical assistance individually would most likely face rejection. This decision would substantially expand the application of CSS-GP in the country. Additionally, the government is planning to promote EMS under ISO 14001 and health and safety under BS 8800 through CSSs. This initiative would undoubtedly improve the depth of GP implementation in the industry.

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# 9. LCA AND B2B, E2COMMERCE - CONCEPT AND LINKAGES

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## INTRODUCTION

For a long time, it was thought that the earth could sustain industrial activity indefinitely. However, people have come to see that the Earth's resources are not unlimited; and they have begun to realize the damage that human activities are causing to the environment. Environmental destruction is diminishing the quality of life in many parts of the world, and over the long term, may threaten Earth's ability to sustain human life itself. Thus, people are becoming increasingly concerned about the environment which has now become a subject for us not to study but to manage, and throughout society, demand has grown for change.

Much of the demand has been focused on the activities of the business community. There is a recognition that the environmental considerations are a fact of life, and if companies do not address them internally, then solutions will be imposed compulsorily from outside. This recognition led to the development of Green Productivity (GP) program of the Asian Productivity Organization (APO), which integrates environmental protection and productivity improvement.

The goal of GP is to attain a higher level of productivity for serving the needs of the society and to protect and enhance the quality of the environment. It encourages business to become more competitive, more innovative and more environmentally responsible. The pursuit of GP does not require companies to abandon all their current practices and systems. It calls for them to adapt these in order to achieve higher levels of economic and environmental performance through continuous improvement. Therefore, many companies are beginning to take a proactive management approach to the environment, transforming the nature of their organization and products to reflect this.

Today in the internet economy, an economy where demand realized translates into demand satisfied - in a matter of seconds, it is expected that the use of the internet with environmental information not only facilitate environmentally conscious commerce among companies but also enhance the productivity, quality, profitability, and environmental performance of the entire supply chain. Therefore, Electronic-Eco-Commerce (E2Commerce) which is the extension of an E-Commerce to include environmental aspects of a product, service or company can create a win-win situation by attaining the objectives of GP. This paper describes the concept of B2B E2Commerce and its linkage to Life Cycle Assessment (LCA) which is one of the environmental management tools.

## LIFE CYCLE ASSESSMENT

Environmental issues are being included in many companies' current management policies and products development processes so as to maintain their market share, sometimes even to survive, and eventually to be able to strengthen their competitiveness in the open market. In order to both minimize risks which may occur in the process of implementing environmental managements and satisfy the needs of the customers companies need to rely on stable schemes and appropriate tools to framework their approaches.

It is known that many environmental management tools such as EMS (Environmental Management System), EPE (Environmental Performance Evaluation), and LCA provide essential elements for sound environmental management practice in organizations. According to ISO 14000 series, EMS arranges management functions so that management plans and decisions support the companies' strategic goals with respect to the environment.

EPE is an internal management process and tool designed to provide management with reliable and verifiable information on an ongoing basis to determine whether an organization's environmental performance is meeting the criteria set by the management of the company. While EPE focuses on describing the environmental performance of a company, LCA is a tool for assessing the environmental aspects and potential impacts that a product has over its entire life cycle – from the extraction, processing and distribution of the raw materials from which it is made, through production, use and disposal.

Among the above tools, LCA has proved itself a valuable quantitative tool as well as methodology or 'way of thinking' that can be applied to procurement, production process, product design and policy issues for the past decade. LCA is only one of a number of environmental decision making tools and does not replace other tools. However, because of its comprehensive and 'cradle-to-grave nature' approach it provides more information about a product chain or system while other tools deal with one aspect of an industrial process only.

According to ISO 14040, an LCA is carried out by

- compiling an inventory of relevant inputs and outputs of a product system;
- evaluating the potential environmental impacts associated with those inputs and outputs;
- interpreting the results of the inventory analysis and impact assessment phases in relation to the objectives of the study.

One of the most important applications of LCA is in identifying issues involving the environmental aspects of a product's system and improving environmental communications by providing a quantitative analysis. It has become clear that LCA can be used to improve existing products or design new products, and provide more and better product information for effective environmental communications. Therefore, it can also be used in formulating marketing, supply chain management (SCM) strategies and procurement of environmentally preferable products.

Most companies are directly responsible for only a small portion of a product's life cycle. However, now times have changed and the idea of 'chain responsibility' or 'extended producer's responsibility' is playing a central role in

industries. The manufacturer of a product becomes responsible for its manufacturing operations as well as for the uses and disposals of a product. This responsibility also extends to the upstream processes of a product. Therefore, companies are increasingly looking at SCM as a way to improve their environmental performances. For companies to address these concerns seriously, LCA can play a critical role in helping them identify and quantify the issues involved by analyzing the inputs and outputs associated with the entire product chain.

## SUPPLY CHAIN MANAGEMENT

SCM is an integrated approach to manage the total flow of a distribution channel from the very first supplier to the final user. With the liberalization of world trade, globalization and the emergence of new markets, many companies have customers and competitors throughout the world. The SCM framework focuses on the inefficiency of material and energy consumption inherent throughout the entire supply chain in current practices.

As a first step, SCM requires an assessment of the current supply chain members. SCM begins with an assessment of the current strength and weakness of a product system or company and identifies gaps where current performance fails to meet the company's target. LCA can be used as one of the necessary tools to assess the environmental performance of the current supply chain members and to bridge the gaps since LCA supports decision making and offers a way of approaching problems from the 'product chain' perspective. In many developed countries LCA-based advice or guide services are developed to support 'best buy' decisions by consumers. LCA or life cycle thinking helps not only companies to choose suppliers in the process of integrating environmental aspects into the product design and development process which is frequently called 'Design for Environment (DfE)' but also companies to advertise their products as environmentally friendly.

The promotion of green purchasing will be needed for the effective implementation of SCM. In many developed countries Green Purchasing Networks (GPNs) were organized to promote green procurement or green purchasing which involves producer, consumer, NGO and government. In the Asian region GPN Japan was established in 1996 to change the market oriented toward ecoproducts and ecomaterials. It is reported that so far more than 1400 major firms in the manufacturing and service sectors are members of the network and 310 municipal governments and 300 NGOs have joined. In Korea, GPN was also formed in 1999 and have since striven to tackle a wide range of issues related to green purchasing, including how to promote green purchasing throughout the entire supply chain and the development of purchasing guidelines.

Environmental labeling scheme is useful in promoting green purchasing since it provides information about a product or service in terms of its overall environmental character, a specific environmental attribute or any number of attributes. Consumers can use this information in choosing and purchasing materials, components or services based on environmental as well as other consideration. Product or service suppliers expect that environmental label will influence the purchasing decision in favor of their products or services. If this happens, the market share of such products or services increases and other suppliers may respond by improving the environmental attributes of their products or services to enable them to also make such claims.

There are three types of environmental labeling programs such as Type I, Type II, and Type III. It is known that Type III environmental declaration, in particular, is closely related with SCM. Type III environmental declaration is the quantified environmental data for preset categories of parameters. The quantified environmental information of raw material, component, or product in this type labeling is based on the procedures and results from a LCA study. Since this label can be endorsed to any supplier along the supply chain from raw material to final product, the promotion of green purchasing through Type III declaration program will be one of the efficient ways to implement SCM.

Another key for the success of SCM is to provide the means for the companies to establish a continuous exchange of information and upgrade the environmental performance along the material flow continuum. A company should build up processes for communication internally or externally on its environmental policy, performance, information on materials, products or services in the framework of supply chain. In this context, ISO recently decided to include environmental communications as a new work item in TC207 and will be published as ISO 14063 (Environmental Communications - Guidelines and Examples). Figure 1 shows the framework of environmental management and correlation to ISO 14000 family, indicating that effective environmental communication is crucial in all areas of environmental managements within the framework of ISO 14000 series.

A variety of communication methods are available that encourage understanding and acceptance of the company's environmental management efforts. Methods of communication may include dialogues, focus groups, labels, press releases and advertisements, annual reports, telephone hotline, internet and so on. Companies should consider the potential costs and benefits of different approaches in developing a communication plan that is appropriate for its particular circumstances. Today, in the internet economy, it is widely accepted that environmental communication to stakeholders including customers can be very effective if electronic networking is established and support two-way communication.

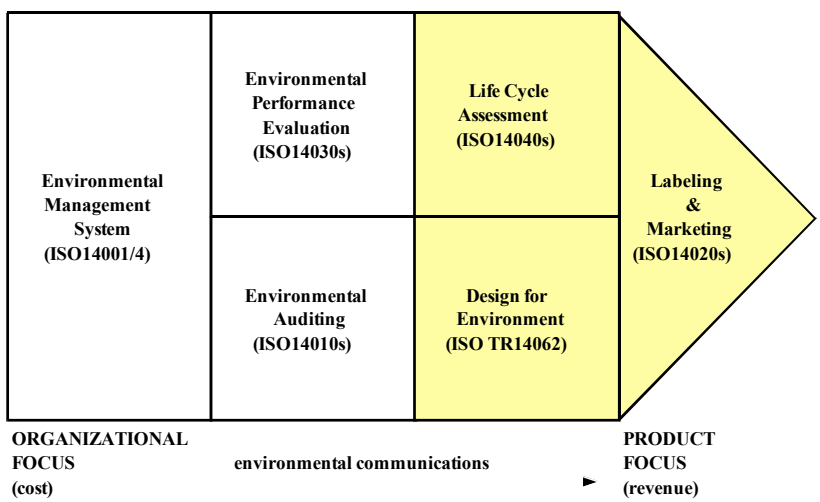


**Figure 1**: Environmental framework

## ELECTRONIC-ECO-COMMERCE

As mentioned above, there is a recognition that if companies do not address environmental management internally, then undesirable solutions will be imposed compulsorily from outside. Therefore, companies are well aware of the need to include environment in their management policy and to improve their environmental performance and are ideally positioned to do so if they are given the necessary information without any delay.

Having a presence in E-Commerce helps the company to exchange the necessary information instantaneously by increasing the velocity of inventory, revenue, and time to delivery and speed to market. In many cases, companies can spend more than 50% of their revenues purchasing goods and services. A reduction in total costs has a direct, positive impact on increased profitability. E-commerce enables to reduce the cost of procurement before, during, after the transaction. Before the transaction, internet technology may lower the cost of searching for suppliers or buyers and making product comparisons in price, quality, and environmental performance. During and after the transaction, E-Commerce can reduce the cost of communicating with counterparts regarding transaction details.

By extending an E-Commerce to include environmental aspects for both inter- and intra-business applications, companies will be able to communicate in real time across the entire supply chain of a product system for better utilization of resources and energy. Becoming E2Commerce by implementing environmental aspects into the area of E-commerce could not only reduce cost but also add value to the company to enhance its competitiveness through the improvement of the environmental performance. Eventually, E2Commerce will make a company a smarter manufacturer, marketer, customer friendly company, and environmentally conscious company.

While B2C(Business-to-Consumer) E-Commerce market has been grown rapidly, it is believed that B2B commerce over the internet is poised for rapid acceleration. The effect of B2B on the sustainability and the environmental improvement would be tremendous since each company can use their purchasing power to influence the supplier along the entire supply chain. To end a long-term supplier relationship due to its poor environmental performance would be undesirable, and may create disaster to the company. And, most of the value-adding activities in the economy are conducted in the B2B marketplace.

In addition, B2C commerce is generally one-way network that deal directly with buyers, and create benefits mostly for suppliers. However, B2B commerce tends to be two-way networks that mediate between buyers and suppliers, and create benefits both for buyers and suppliers. Consequently, the value created by B2C tends to increase linearly in the number of buyers, while the value created by B2B increases as the square of the number of participants.

If B2B application of E2Commerce is a solution for the success of business, it is crucial to develop the mechanisms and approaches that let partner organizations, such as suppliers and consumers, share relevant environmental information. Therefore, the challenge of B2B and E2Commerce is to share and exchange environmental data and information without requiring sweeping changes to a company's data structure. In this context, LCA and EPE which provide the essential information on the environmental performance of the company and the environmental aspects of its product system have to be intimately linked with B2B and E2Commerce. In particular, LCA can give the

environmental information of a product along the entire supply chain. Recently, the document about 'LCA data documentation format' is published as ISO/TS14048. As shown in Figure 2, this document contains the standardized documentation processes and format for LCA data which will facilitate the communication between supplier and buyer in real time since it is in the form of electronic-based data handling with EXPRESS.

**Model of B2B E2Commerce**

In order to introduce and facilitate B2B E2Commerce it is desirable to have an appropriate business model or marketplace which utilizes current available systems in the areas of both environmental management and internet without making a drastic change. In the past most of attention in B2B E-Commerce has focused on individual firms which do not have middlemen and sell directly to business customers. However, it has been reported that the creation of middlemen or intermediary is very effective since the real B2B E-Commerce is taking place outside the boundaries of individual firms.

These intermediaries can be named differently as 'electronic hubs (eHubs)' which is defined by M. Sawhney and S. Kaplan (2000) as neutral internet-based intermediaries that focus on specific product or industry chains and business processes to mediate any-to-any transactions among businesses. eHubs can be very effectively utilized in E2Commerce by aggregating buyers and sellers, creating marketplace liquidity, and reducing transaction costs. Therefore, it is proposed here to introduce the concept of eHubs in B2B E2Commerce which is a different marketplace concept from the old one.

At the broadest level, business purchases can be classified into manufacturing inputs and operating inputs. Manufacturing inputs are raw materials and components that go directly into the manufactured product or manufacturing process. Manufacturing inputs tend to be vertical in nature and they are typically sourced from product-specific or industry-specific suppliers or distributors, and they require specialized logistics and fulfillment mechanisms. Operating inputs sometimes called MRO (Maintenance, Repair, and Operating), on the other hand, are indirect materials or services that do not go into the finished products. Unlike manufacturing inputs, operating inputs tend to be horizontal in nature. For instance, every business needs computers, office supplies, and so on.

The other distinction in business purchasing lies in how business buys products and services. Business can either engage in systematic sourcing or in spot sourcing. Systematic sourcing involves buying through per-negotiated contracts with qualified suppliers. These contracts are often long-term in nature, so systematic sourcing is relationship and performance-oriented. A large portion of material inputs is purchases through this mechanism. On the other hand, businesses can also buy commodity products on the spot market. Spot sourcing is transaction-oriented, and rarely involves a long term relationship. A large portion of operating inputs is obtained through spot sourcing.

In contrast to old marketplaces, eHubs are contextual marketplaces, which mean that eHubs need to focus on a specific group of products. Attempting to be everything to everybody is a recipe for failure because it is never able to attract enough

buyers and sellers to generate liquidity. Thus, considering the distinctions in business purchasing, it is suggested to classify eHubs for B2B E2Commerce into two primary types, vHubs (vertical eHubs) and hHubs (horizontal eHubs). Together, vHubs and hHubs can form the web of B2B E2Commerce. As shown in Figure 2, an eHub can specialize vertically along a specific product system, industry or market, or it can specialize horizontally along a specific life cycle stage of product systems or business process. This has some similarities with Figure 4 which is a schematic representation of the characteristics and the scope of environmental management tools. vHubs in Figure 2 typically start out by automating and hosting the procurement process for a special vertical product system, and then supplement their offerings with industry specific content.

The environmental information needed in this vHubs can be provided by LCA in Figure 3 which compiles the information of environmental aspects and impacts associated with a product's system along the vertical life cycle. In this case the standardized LCA data documentation format or Type III labeling may be used in order to facilitate the communication of the required environmental information. One of the primary challenges for vHubs is the difficulty of diversifying and extending their business into other vertical market, because their expertise and relationships are fairly domain-specific.

hHubs in Figure 2 focus on providing the same functions or automating the same business process across different product systems or industries. Their expertise usually lies in a business process that is fairly "horizontal" which means it can be generalized across vertical markets. One of the typical examples of hHubs is buying & selling used capital equipments. Other examples include logistics monitoring and tracking, MRO procurement, energy management, and waste exchange & recycling.

The environmental information needed in these Hubs can be provided by EPE or EMS in Figure 3 which focuses on describing the environmental performance of a company. The necessary information can be presented in the form of environmental performance indicators or included in the company's environmental report. The primary challenge for hHubs is the lack of industry specific content.

As mentioned above, one of the possible ways to establish a basic business model and to provide necessary information for B2B E2Commerce has been presented. The architecture of a new marketplace for B2B E2Commerce may be composed of vHubs and hHubs. Depending on the e-Hubs which a product belongs to, the environmental information can be provided from either LCA or EPE.

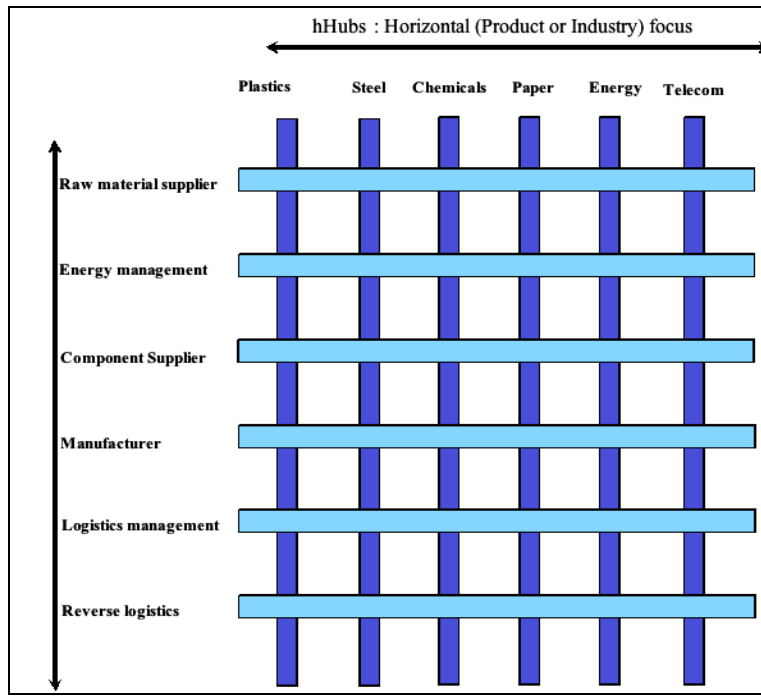


**Figure 2** Framework of eHub

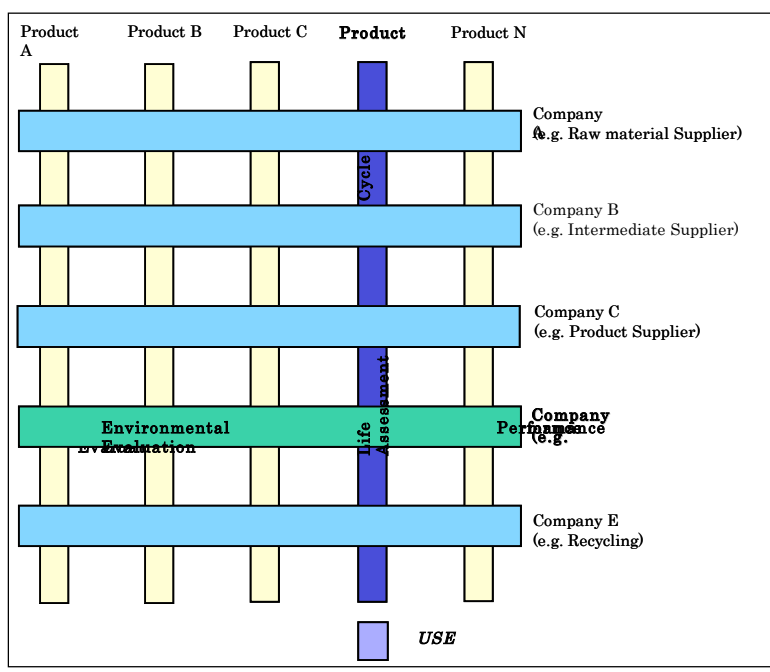


**Figure 3** Scope of LCA and EPE

## SUMMARY

E2commerce is a new concept that extends an E-Commerce to include environmental aspects of a product or company for both inter- and intra-business applications. Being able to communicate in real time across the entire supply chain of a product system for better utilization of resources and energy is expected not only to reduce cost but also to enhance the productivity, quality, and environmental performance through a continuous flow of information by the use of internet.

One of the challenges of B2B and E2Commerce is to share and exchange environmental data and information without requiring sweeping changes to a company's data structure. In order to promote and utilize B2B E2Commerce in various fields of our society, LCA and EPE which provide the essential information on the environmental performance of the company and the environmental aspects of its product system have to be intimately linked with B2B and E2Commerce. In particular, the information from LCA is very useful to most companies for the effective implementation of SCM since it gives them the environmental information of a product along the entire supply chain.

It is also important to develop an appropriate model for B2B E2Commerce so that it is able to attract enough buyers and sellers to generate liquidity. eHubs as intermediaries are expected to play central roles in B2B E2Commerce, bringing buyers and sellers together, creating marketplace liquidity, and reducing transaction costs. The information from LCA and EPE can be linked with vHub and hHub, respectively.

With sustainable development continuing to gain great importance within the global economic framework, the vitalization of B2B application of E2Commerce is one of the necessary conditions and through such recognition with associated efforts, it is expected that both environmental protection and productivity improvement can be accomplished within all aspects of our society in an efficient way.

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# 10. ELECTRONIC ECO-COMMERCE OF GREEN PRODUCTS

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**Abstract**

Green products are defined as those products that have less stress on the environment than ordinary products with the same functional characteristics. We usually use 'low pollution, resource saving and recyclable" to describe these products. Low pollution means less emission to the environment, especially during the production phase or the disposal phase. Resource saving means use of less water or energy or nonrenewable resource. Recyclable means either the products can be recovered and reused or are made with recycled material.

In Taiwan, there are two types of green products that are formally identified and promoted by the Environmental Protection Administration (EPA). The first type is the Green Mark labeled products. Green Mark is a patented logo, owned by EPA. The purpose of this labeling scheme is to identify products with the best environmental performance within various product categories, e.g., washing machines, laundry detergents or computers, with this logo. Today, there are already 70 published product criteria, 1,020 labeled products and around 250 licensed manufacturers available to the public.

The second type is not labeled, but certified green products. These products may not have the best environmental performance, but have innovative environmental characteristics within various product categories. Examples are (1) molding plates made of recycled aluminum; (2) particle boards made of coconut shells and (3) framed pictures with spent marble scrapes, etc. These products are certified by Environmental Development Fund (EDF) first and approved by EPA. Certification by a third party such as EDF increases the credibility of these environmental claims and helps to attract more purchasers.

One of the most important incentives for green products is government green procurement. In advanced countries, government procurement comprises about 15~20% of national spending. The percentage is even higher for developing countries. Furthermore, government agencies are easier to be educated and targeted for sale than the general consumers. In Taiwan, the Government Procurement Law promulgated in May 1999 has a special provision (Provision 96) which states that government agencies may choose to buy the green products in priority to others. After two years of promotion, the Executive Yuan finally announced an Action Plan to implement this green provision. In the Action Plan, starting from the beginning of next January, all the government agencies, public schools, hospitals and utilities will be required to report twice a year to EPA the amount of green office equipment and utensils actually purchased. The goal for government green procurement is set at 50% for the year 2002. The requests from these agencies for information on green products increased drastically in the past few months.

The idea of creating an E2 (e-commerce of eco-products) company for green products by EDF was initiated in September 1999. We have even developed a business plan in June 2000. However, without real actions from government agencies at that time, the business plan was not very attractive to investors. Now it seems to be a good time to

revitalize this plan with some modification and updated information.

**Definition of Green products**

Green products are defined as those products that have less stress on the environment than ordinary products with the same functional characteristics. For example, washing machines which save energy and water while in use but have the same cleaning capacity as ordinary models. We usually use 'low pollution, resource saving and recyclable" to describe these products. Low pollution means less emission, e.g., waste water, waste gas and solid waste to the environment, especially during the production phase or the disposal phase. Resource saving means use of less water or energy or nonrenewable resource, e.g., mineral and coal. Recyclable means either the products can be recovered and regenerated or the products are made with totally or partially recycled material.

**Types of Green Products in Taiwan**

In Taiwan, there are three types of green products that are formally identified and promoted by the Environmental Protection Administration (EPA). The first type is the Green Mark labeled products. Green Mark is a patented logo, owned by EPA. The purpose of this labeling scheme is to identify products with the best environmental performance (usually 20~30%) within various product categories, e.g., washing machines, laundry detergents or computers, with this logo. The procedure to award the logo is very stringent. A manufacturer who is interested in using the logo has to file an application to the implementation body of the scheme (the Environment and Development Foundation, EDF) with proof that his product meets the pre-set criterion and other requirements of washing machines. The key issues are the water and electricity consumptions of this model. They should be less than 30 liters and 0.04 kwh per kilogram of laundry, respectively. Then EDF will perform an on-site audit and present the case to the Green Mark Review Committee for approval. Today, there are already 70 published product criteria, 1,020 labeled products and around 250 licensed manufacturers available to the public.

The second type is not labeled, but certified green products based on manufacturer's claim. In other words, there is no pre-set criterion and usually the claim is only on single not multiple environmental issues, e.g., only on "energy-saving" or on "made of recycled material". These products may not have the best environmental performance, but have innovative environmental characteristics within various product categories. In order to make sure that the claim is accurate and not misleading, an expert panel is organized by EDF to review the application and approved by the Green Mark Review Committee. The claim has to have a life cycle approach to ensure that the product has a net environmental benefit. Examples of these second type of green products are (1) molding plates made of recycled aluminum to replace ordinary wood plates, (2) Polyethylene bags to replace polyvinyl chloride (PVC) bags for medical purposes and (3) framed pictures with spent marble scrapes, etc.

The third type of green products is the Energy Star labeled. Energy Star is a logo owned by the USEPA. The logo is awarded to energy-saving products only. Since it is very successfully implemented in the United States, USEPA is currently promoting this scheme to many other countries, including Japan, New Zealand, Australia, Sweden,

European Union and ROC. EDF is the certification of Energy Star products in Taiwan. However, the certification is only limited to office equipments, such as computers, fax machines, copiers and multifunction devices, etc.

A few other government agencies are also promoting ecolabeling schemes, such as the Water Saving logo by Water Resource Bureau, the Green Building logo by the Ministry of Interior. These logo and the Energy Star are all classified as Single Issue ecolabel, in contrast to Green Mark which is a Multiple Issue ecolabel.

In addition to the EPA and other government endorsed green products, EDF is in cooperation with an American company, the Scientific Certification Systems, Inc. (SCS), to certify manufacturer's claims, using ISO 14021 standard. We named this type of service Product Environmental Claim Certification, abbreviated as PEC certification. The claim has to meet, among others, the definition, test and verification method described for specific environmental claims. There are a total of 12 claims in the ISO 14021 standard (Environmental Labels and Declarations Self-declared Environmental Claims). Products certified by EDF/SCS will be awarded a license and are eligible to use a label (not a patented logo). Examples of these type of green products are (1) electronic products which have not used Class I and/or II Ozone Depleting Chemicals, (2) particle boards made of recycled coconut shells and (3) energy saving elevators. Certification by third party certification bodies such as EDF and SCS increases the credibility of these environmental claims and helps to attract more purchasers, especially foreign purchasers.

**Government green procurement**

One of the most important incentives for promoting green products is government green procurement. In developed countries, government procurement budget comprises about 10~20% of national GDP. The percentage is even higher in developing countries. Furthermore, government agencies are easier to be educated and targeted for sale than the general consumers. In Taiwan, the Government Procurement Law promulgated in May 1999 has a special provision (Provision 96) which states that government agencies may choose to buy green products (services and constructions are not included) in priority to others. The provision classified green products into three categories: (1) government approved ecolabeled products, (2) products that have the characteristics of "low pollution, energy saving, recycled material and retrievable" and (3) products that can increase social benefits or reduce social costs. The Provision also states that green products may enjoy a price preference of no more than 10% over traditional products with the same or similar functions. The EPA and the Public Construction Committee together promulgated a "Measure for the Priority Procurement of Environmental Preferable Products" at the same time to clarify the Provision. Under this Measure, these three product categories were further explained and responsibility of promotion designated to different government agencies. Currently, the EPA is responsible to promote the first two categories (Green Mark and the above-mentioned second type), whereas there is no agency volunteered to promote the third one.

After two years of promotion, the Executive Yuan finally announced an Action Plan in August this year to supervise this government green procurement initiative. In the Action Plan, starting from the beginning of January 2002, all the government agencies, public schools, national hospitals and government-operated utilities will be required to report twice a year to EPA the amount of green products

bought. The office equipment (including but not limited to computers, printers, monitors, keyboards, recycled printer cartridges, refrigerators and air conditioners) paper products and writing utensils will be the targets of reporting. The goal for government green procurement is set at 50% for the year 2002. For instance, if an agency has a budget of 10,000 US for computers, it is expected to spend at least 5,000 US on Green Mark computers. This goal will be increased gradually, if there is not much problem of implementing. After the announcement of this Action Plan, the requests from government agencies to EDF and to EPA on what, where and how to buy green products increased drastically in the past few months.

**Market Size Estimation of Green Products**

Now let us look at the market size of government procurement first. In 1999, the purchasing power of government agencies amounted to 14.3 billion US dollars, shown in the following table (Table 1). The potential market for green products only, excluding services and constructions, is 4.8 billion US.

Table 1. Market size of government procurement, 1999 Unit: Billion US

| | Central Government | Local Government | Others* | Total |
|---|---|---|---|---|
| Products | 1.5 | 0.7 | 2.6 | 4.8 |
| Services | 0.4 | 0.2 | 0.5 | 1.1 |
| Constructions | 1.9 | 3.8 | 2.7 | 8.4 |
| Total | 3.8 | 4.7 | 5.8 | 14.3 |

Note: Others includes national colleges/universities, hospital and government–owned businesses.

If we look into the major products purchased by government agencies in 1999 and match them with the existing Green Mark product categories and certified second type of green products, they fall into the following table (Table 2). The new addition of green product categories after 1999 is underlined. The numbers in front of each product category is the official product code.

It is very difficult to estimate the market size of government green procurement. In 1999, the total monetary value of tenders for products under the above mentioned product categories (excluding the underlined) was 13 million US, which was 2.7% of 4.8 billion US (see Table 1). This number should be doubled with the added product categories by now. In other words, budget for green procurement should be around 5% of the total government spending on products, or 26 million US.

In 1998, the private sector's spending on products was 86.7 billion US, which was about 21 times of the government spending on products. It is reasonable to estimate that the private sector's spending on green products at a minimum of 546 million US, since the range of products purchased by private sector is much broader than those purchased by government agencies. The summation of the potential government and the private sector's spending on green products in 1998 was thus at least 572 million US.

| Table 2. Existing products categories for government green procurement | | | | | |
|---|---|---|---|---|---|
| 341 | Refrigeration and Air Conditioning | 345 | Hygiene Equipment | 347 | Pipes and Accessories |
| 355 | Wood Boards | 356 | Engineering and Construction Material | 362 | Lighting Instruments and Bulbs |
| 371 | Furniture | 372 | Home and Commercial Appliances | 374 | Office Machines and Word Processors |
| 375 | Office Equipment | 376 | Books, Maps and other Printed Matters | 379 | Cleaning Equipment and Products |
| 380 | Paints | 383/384 | Clothing and Textile Products | 385 | Toilet Products |

Note: Underlined are product categories opened for application under the Green Mark scheme or certified second type of green products after 1999.

**E-commerce of eco-products**

The idea of creating an E2 (electronic eco-commerce) company for green products by EDF was initiated in September 1999. We have even developed a business plan in June 2000 and created a website for green products, http://www.greenproduct.com.tw. However, without real actions from government agencies at that time, the business plan was not very attractive to investors. Now it seems to be a good time to revitalize this plan with some modification and updated information.

There are a few things we will have to do in the near future:

(1) Add more information on green products to the website. Without enough product information, the viewer loses interest very quickly. Information needed includes functional characteristics, price, sale points, contact persons, etc.

(2) Provide government green procurement guidelines and samples of tenders to government officers to use.

(3) Collect and disseminate information on government tenders on the website to our licensees as a paid service.

(4) Attract more manufacturers to the website and encourage them to have their products certified.

(5) Provide technical consultation to manufacturers to improve the environmental performance of their products, and

(6) Increase the visibilities of the certified green products to general consumers, including cooperation with retailers and consumer groups.

In conclusion, electronic commerce is without doubt a valuable tool to promote green products, since most of the complaints in the past from both general consumers and government procurement officers are on the lack of enough information on what, where and how to buy green products. They are all very concerned about the price, brand name and functions of products whereas the later is also concerned about violating the other procurement restrictions.

Therefore, EDF is aiming at acting as an information provider first and will

consider making profit out of e-commerce to sustain the operation and to expansion of the functions of the website.

E-government comprises national programs. The objective is to outsource as much as possible of government business, including education and business development. There are so-called flagship projects that have been newly developed to this end. The e-society component aims to reduce the digital difference within society. The following discussion focuses entirely on the third component, e-industry.

# 11. GP AS A COMPREHENSIVE APPROACH TO SOCIO-ECONOMIC PRODUCTIVITY-LINKING GP WITH B2B AND E2 COMMERCE FOR ECO-EFFICIENCY SERVICES

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The environment is undergoing rapid change. Forest loss, species extinction, and the population explosion make it clear that modern industrial civilization has reached the limits of the Earth's carrying capacity. It is imperative that the switch to sustainable civilization be made in the first half of the 21st century. The deterioration of the global ecosystem has reached crisis point. The Greenland ice mass is melting at a rate of 51 billion tonnes a year. The total area of sea ice in the northern hemisphere has been shrinking at the rate of 34,000 sq. km a year. China's desert is expanding at the rate of 78 sq. meters per second; the desert is closing in on Beijing and is already within 70km of the city. We have to recognize that the Earth's carrying capacity is finite. One example of this environmental burden is the release of greenhouse gas emissions by industrial production, which is contributing to the thinning of the ozone layer. The Earth's capacity to absorb anthropogenic changes is limited.

We have to change our attitudes and technology, and move the social system from the old industrial economy to a new service-based economy. More importance needs to be attached to the utility value of products rather than their exchange value, to maximize the functional utility of the products. Manufacturers have to change their business models to focus on selling functions, or *functional sales*, rather than product sales. The product is a service-providing instrument and the service it provides must be the ultimate luxury. In short, we must change our relationship to the product from owning it to benefiting from its service; from ownership to user ship.

## ACHIEVING A GREEN ECONOMY

How do we realize a green economy? The primary methods are: environmental management systems; eco-design technologies; and environmentally sound manufacturing.

Environmental management systems should adopt ISO14001 and environmental performance evaluations. Companies should practice information disclosure by publishing their environmental reports and making public environmental accounting.

Eco-design and life-cycle assessments will enable us to develop environmentally friendly products and services. Eco-labeling will disseminate necessary information on these products and services.

Several market-based mechanisms to promote green technologies are available. Society should undertake green investments and green financing for companies. Local governments, the central government, and the public have to become aware of the

eco-efficiency of products and make the switch to green purchasing and Green Procurement.

Green Productivity is a strategy for the 21st century. It also offers manufacturers a toolbox of environment-related concepts, methods and technologies. We must achieve, within 50 years, a green economy worldwide, in both developed and under-developed countries. In so doing, developed countries will need to decrease their resource consumption, allowing a doubling of resource consumption in under-developed countries.

## REDUCING RESOURCE CONSUMPTION

To what extent must we reduce resource consumption? Based on the equity principle, countries that consume 80 percent of the natural resources should reduce consumption to 20 per cent. In other words, resource productivity should be improved by a factor of four immediately.

Even this may not be enough, however. At the mid-point of this century, the world population will reach 9-10 billion. A factor four productivity improvement might not be enough to sustain this many people; we might have to aim for a factor of ten. The objective is to keep the environmental impact at the present level. I am proposing a Factor Eight improvement as the basis for a sustainable economy. At present, the world annual consumption is 40 percent over the sustainable level, based on the surveys of ecological and eco-science analysis. Industrial countries need to get away from their material intensiveness.

Eco-design and Green Productivity are very important and useful concepts. Eco-design's objective is to *maximize environmental eco-efficiency* in terms of energy resource utilization as well as the life cycle of products. This requires resource conservation, energy conservation, extension of service life and facilitation of repair. Using eco-design, we can achieve both financial and resource productivity. There are four types of eco-design innovations:

- product improvement;
- product redesign;
- product concept innovation; and
- system innovation.

Using these four kinds of eco-design innovations we may achieve reduction in consumption and improvement of eco-efficiency, or resource productivity.

I have classified best practices for eco-design in Japan, where we have been organizing eco-products exhibitions since 1999. This year (2001) we are organizing the third eco-products exhibition and, simultaneously, the 2001 International Conference on environmentally friendly manufacturing and design.

The Japanese government just started green purchasing. I am the chairman of the national green purchasing committee and we have selected 101 product categories for the program, including paper, supply-oriented material, stationery, equipment, office machines, household electrical appliances, writing supplies, uniforms, working and office clothes, utility systems, public works and services, and automobiles.

## DEVELOPING SERVICE MODELS

Developing products is only part of the task; we also need to overhaul our services. One crucial need is to develop innovative business models for constructing a sustainable service system.

Shredder, Hooker and Martin Charter in England have classified three categories of eco-efficient services:

1. Product Services: providing additional customer services for sold products, such as maintenance and guarantees.
2. Used Services: the provider no longer sells the product but only its usage, as in leasing, renting, sharing and pooling. These services offer consumers the opportunity to benefit from material goods without buying them. The product is owned and run by the supplier.
3. Result Services.

How do we measure the success of a product service business? Evaluation methods include assessing: the ecological performance of the product service system; congruence with the company's identity and strategy; market acceptance; and the relationship between commercial values and environmental impact.

In the Netherlands, a Product Service (PS) system has been defined after a study was made of the country's eco-products services system. A PS system is *a marketable set of products and services capable of jointly fulfilling a user's need*. The PS system is provided by a single company or an alliance of companies. My research group found almost 80 Japanese examples of eco-services. I have classified these 80 eco-services into three categories: PS means the main product and the additional service; ES means Ecological Service in general; and SP, the main service plus additional products. The distribution and examples of product services in Japan are shown as follows:

| | | |
|---|---|---|
| PS | 32 percent | Extension of product's life through repair and reform; vehicles repair, reuse, and remanufacturing; recycling; upgrade services. |
| SP | 20 percent | Rental and lease. |
| ES | 48 percent | Consulting service, internet, IT, e-commerce; certification of wind power generation; green fire insurance; insurance; e-commerce; agent services, information, and green transport. |

We have also tried to classify eco-service in Japan into B2B, B2C and C2C:

| | | | | | |
|---|---|---|---|---|---|
| B2B | 61 percent | B2B | 35 percent | C2C | 4 percent |

## CONCLUSION

Eco-commerce is a very powerful tool for building a green economy. In Japan, eco-commerce is expanding rapidly. Through the internet, consumers can access information on the eco-profiles of companies and products before they make a purchase. This is a promising trend that needs to be encouraged.

# PART III

# CASE STUDIES

# 1 GREEN PRODUCT DEVELOPMENT AND GREEN PROCUREMENT OF MATSUSHITA ELECTRIC GROUP

***Nobuhisa Itoh***
*Director, Corporate Environmental Affairs Division*
*Matsushita Electric Industrial Co., Ltd., Japan*

The Matsushita Electric Group has always pursued basic quality and performance, twin principles that encompass convenience, amenity, pleasure, efficiency and cost. We are now producing Green Products, adding environmental quality and performance to the three environmental principles of SAVE, CLEAN and the 3Rs (Reduce, Reuse and Recycle). In order to develop Green Products, it is important to assess the possible environmental impact of our products during the planning and design stages. For this purpose, we have introduced the Matsushita Product Assessment System.

The first step in the production and sale of Green Products is the introduction of environmentally-oriented materials. Since 1999, we have promoted programs together with our material suppliers to encourage them to reduce the environmental impact of their materials. By adding environmental impact to the existing indices of quality, cost and delivery time, we have been able to promulgate the Green Procurement Standards and the Chemical Substance Management Rank Guidelines. We are carrying out Green Procurement based on these two standards for both suppliers and materials. Material assessment in particular focuses on the content of chemical substances. Based on our own Management Guidelines, we identify the types and volume of chemical substances used in our purchasing materials and develop our Green Products accordingly.

This paper details Green Product Development and the Green Products of the Matsushita Electric Group.

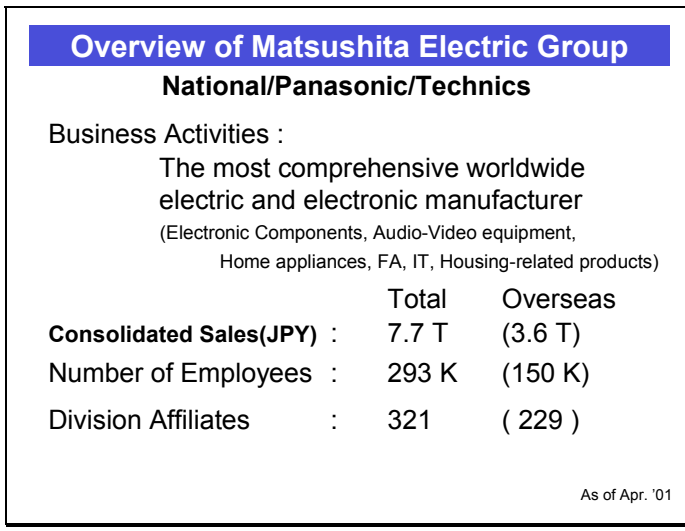



**Figure 1** Overview for Matsushita Electric Group

Figure 1 shows an outline of the Matsushita Electric group. Matsushita is one of the most comprehensive worldwide electric and electronic manufacturers, which produces electric and electronic components, audio & visual equipment, home appliances, factory automation, information technology, housing-related products and so on.

Gross consolidated sales as of April 2001 was 7.7 trillion yen including 3.6 trillion yen overseas sales. Total employees as of the same date were 293 thousand including 150 thousand overseas staff, and there are 321 divisions affiliates in the world, including 229 overseas division affiliates.

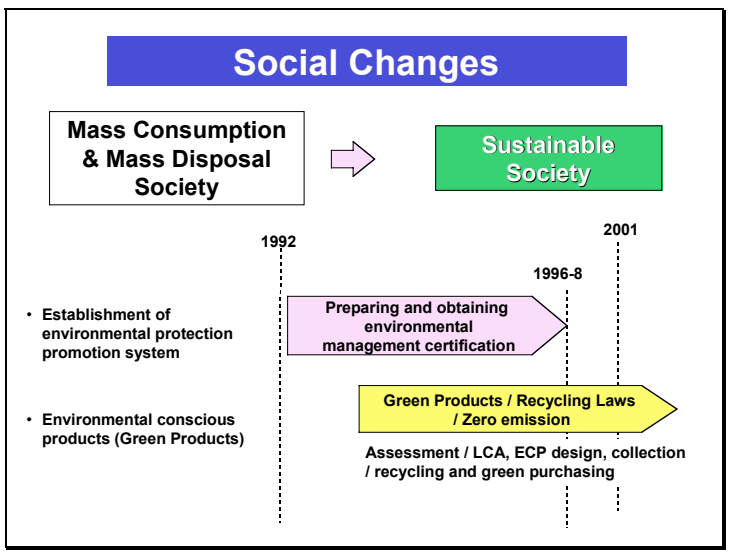



**Figure 2** Social Changes

We are currently in the middle of a significant change to society. Especially, with regards to the environment, society is changing from mass production, mass consumption, and mass disposal to a sustainable society. In response to this change, we are conducting the activities as shown in Figure 2, such as environmental protection, Green Products, and so on. We strive to make every possible contribution to the development of a sustainable society.

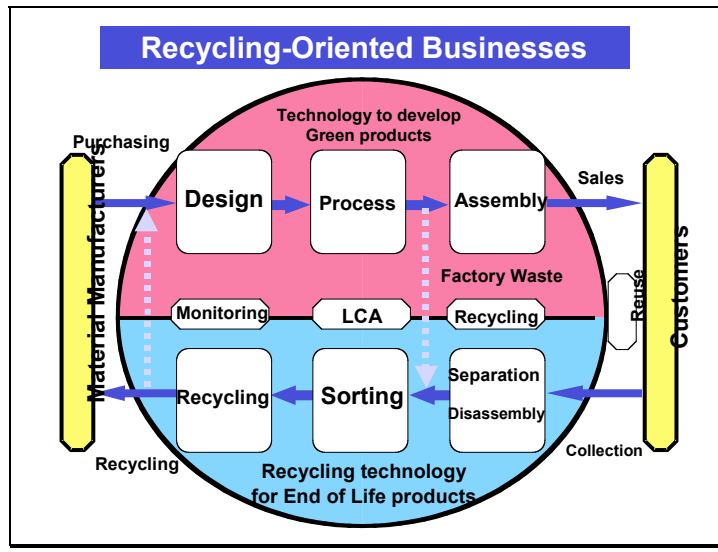



**Figure 3** Recycle-Oriented Businesses

What is the business in a sustainable society? The ultimate aim is to support a resource recycling-oriented economic system, where a good balance between "arterial" production and "venous" recycling is achieved by environmentally-responsible management as shown in Figure 3.

In the past, we simply purchased materials and parts from suppliers, processed, and assembled them into products. Apart from after-sales services, we regarded our business as complete when we sold our products to customers, but times have changed. We now need to collect end-of-life products from customers, disassemble them, and sort and recycle them into new materials.

We have often used the phrase, "from the cradle to the grave" when talking of caring for people, but from now on, we need to be responsible for our products "from the cradle to the cradle."

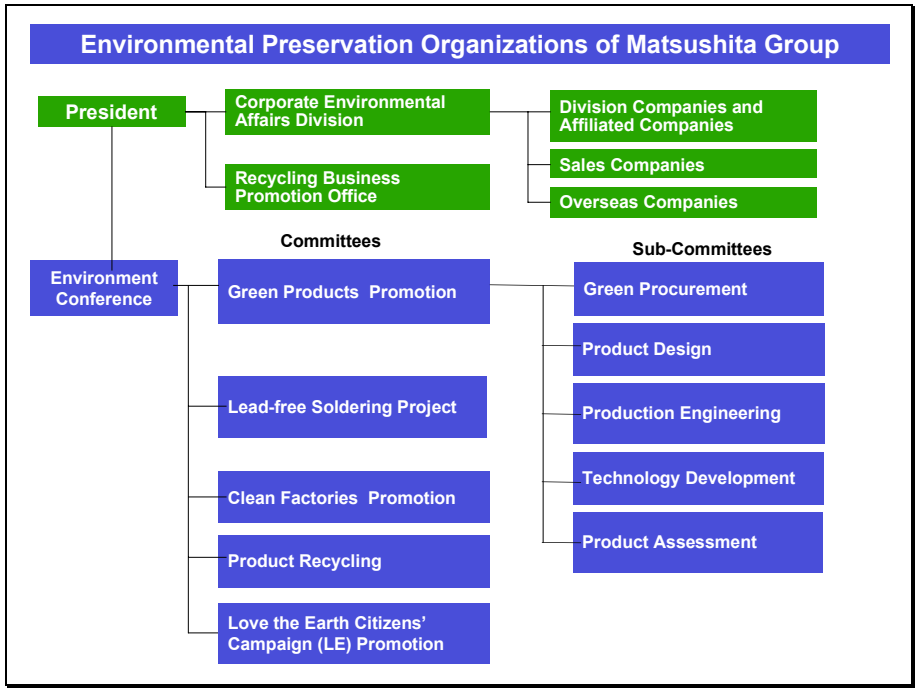



**Figure 4** Environmental Preservation Organizations of Matsushita Group

To make a sustainable society a reality, we have established a special organization to promote our environmental preservation activities.

As group-wide organizations shown in Figure 4, we have two units under the supervision of the company president. One is the Corporate Environmental Affairs Division (CEAD). This is a central organ that monitors the Matsushita Electric Group's overall environmental preservation activities. The second is the Recycling Business Promotion Office. This Office engages in the promotion of end-of-life product-recycling activities.

As an Environmental preservation organization, we have Environment Conference and Committees, Sub-Committees, and Working Groups. Major environmental policies and measures are deliberated at the Environment Conference. Based on these policies, each business unit carries out environmental activities headed by their environmental compliance administrators. For important themes that concern the entire Matsushita Electric Group, Committees, Subcommittees, and Working Groups are set up to go beyond the existing organizational framework to find solutions.

At present, five committees are ongoing. Each of these is now working on company-wide issues. We think Green Products development is essential for the achievement of a sustainable society, therefore we have formed a Green Procurement subcommittee under the Green Products Promotion Committee.

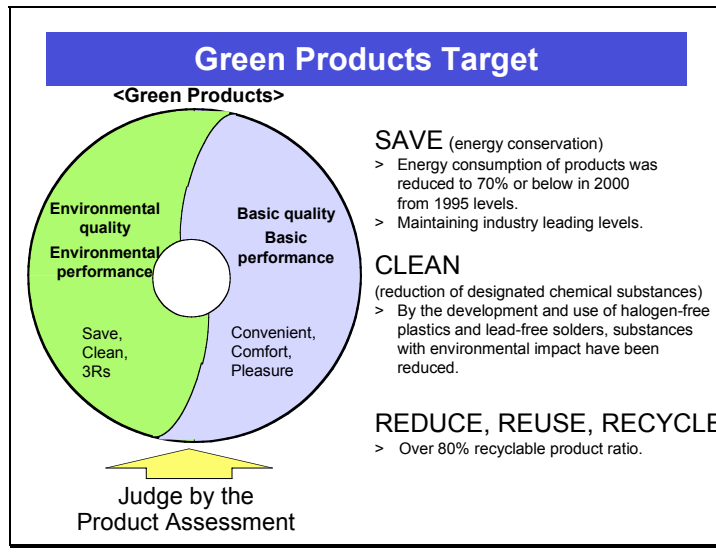



**Figure 5** Green Products Target

In 1997 Matsushita Electric started the development of products with less environmental impact, called Green Products. In addition to our products' basic qualities and performance -- convenience, comfort, and pleasure -- which we have always pursued, excellent environmental qualities and performance have been required to develop Green Products.

In the Green Product development, there are three aspects: Save, Clean, and 3Rs (Reduce, Reuse, Recycle), shown in Figure 5. It is important to assess the possible environmental impact of entire life cycle of products. We assess the environmental qualities and performance of products by conducting a Matsushita Product Assessment. alternate (see Figure 6)

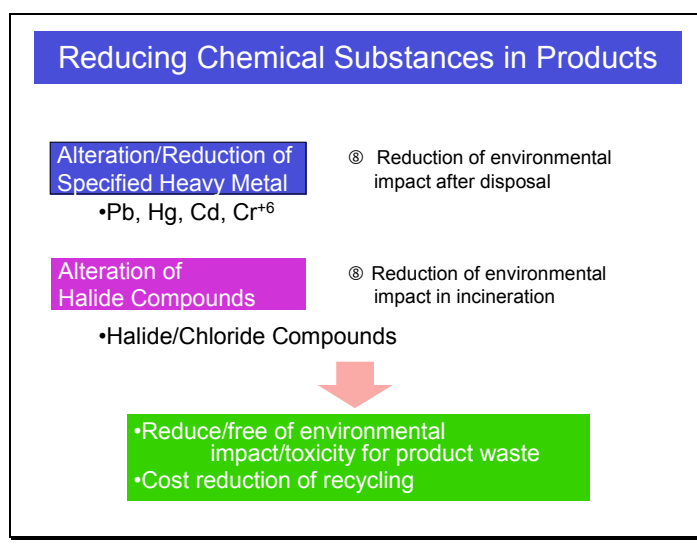



**Figure 6** Reducing Chemical Substances with Products

(see Figure 7)Concerning Green Products, the most important issue is the impact of chemical substances. Products like home appliances often contain specific heavy metals or halide compounds that may cause environmental or health problems when they are disposed into the environment. To reduce, alternate, or eliminate these substances is a very effective and important measure to reduce their environmental impact.

In addition, the recycling cost can be reduced because some processes designed to remove toxic substances are not necessary.

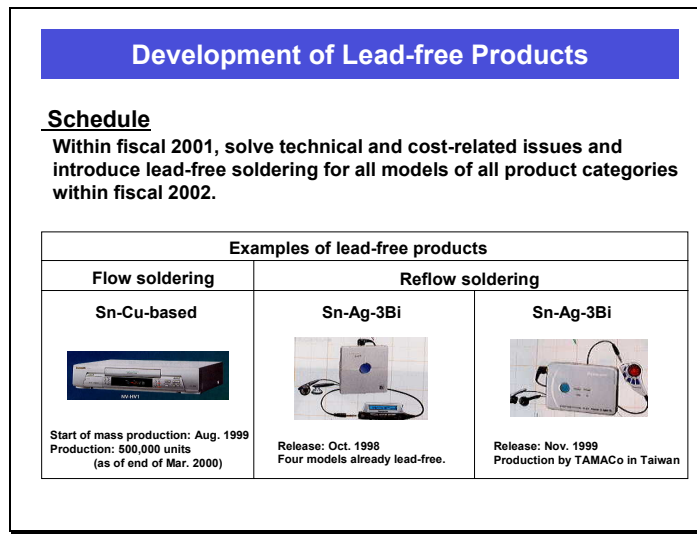



**Figure 7** Development of Lead-free Products

An example of this is the alternation of lead solder. By March 2000, we had accomplished lead-free soldering in four items, VTR, portable MD player, headphone stereo, and electric table-type heater.

The next objectives are as follows:

- - Technical and cost issues shall be solved within fiscal 2001.
- - All items and types shall be lead-free within fiscal 2002.

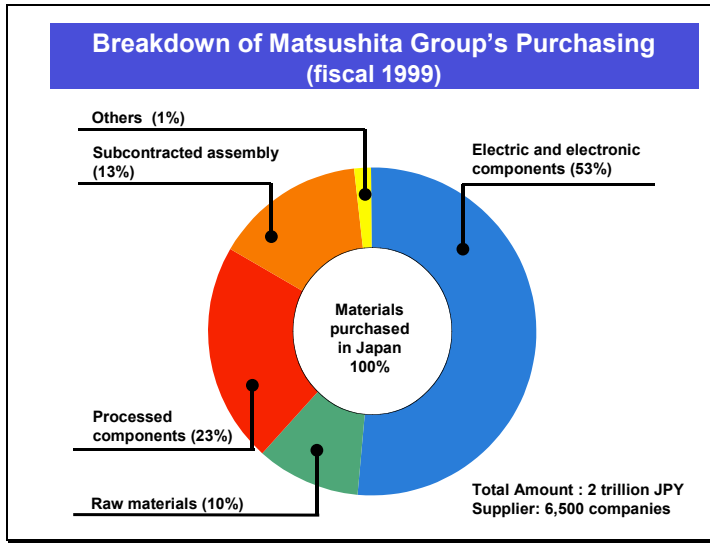



**Figure 8** Breakdown of Matsushita Group's Purchasing (fiscal 1999)

The next topic is Green Procurement, which is the main theme of this paper. Figure 8 shows the kind and quantity of materials purchased by our Japanese sites in fiscal 1999. The total amount is 2 trillion yen and suppliers total 6,500 companies.

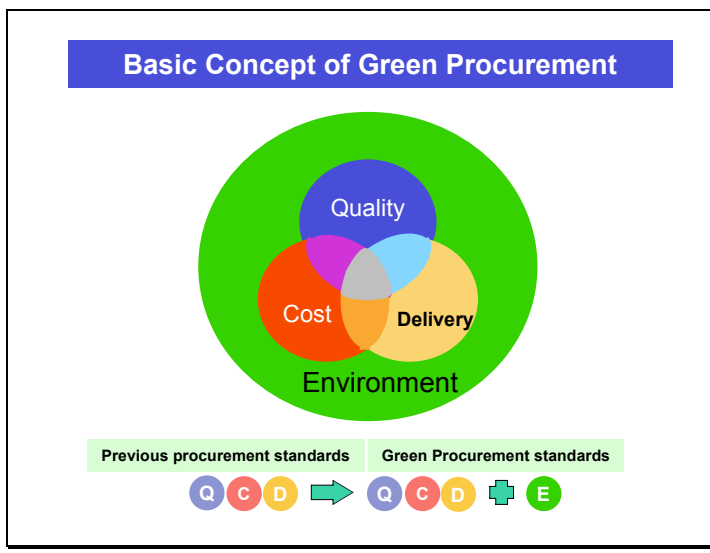



**Figure 9** Basic Concept of Green Procurement

The idea of Green Procurement is to optimize Quality, Cost, Delivery, plus the Environment in our material purchases. In other words, we have added the Environment to our procurement activity system as a new consideration (see Figure 9).

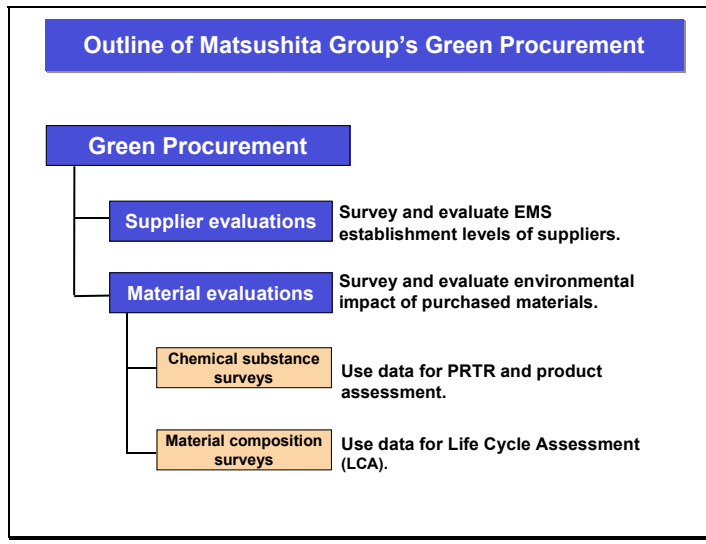



**Figure 10** Outline of Matsushita Group's Green Procurement

Figure 10 outlines how Green Procurement is made from supplier evaluations and material evaluations. Supplier evaluations are surveillance and evaluation of EMS establishment levels of suppliers.

Material evaluations include the surveillance and evaluation of the environmental impact of purchased materials, and involve chemical substance surveys and material composition surveys. The Green Procurement Standards Manual shown in Figure 11 is a summary of these evaluation methods.


**Figure 11** Green Procurement Standards Manual

The objectives of Green Procurement are to obtain materials while minimizing the impact on the global environment, and to contribute to manufacturing

environmentally-conscious products. These ideas are being put into practice by applying the Green Procurement Standards in every business division.

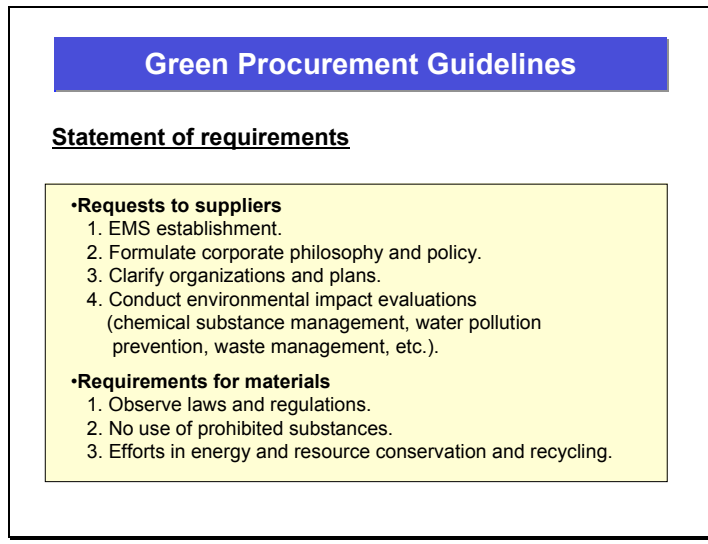



**Figure 12** Green Procurement Guidelines

The Green Procurement Guidelines as shown in Figure 12 state several requirements for our suppliers.

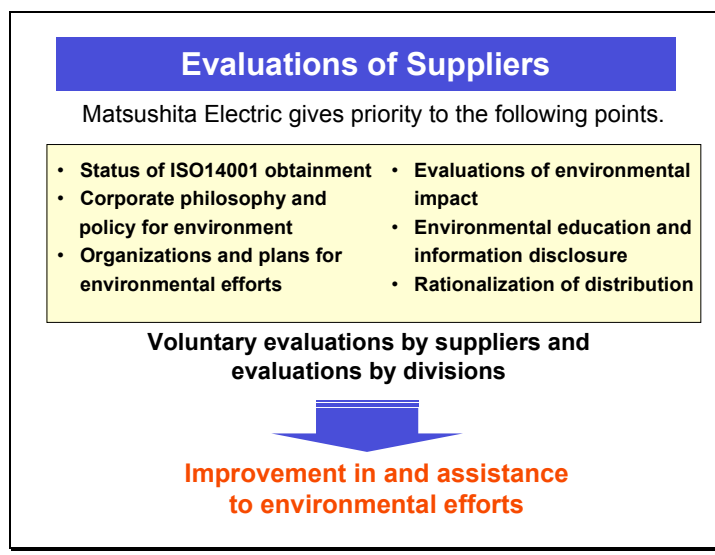



**Figure 13** Evaluations of Suppliers

When evaluating suppliers, we focus (refer Figure 13)on several points:

- - The status of their ISO 14001 acquisition
- - Their corporate philosophy and policy on the environment
- - Their environmental-related corporate organizations and planning

- - Their environmental impact assessment of their products and activities
- - Their environmental education and information disclosure
- - Their rationalization of distribution

These points will be evaluated by suppliers and by our business divisions, and then we ask the suppliers to take action in order to achieve improvement. Assistance and guidance is provided in the carrying out of improvement activities.

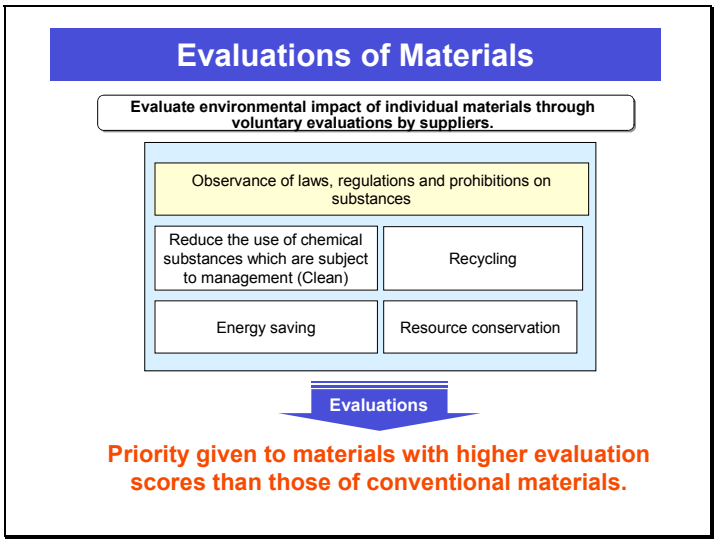



**Figure 14** Evaluations of Materials

As for the evaluation of materials, we rely on the results of evaluations conducted by suppliers. The suppliers shall evaluate the environmental impact of their individual materials with respect to (refer Figure 14):

- - Observance of laws and regulations and forbidding of the use of prohibited substances
- - Reduction of the chemical substances in its Management Rank Guidelines
- - Energy saving
- - Recycling

- Resource conservation

Based on the suppliers' evaluation results, our purchasing divisions choose more environmentally-conscious materials than those used previously.

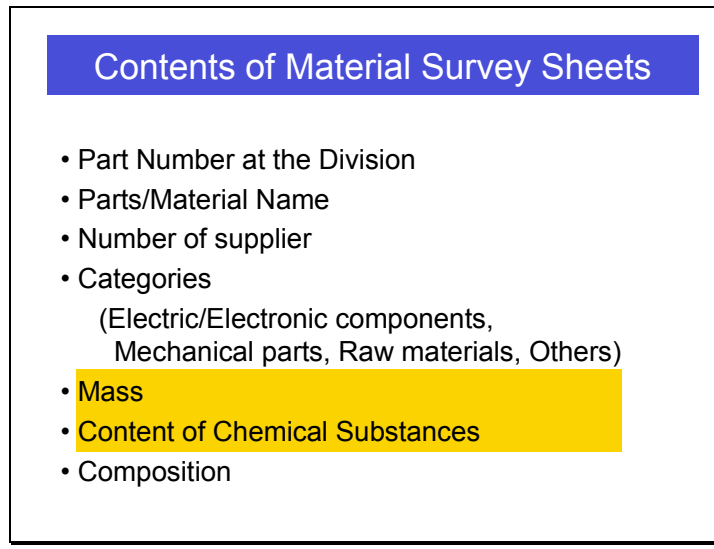



**Figure 15** Contents of Material Survey Sheets

The contents of Material Survey Sheets are shown in Figure 15. The most important items are mass of material and contents of chemical substances in percentage. The next step is to evaluate the materials in accordance with our Chemical Substance Management Rank Guideline.

**Comprehensive Chemical Substance Management**

**506 applicable substance groups**

| Rank | Substance group | Major substance |
|---|---|---|
| Prohibition | 33 | CFCs, cadmium compounds, chlorine-based organic compounds, hexavalent chromium compounds, nickel compounds, arsenic compounds, etc. |
| Reduction | 112 | Toluene, xylene, HCFCs, antimony compounds, non-organic cyanides, polyvinyl chloride, halogen-based flame retardants, lead, etc. |
| Adequate manage-ment | 361 | Zinc compounds, aluminum compounds, silver compounds, barium compounds, boron compounds, manganese compounds, copper compounds, organic tin compounds, etc. |

**Figure 16**: Comprehensive Chemical Substance Management

In March 1999, we published the "Chemical Substances Management Rank Guidelines," in which chemical substances are divided into three categories: prohibited, reduction, and adequate management, based on the results of their risk evaluation (see Figure 16). These Guidelines are not only applicable to the activities inside Matsushita Electric Group, but also to our materials and parts suppliers, to serve as the core of the Green Procurement Standards Manual.

In July 2000, we revised the Guidelines, including chemical substances specified by the PRTR Law. We will increase the number of chemical substances to be monitored and managed in future.

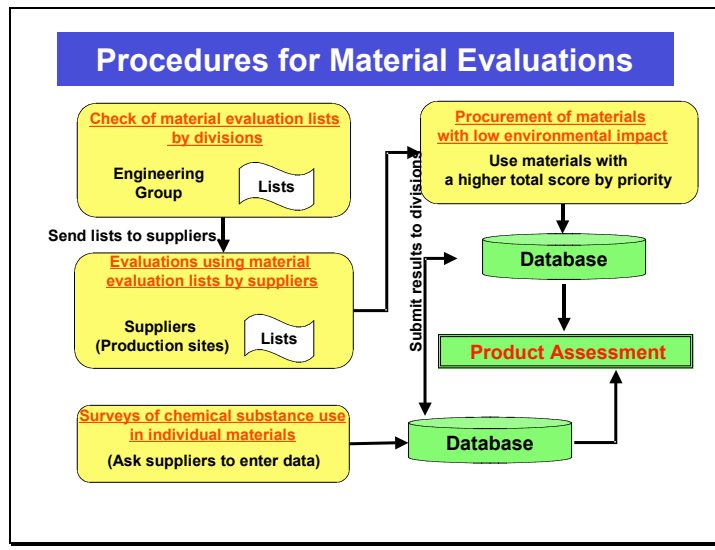



**Figure 17** Procedures for Material Evaluations

Figure 17 outlines the procedures of material evaluations. First, each business division goes through the material evaluation checklist and enters an evaluation with Yes or No for items corresponding to the parts or products in question.

After finishing the evaluation, the material evaluation list will be sent to suppliers. The suppliers evaluate their product by themselves and submit the results to our business divisions, and we then select the materials with a higher total score. The materials selected based on these criteria will be incorporated in our product assessment, and they will be one of the standards used to evaluate environmentally conscious products.

We are composing a database of materials information to utilize in product assessments and to make PRTR reports. Otherwise the precious data is going to be a useless just pile of papers. By using these resources, we have obtained the full-scale deployment of the procurement evaluation system.

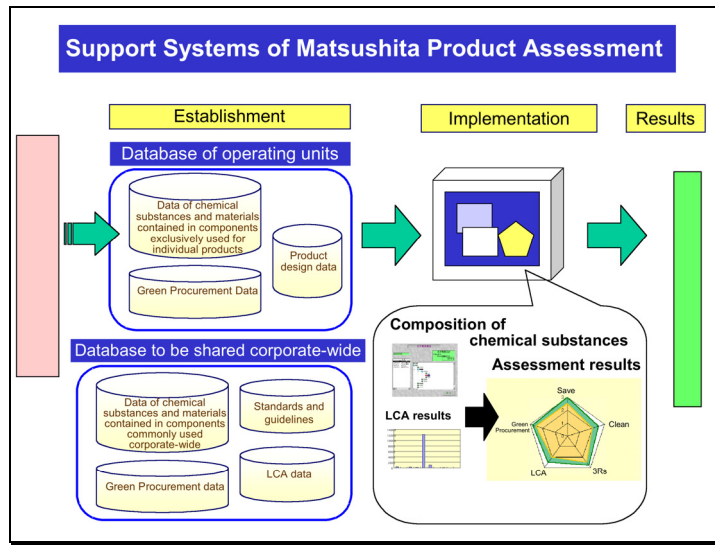



**Figure 18** Support Systems of Matsushita Product Assessment

Matsushita conducts product assessments to minimize the environmental impact of its products. As Figure 18 shows, the system is utilized in corporation with databases. With these databases, the evaluation of the total environmental impact of our products can be obtained precisely and easily.

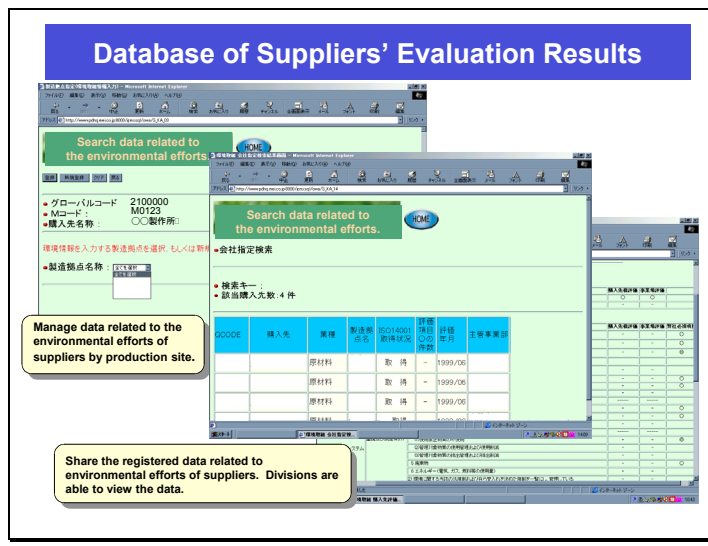



**Figure 19** Database of Suppliers Evaluation Results

Figure 19 outlines the Suppliers' Environmental Evaluation Management System which is designed to manage suppliers' evaluation data. Suppliers' environmental activity data is evaluated by themselves and the manufacturing sites have access to this system allowing them to share the data company-wide. Figure 19 is an input window. The status of suppliers' environmental activities can be retrieved and its

evaluation information can be viewed.

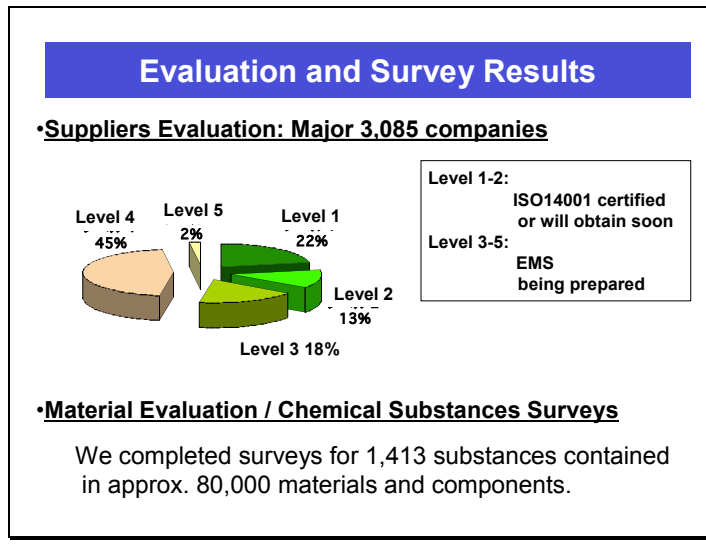



**Figure 20** Evaluation and Survey Results

A suppliers database can be used in many ways. For example, we can analyze the EMS status of suppliers, as shown in Figure 20. From this analysis, you can tell that approximately one third of suppliers have reached Level 1 to 2 which means they are certified or will soon obtain ISO14001. From another viewpoint, we have noticed there is a tendency for a small capital company to have a low level of EMS. We are thinking about possible ways to support such companies to improve their EMS.

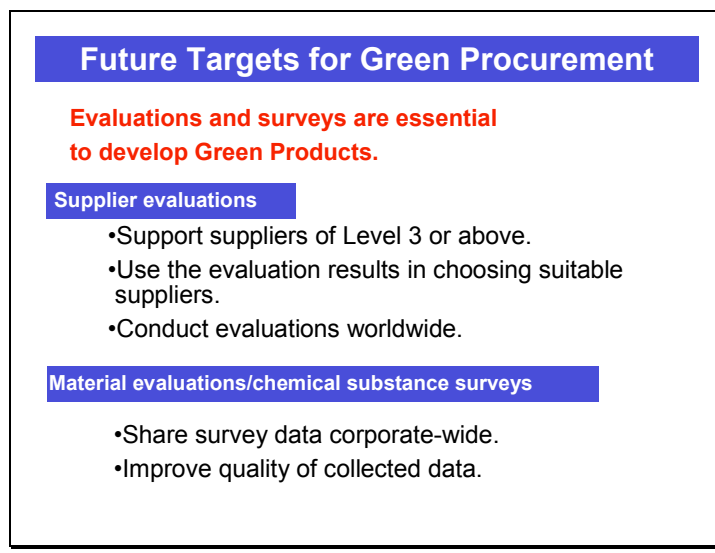
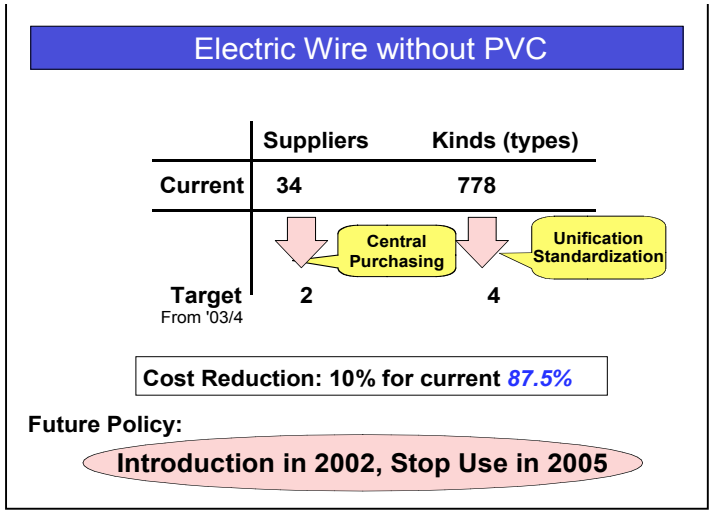



**Figure 21** Future Targets for Green Procurement

The surveys and evaluations in Figure 21 are essential to develop Green




Products. Therefore we have set targets for suppliers and material evaluations in order to further promote Green Procurement.

For suppliers evaluation;

- - support suppliers of level 3 or above in their EMS,
- - use the results for choosing suitable suppliers, and
- - conduct the evaluation worldwide.

For material evaluation;

- - share the survey data corporate-wide, and
- - improve quality of collected data.

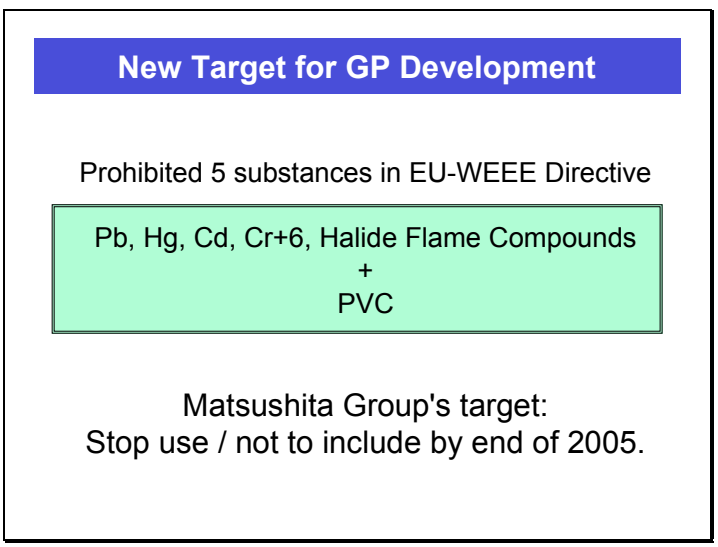



**Figure 22** New Target for the GP Development

The five substances (Lead, Mercury, Cadmium, sexivalent chrome, and Halide Flame Compounds) are subject to prohibition based on the EU WEEE directive which will come into effect in 2006. However, to promote the Green Product development, we aim to eliminate the 5 substances and PVC by the end of 2005 (see Figure 22).

(see Figure 23)

**Figure 23** Electric Power Wire without PVC

The PRTR (see Figure 24)

We are now undertaking a new endeavor to eliminate the use of PVC from electric power wire. As you know, PVC is commonly used with electric power wire because it has flame resistance and adequate flexibility. We have developed an alternative material and find that by concentrating the mass and integrating the type of wires results in a 10% cost reduction. Therefore, we have set two targets for the introduction of PVC-free electric power wire in fiscal 2002 and its complete elimination in fiscal 2005.

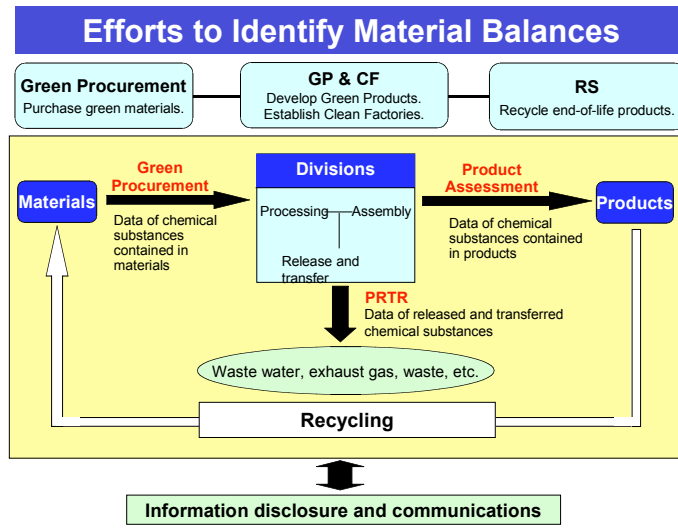



**Figure 24** Efforts to Identify Material Balances

The law of PRTR deals with monitoring emissions and the transfer of raw materials. We think that it is important to understand the total material balance at each site. Therefore we have established interaction with Green Procurement, and built a database operation system so that all chemical substances can be monitored including substances contained in supplied parts. With this system we endeavor to monitor chemical substances contained in our products, as well as those emitted and transferred from our business divisions

This paper has outlined the Matsushita Electric Group's environmental preservation activities, and our efforts toward Green Product development and Green Procurement as an important part of our activities. These activities are now being developed and we believe it is essential for us to continue pursuing environmental preservation with all our energy, because we believe that to seek "Coexistence with the global environment" is the true course of corporate business management.

2

# EVEN A SMALL MARKETING COMPANY CAN LEAD IN GREENING THE MARKET

***Hiroaki Koshibu***
*Corporate Statutory Auditor*
*Fuji Xerox Office Supply Co., Ltd., Japan*

Drawing on my past experience as the Head in charge of Environment and Product Safety of Fuji Xerox Corporation, my presentation deals with the management aspects of "greening the market" from the perspective of a small company, Fuji Xerox Office Supply (FXOS).

## FUJI XEROX OFFICE SUPPLY (FXOS)

First, a brief overview of FXOS:

- 100 per cent owned by Fuji Xerox, Tokyo, which is owned 75 per cent by Fuji Photo (Japan) and 25 per cent by Xerox Corp. (USA)
- Founded in October, 1979
- Focuses on marketing office supplies, namely copying/printing paper
- Revenue: USD 518 million in 2000
- Employees: 417 at the end of 2000

### Management business focus

The management of Fuji Xerox Office Supplies (FXOS) puts emphasis on the so-called Environment Marketing. The reasonO is that office supplies are typically a low margin business, with gross profit margin of less than 20 per cent. In other words, the ratio of costs to revenue is more than 80 per cent. Further, competition is tough, especially from countries where paper product costs are lower than in Japan. It is also difficult to differentiate one product from another-paper is paper. This is not a high technology-oriented product. All these factors combine to create a strong need for differential marketing, which Environment Marketing can provide.

### Paper: typical environmental impact

Researchers at Fuji Xerox conducted a life cycle assessment or analysis on copy machines to identify the contributing factors to emissions. Emissions are highest from printing and copying paper, followed by electrical power consumption used in business premises. These two key elements were then identified as the main problems to be resolved technologically by our research engineers.

### Greening the Product

In order to green our product-paper-the following are the problems to be

solved:

- make paper lighter to decrease pulp usage
- include more recycled pulp and less whiteness.

minimize

To reduce the whiteness, the technical parameters or challenges are:

- manipulate the weight, thickness, or stiffness of paper. Thinning the paper will save pulp use. However when the stiffness of paper is reduced, the paper will get caught in and therefore jam up copying machines, which increases energy use.
- surface smoothness. Obtaining good surface smoothness is very difficult technologically with used pulp.
- see-through. If the paper is thin, the image will show through to the other side, which means the paper cannot be print on both sides, and this creates extra waste.

## FXOS Green Products History

FXOS has had a good history in marketing green products. We were the first company in Japan to achieve the following:

- pulp-saving, lightweight paper (1977)
- the first recycled pulp contents paper (1981)
- so-called long life alkaline paper (1984), the very first in the industry, which is believed to last over a hundred years because of the content of the chemicals in the paper
- introduced the very first 100 per cent recycled pulp paper to the world (1992)
- introduced 100 per cent recyclable paper which is called Green 100 (1997)

## Green 100

Introduced in March 1997, Green 100 has been a real marketing success; it remains the best-seller and has achieved global acceptance in the market for its superior "environmentality" and is used in government offices and large corporations. In the government's green purchasing guidelines for their offices, the guidelines for copying paper were triggered by the characteristics of the Green 100 paper. These characteristics are:

- 100 per cent recycled pulp content paper
- 70 per cent whiteness paper-no chemical bleach. The usual whiteness content of white paper is 80 per cent but this has been reduced to 70 per cent for Green 100
- recyclable wrapping paper and tape. Normally, wrapping paper cannot be recycled because of the film attached to the paper, which serves to prevent humidity from entering the paper. We tried to develop a no-film wrapping paper.

- 100 per cent recycled/recyclable corrugated paper box. This is generally accepted on the world market

## Greening the Society Together with Customers

Environmental Marketing is not limited to providing a green product. It is our view that our business mission must be to help customers solve their own environmental issues. We offer help in matters dealing with, for example, ISO14001 certification. ISO1401 certification is spreading rapidly in Asian countries, beginning in Japan. In the Asian areas, altogether there are about 7,000 certified companies compared to almost 23,007 worldwide. Through talking with customers, our staff members have learnt that those companies that are certified are looking for ways to improve their environmental performances, like how to handle wastes, recycle their paper wastes, or reuse printer cartridges. We offer FXOS business models and share our own environmental experiences with such customers.

One example is Japan Railroad East Co. Ltd. (JR East)-the former Japan National Railroad—a monopoly corporation owned 100 per cent by the government but privatised. They operate in the eastern part of Honshu island. They have 7000 railroad stations, 75,000 employees, and possibly six million passengers a day. Given the size of their operations, they have a major environmental impact. They must do something with the 53,000 tonnes of waste generated per year and try to achieve zero emissions/zero landfill.

The FXOS solution is illustrated in Figure 1. This is a closed loop recyclable system for paper waste; the largest are in the form of magazines and newspapers. FXOS acts as a central agency for developing and operating this system.

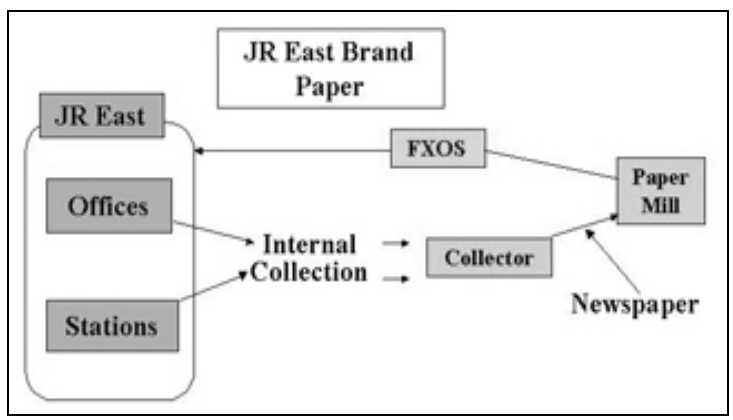



**Figure 1** JR East closed loop recycling system

As shown in Figure 1, JR East offices and train stations ship their wastes to the internal collection site. From there, collectors take the wastes along with newspapers from other areas to the paper mills. There the wastes are processed into Green 100 paper and shipped back to JR East, which produces brown papers (JR East brand paper). This idea was initially proposed by FXOS then accepted by JR East. It has received media attention and was reported on the front page of *Nikkei*, the "Wall Street Journal of Japan".

Our goal for Green 100 is to achieve the use of recycled pulp up to 50 per cent

of all the usage of pulp of our products. Theoretically and technologically it is believed that the maximum content of recycled pulp is around 55–60 per cent. Pulp cannot be reused forever because the collagen fiber of pulp deteriorates in the recycling process. New pulp is always needed. To compensate, we invest funding into a company, say, in New Zealand, to plant trees officially. So our environmental contribution is on two fronts: take wood from timber plantations as opposed to natural forests; and recycling. This year we have achieved the target 50 per cent of recycled pulp content in our products or in pulp used for our products.

## Conclusion

As this discussion has shown, a small marketing company such as Fuji Xerox Office Supplies can lead in green marketing. The qualities needed are management focus, a clear path and direction, technical development, and aspiration, conviction, and commitment.

# 3 CASE 3: INDUSTRIAL ECOLOGY AND BUSINESS ETHICS

***Takashi Kiuchi***
*Chairman*
*E-Square Inc. and The Future 500, Japan*

To start, I would like to recall the three conditions with which I began my earlier presentation (see Chapter 2). Briefly, they are:

1. There is no guarantee that future generations will be better off than ourselves. The future is a big question mark.

2. We are the first generation to feel the limits of the earth's capability to absorb incessant industrialization and economic progress.

3. Because tomorrow's society will not necessarily be a continuation of today's, the living conditions of future generations depend on what we do.

These three factors are the starting point for any dialogue or discussion.

We should also keep three keywords in mind. These are:

- ecology / environment;
- solidarity and networking; and
- conservation - something that no politician talks about -.

Consumption is not a virtue. We should not spend our resources on unnecessary things. Conservation, savings, modesty, a humble life are all important. We should not complacently continue doing what we've been doing. We have to shift gears, change our lifestyles, change our mindset; we have to endeavor to create our future. The future is in our hands.

As we reach the limits of the earth's resource capacity, we need to have a different value system. The subject of my discussion concerns what I feel are the universal values for sustainability. Precisely, there are 13 such values.

## UNIVERSAL VALUES FOR SUSTAINABILITY

The values listed below are not new. But unless we have a clear understanding of these 13 issues, I do not think we can come up with ways to create a better future.

1. Ethics. Yes, every society has ethics but we have to have ethics on a larger scale. We need to go beyond individualistic ethics and aim for global-scale ethics. The September 11$^{th}$ tragedy shows that we lack global ethics.

2. Affluence. There are social differences among the 18 APO member countries, with some countries being poor and others highly affluent. But all of us need to share a

basic philosophy. It is a common human trait that affluence leads to arrogance. Arrogance is our enemy. Think about this statement: "Enough is as good as a feast". Based on this idea of pursuing a simple, modest life, let us create a fundamental philosophy that we can all share and practice in our lives.

3. Solidarity. We have become very individualistic. The United States exemplifies egoistic individualism. While there are discrepancies between the North and South, the rich and poor, we also have to think about the discrepancies between the present and the future. We are taking too many resources from future generations. Mahatma Gandhi said, *if you have something under your ownership which you are not using now, that is stealing from the future*. If you have many possessions that you are not using, you are stealing from your children and grandchildren. Acquisitive, arrogant ownership leads us to this undesirable selfishness.

4. Energy. We must solve the energy issue. Petroleum is at the heart of President George Bush's motivation. I was told he has 12 advisory groups that supported his election as the President of the United States. He is the most powerful and influential politician in the world. Yet, he has to listen to those 12 groups of vested interests, the majority of whom are oil-related. We must leave behind this society based on fossil fuel consumption. Sooner or later, renewable energies such as hydrogen, wind, solar, and wave energy will predominate. I think some of you know that finding alternatives to oil is not always welcome. Researchers who propose ways of making petroleum obsolete face an uphill battle to win acceptance; they might even face threats against their lives. But the time has come for such efforts and we must support them.

5. Nature. We cannot dominate nature. Science and technology cannot dominate nature. Nature is our mother and main life support system. Our society and economy is the sub-system, the child of nature. We can destroy nature and destroy the mother system, but we cannot rebuild it.

6. Science and Technology. We need a conscience. We need humanistic values. Do we have humanism in our scientific and technological development? That's a very important question. Unfortunately, we've become arrogant, demanding and hungry for money. We forget the humanistic aspects of our efforts.

7. Education. We are busy memorizing much information but forget about moral education. Morality is important when it comes to business. Unless we have that, we are bound to spoil the entire globe. We need intellectual training.

8. Leadership. We lack leaders and leadership. Leadership has three characteristics: Number one, a leader must have very attractive characteristics and personality, and the magnetism to attract people. Where do we find those leaders? Where can we find that leadership? Number two, a leader should take responsibility. Shirking responsibility is not leadership. Number three, what we need from leaders is foresight and vision. Each one of us could be a leader.

9. Citizens. The famous anthropologist Margaret Mead said: “Only thoughtful, committed, small groups of citizens change the world”. That’s us - thoughtful, committed citizens who can change the world. The founder of the outdoor clothing company Patagonia said: “If citizens move, the leaders will follow”. It is not the leaders who are moving us. It is when people, the public, move that leaders will follow. So the source of power is us.

10. Nation and government. We must think about roles and responsibilities. We talk about globalization but at the same time we must think how we can decentralize. Each country has its own personality and characteristics that we must respect. We do not want homogeneity; 200 countries all sharing the same characteristics, same values. Differences make our societies interesting and dynamic.

11. Cultural exchange. There are at least 150 ongoing international disputes. These disputes arise from differences over religion, race and territory. The clash of civilizations is inevitable unless we promote cultural exchange. The APO is among the mechanisms that enhance this international dialogue. Cultural exchange is vital for risk management.

12. Economy. Our problem is that we put the highest priority on the economy. There are more important priorities. The economy is not the end; it is the means and the tool to accomplish something.

13. Cooperative society. The school motto of my elementary school was: “Be Honest. Be Hardworking. Be Kind”. In business, honesty and hard work may be valued but rather than “kindness”, companies value technology. Until recently, perhaps, technology *was* very important. Now, I suggest we think about how we can be kind to plants, animals, people, the environment and the planet. Kindness is more important than technology in today’s society.

Future generations and the environment; ethics and solidarity; these issues are very important. When we compare machinery and humanity, we should put more emphasis on humanity. Many people have great wisdom and ideas and we respect the cleverness of people. Instead of cleverness, I would like to emphasize kindness and gentleness. We tend to think too much and feel too little. Let us change that so that we feel a lot rather than think too much.

# 4 CASE 4: TOSHIBA'S ACTIVITIES CONCERNING ENVIRONMENTALLY SOUND PRODUCTS AND GREEN PROCUREMENT

***Seizo Doi***
*Chief Specialist, Environment Protection Planning Division*
*Toshiba Corporation, Japan*

This chapter introduces Toshiba's environmental activities. The discussion is organized as follows:

- overview of Toshiba's environmental protection activities
- activities concerning Environmentally Sound Products (ESP)
  - development of ESP
  - Life-cycle analysis (LCA) as a tool
- activities concerning green procurement (GP)
- ecodesign support innovation system with mobile agent technology as a system for e2commerce.

## OVERVIEW OF TOSHIBA'S ENVIRONMENTAL PROTECTION ACTIVITIES

### Basic policies

Toshiba Corporation recognizes that the Earth is a precious asset and that it is mankind's duty to hand it on to future generations in a sound state. It considers environmental protection to be one of management's primary responsibilities and promotes relevant activities in a technically and financially appropriate way. It is committed to the people and the future of the company. The following are the basic policies of Toshiba Corporation:

- specifies objectives and targets for its business activities, products, and services and aims to reduce environmental impacts and prevent pollution.
- strives to continuously improve the environment through vigorous implementation of environmental measures.
- contributes to society through its environmental protection activities, which include the development and supply of excellent, environmentally conscious technologies and products and cooperation with local communities.
- complies with all laws and regulations and those industry guidelines it has endorsed, and with its own standards for environmental protection.
- recognizes that natural resources are finite and promotes their efficient utilization.

- strives to enhance the environmental awareness of all its employees and requires that they make a practical contribution to environmental protection through their work.
- operates globally, and accordingly, promotes environmental activities throughout the world

These policies are illustrated in Figure 1.

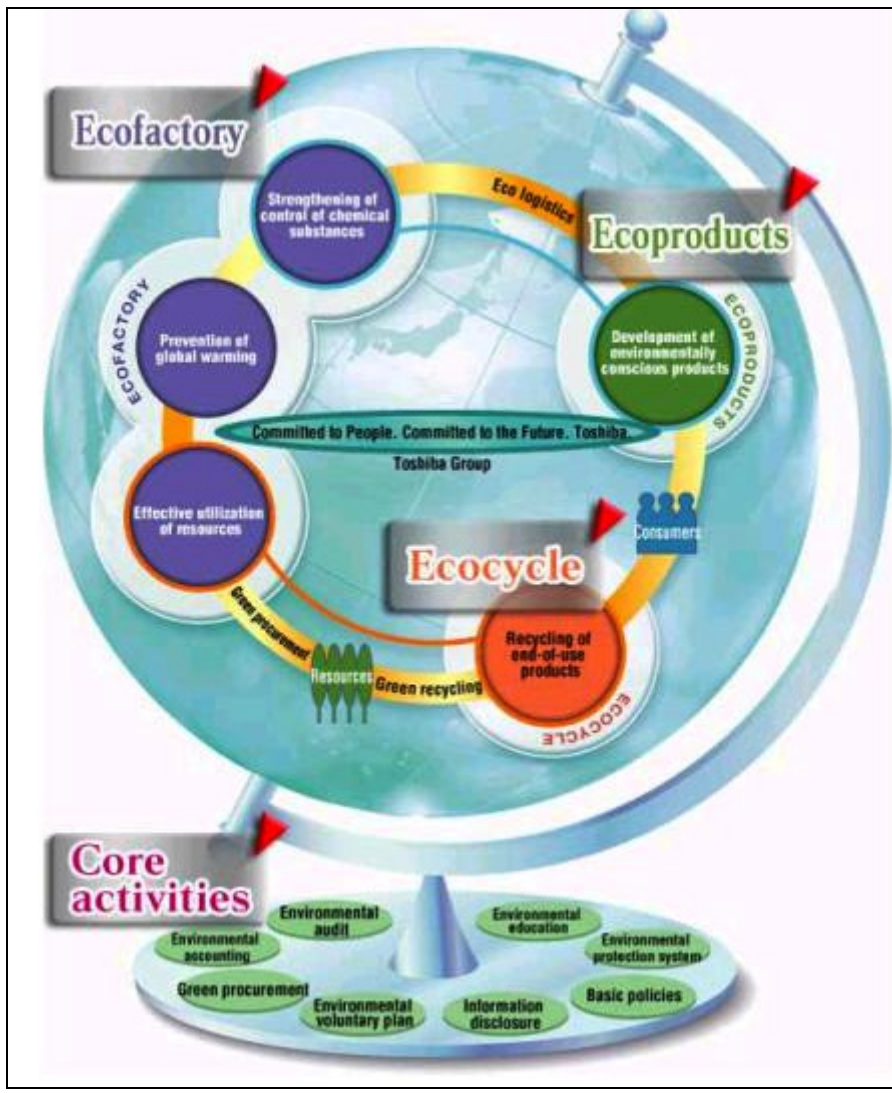



**Figure 1** Toshiba Corporation's basic policies for environmental protection

As shown in Figure 1, Toshiba examines the impact of each usage of a contemplated product and tries to maximize its recyclability and ease of disposal. As a practical expression of the Toshiba group's slogan 'Committed to People, Committed to the Future of Toshiba' we are striving to reduce our impact on the earth's environment. Our efforts encompass effective utilization of resources, prevention of global warming,

strengthening of our control of chemical substances, development of environmentally sound products and recycling of end-of-use products. Activities include environmental auditing, accounting, and environmental education. We take a productive approach to the disclosure of environmental information. Thus, Toshiba is at the forefront of the drive to make the recycling society an everyday reality.

**Corporate environmental protection concept**

In view of our drive to enhance commitment to environmental protection throughout the Toshiba group and to make this clear to the operation of every Toshiba group company, Toshiba had set up the corporate environmental protection concept in 1991. This is led by the elected officer responsible for environmental protection throughout Toshiba. The concept covers a wide-ranging agenda. It proposes solutions to environmental programs affecting management, technological development, production, and sales. It determines basic policies and it views the progress of in-house companies and operations. It has three subordinate organizations:

- the environmentally sound product Development Promotion Committee which promotes the development of environmentally sound products and technologies;
- the FREE Promotion Committee which promotes environmental protection after operations;
- the recycling promotion committee

Further, it is incumbent upon companies (e-solution companies) to hold in-house environmental protection conferences where they set goals and targets regarding specific products and regions and promote environmental protection activities. Figure 2 illustrates the organizational structure of this system.

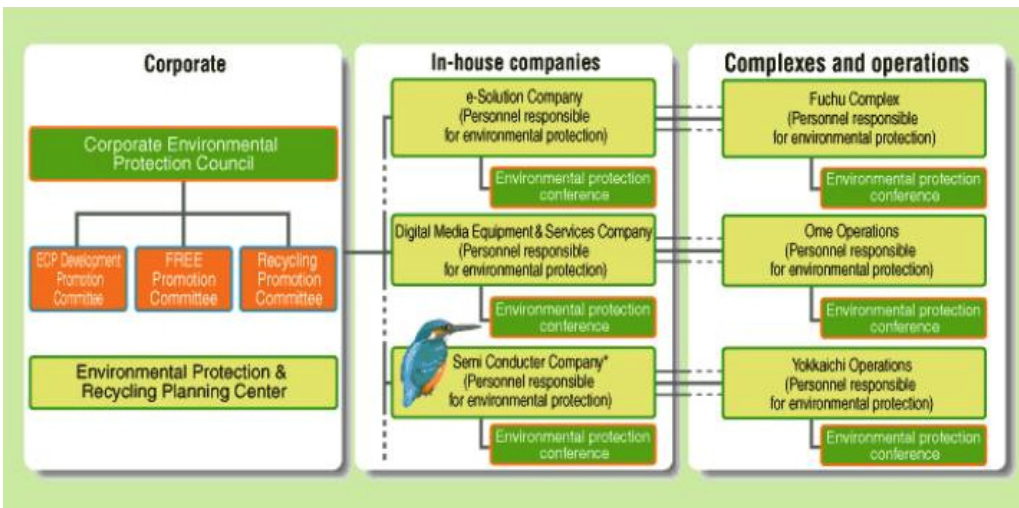



**Figure 2** Organizational chart of Toshiba's corporate environmental protection system

**Environmental management activities**

One example of our activities is ISO 14001. Toshiba considers ISO

certification to be a passport to inclusion in the ranks of the world's most environmentally responsible enterprises. As illustrated in Figure 3, Toshiba's commitment to this environmental certification started in the early 1990s. By September 1997, twenty of Toshiba Corporation's operations in Japan had gained certification and they have maintained this certification ever since. 72 subsidiaries and affiliates in Japan have also gained certification. To date, 31 overseas subsidiaries, accounting for more than eight per cent of Toshiba's overseas subsidiaries, have gained the certification. And we plan to achieve certification for all our overseas facilities.

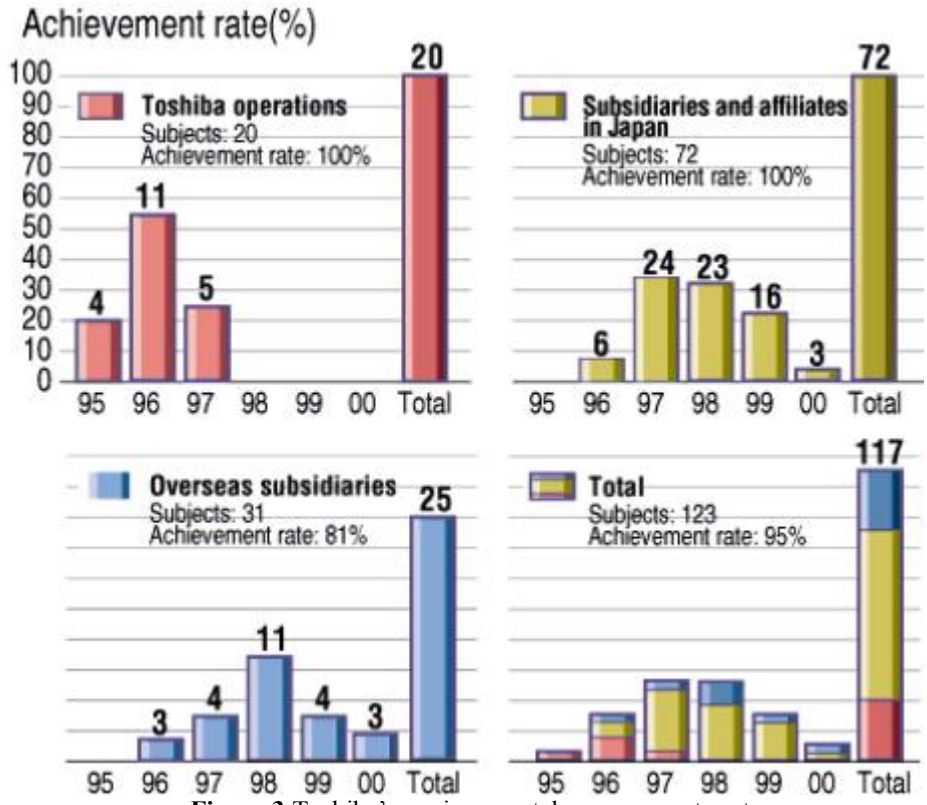



**Figure 3** Toshiba's environmental management system

The second example concerns Toshiba's voluntary environmental plans. The first of the plans was announced in March 1993. By the end of FY 1995, we had achieved the initial targets. In accordance with the second voluntary plan launched in FY 1996, a corporate-wide effort was made. The third voluntary plan is now being implemented, covering the period from FY 2001 to 2005 (see Table 1 for details). The major targets are: to promote zero emission waste; reduction in the use of chemical substances; reduction in the use of $CO_2$; and creation of environmentally sound products such as the adoption of lead-free solders, etc. This revolutionary plan is being promoted throughout the Toshiba group including our affiliate companies.

**Table 1** Toshiba's third environmental plan

| Items | Target |
|---|---|
| **Zero emission of waste** | Step-by-step implementation (reduce waste, leading to complete reuse and recycling) and the quantity of final disposal to be 1 per cent or less of total discharge in FY 2003. |
| **Reduce release of chemical substances** | 30 per cent reduction in FY 2005 compared with FY 2000. Toshiba is developing technologies for reduction and alternatives and have installed collection equipment. |
| **Reduce $CO_2$ release** | 25 per cent reduction in FY 2010 compared with FY 1990, through organization of capital expenditure and control |
| **Green procurement** | Set target for FY 2005 with FY 2000 as a benchmark |
| **Provide product information** | 50 per cent of products to be in compliance with voluntary environmental standards by FY 2005 |
| **Reduce electricity consumed per product function** | 30 per cent reduction in FY 2005 compared with FY 2000 |
| **Apply lead-free soldering** | Application of lead-free soldering to all products by FY 2003. Beginning with application for the major consumer electronic products and PCs in 2000 and is being expanded step-by-step. Toshiba introduced lead-free soldering to new models of the principal consumer electronics products in FY 2001. |
| **Phase-out HCFCs** | Abolition by December 2004 |

Based on the voluntary environmental standards for products drawn up in FY 2000, the creation of environmentally sound products will be promoted. The target is for 20 per cent of all products to be in conformance with voluntary environmental standards in FY 2002, increasing to 30 per cent in FY 2005.

**Environmental audits**

Toshiba conducts annual audits of the Corporation's operations and those of subsidiaries and affiliates. We use Toshiba's audit system known as EASTER. EASTER is based on the principle of eco-responsibility. Audits are performed by groups consisting of the Chief Auditor and auditors who are qualified in accordance with Toshiba's standards for auditors (regardless of whether they are employees of Toshiba Corporation or affiliate companies). Participation in auditing provides opportunities for auditors to deepen their experience and refine their skills. The requirement is that the auditor grasps the actual situation regarding environmental protection and achievement of improvement in environmental protection technology so that continuous improvement of environmental protection activities can be achieved.

There are four audit items:

- Environmental Management Systems;
- control of workplace;
- degree of achievement of voluntary plan; and
- creation of environmentally sound products

The results of an audit are compiled in an Audit Report together with issues to be addressed and proposals for further improvement. The receiver of the report must draft an improvement plan covering urgent and important issues identified by the audit. After a certain period, a follow-up is executed to monitor progress.

## ENVIRONMENTALLY SOUND PRODUCTS

### Development of ESPs

Toshiba tries to create products whose environmental impacts are minimized at every stage of their entire life-cycle from materials procurement, manufacturing, and distribution through the conception and the eventual disposal. All Toshiba products are subjected to environmental assessments. As shown in Figure 4, Toshiba considers that there are three targets to achieve in an environmentally sound product

- design
- assessment
- indication

In particular, these are achieved through:

- environmentally sound design
- life-cycle assessment (LCA)
- labeling

Details of Toshiba's recent activities in terms of in-house systems, guidelines, and tools to promote the development of ESPs are found in Figure 4. Following are some examples of ESPs among the personal products and industrial equipment.

In February 2000, Toshiba introduced Model TWF70, the world's first washing machine with dryer equipped with a DB inverter. This new equipment provides quiet operations and the TWF70 has become very popular. Following that, the TWG70 was introduced in January 2001 and provides higher basic performance and ease of use than TWF70. Unlike other drum-type washing machine, the TWG70 can use regular detergent powder because it is equipped with the function to detect and control excessive bubbling. The new detergent amount indicator shows how much detergent should be put in based on sensing the amount of washing by the DB inverter motor, immediately after the settling operation. Indication of optimum amount of detergent prevents excessive use of detergent. Noise level is further reduced to 35 decibels for washing, 45 decibels for spinning and 40 decibels for drying, due to the improvement of the control system. In accordance with Toshiba's third voluntary plan, lead-free soldering was adopted. Finally, packaging was reduced by 50 per cent.

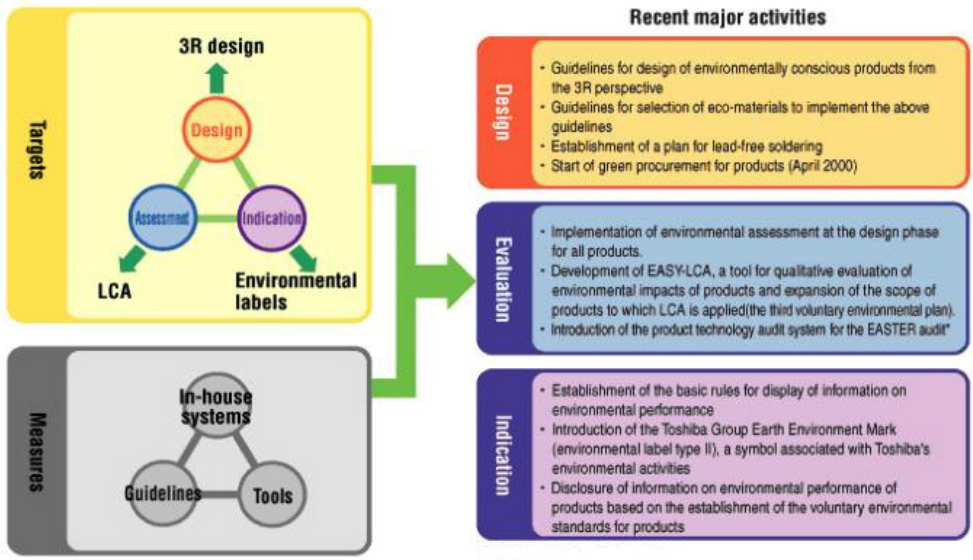



**Figure 4** Development of environmentally sound products

Personal computers are designed with consideration for many aspects of eco-design. Toshiba adopted lead-free soldering for the operating circuit board of the Dynabook SS3490, a notebook personal computer introduced in February 2001. The operating circuit board of this model is made up of antimony-free materials that Toshiba developed and began mass-producing for notebook computers in November 1998. The Japanese device recycling law requires that the manufacturers shall ensure the design of PCs facilitates the 3Rs-reduce, reuse, and recycle. Consequently, Toshiba is stepping up its efforts, focusing on compactness, resource-saving, long life, upgradeability for long time use, and the adoption of reuse of units and recyclable plastics. In April 2001, these efforts succeeded in gaining Toshiba the Japanese Environmental Associations' eco-mark certification for three types: the Toshiba Notebook, PCs for businesses, and 600PCs. Toshiba's notebook PCs for Europe gained the German Blue-Angel mark in December 2000, the most prestigious environmental label in Europe. Toshiba's was the first notebook PC to gain this mark.

The automatic mail-sorting system that reads postal codes and addresses of mail for automatic sorting has been available for the past 30 years. The first generation system had the ability to process a large volume of mail by reading postal codes, addresses, and bar codes. Toshiba has reduced the weight of the system by simplifying the mechanics, reduced the materials that are difficult to recycle, and reduced the time required for disassembly for recycling. This system reduces mail sorting units to about one third because of the use of homogenized parts for transportation of mail. With the adoption of inverter control and half the number of motors, the number of operating circuit boards used for reading addresses was reduced to one-third. This is the result of system integration through adoption of multipurpose technology, which is an improvement in terms of both function and performance as is evident in the case of personal computers. To reduce the time required for disassembly, the standardization of screws was promoted thereby reducing the number of screws to one-sixth.

**LCA as a tool**

Toshiba has developed a simplified LCA tool, the memory Easy-LCA, in order to evaluate the environmental load or impact of production. Awareness of LCA has been increasing. However, as applied to the variation of component products such as personal computers, there are many issues in terms of methodology and database. Therefore, we have developed a tool for designers who do not have knowledge of LCA.

The characteristics of easy LCA are as below:

- Those other than LCA experts can easily calculate environmental loads and impacts.
- Used as a screening tool for the estimation of environmental load in products design and/or planning stage.

As for simplification, the following are considered in LCA tools development:

- A product life cycle is modeled in a simplified form.
- Easy data input operation.
- Results of the computed environmental load are displayed intelligibly.
- The Economical Input/Output Table (published by the Japanese government) is used as environmental load database.

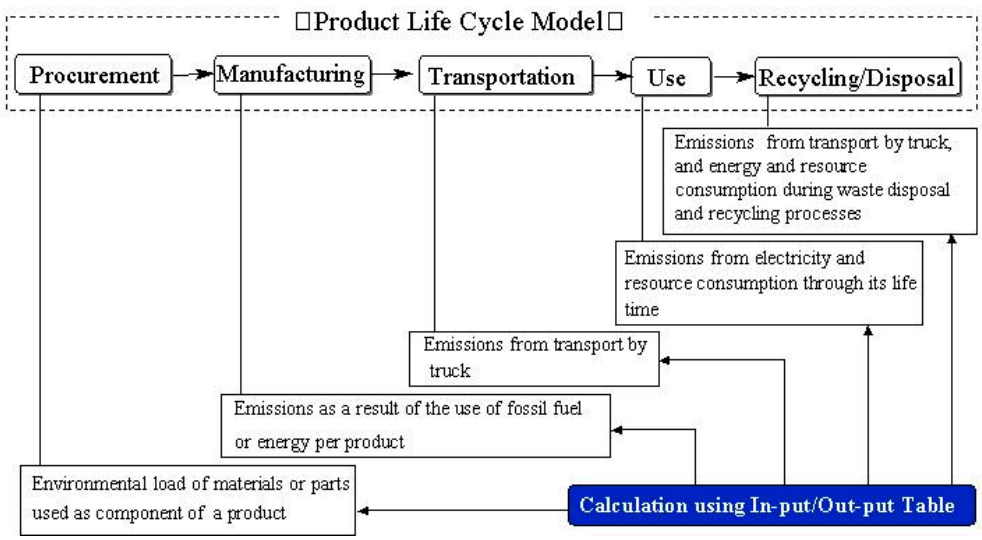



**Figure 5** Outline of life-cycle model and environmental load calculation method of Easy-LCA

Figure 5 shows the outline of life-cycle model and the environmental impact calculation method. The formulated product life-cycle process consists of six areas-procurement, manufacturing, transportation, reuse, recycling, and disposal stage. In Figure 5, each stage of the environmental load calculation procedure is detailed in the square boxes. For example, in the case of the procurement stage, the environmental load is calculated from the components of a product such as its parts.

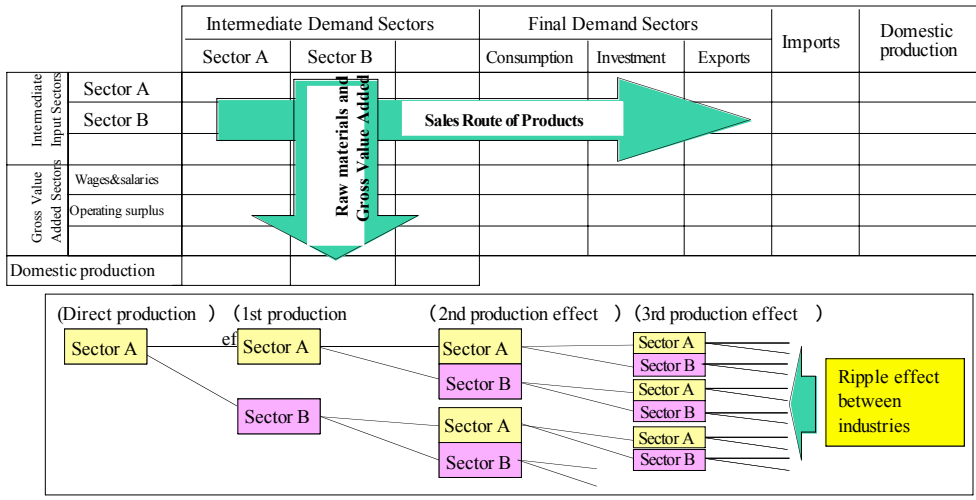



**Figure 6** Easy-LCA's input-output table

Here we briefly examine the input-output tables used in Easy-LCA database (see Figure 6). The input-output table contains statistical data showing the monetary trend between the domestic industries and is published by the government every five years. The Japanese input-output table describes all inter-industrial monetary transactions among 400 sectors. The input-output table can be shown dealing with the monetary amounts that are influenced by economic activities. Various industrial products are included in the manufacture of a certain product. The products that are manufactured are combined with various other industries again. Thus various products are correlated with each other as inputs and outputs. In other words, they form complicated networks. Using an input cohesion matrix and index matrix, which are calculated from the input-output table, we can obtain direct and indirect business connections between industries required for manufacture. Therefore, from the input-output table we can see various inputs of energy-containing products such as crude oil, petroleum, coal, in the industry. The products and the carbon contents of each energy-containing product can then be translated from monetary inputs to units of $CO_2$, smoke, or gaseous emissions.

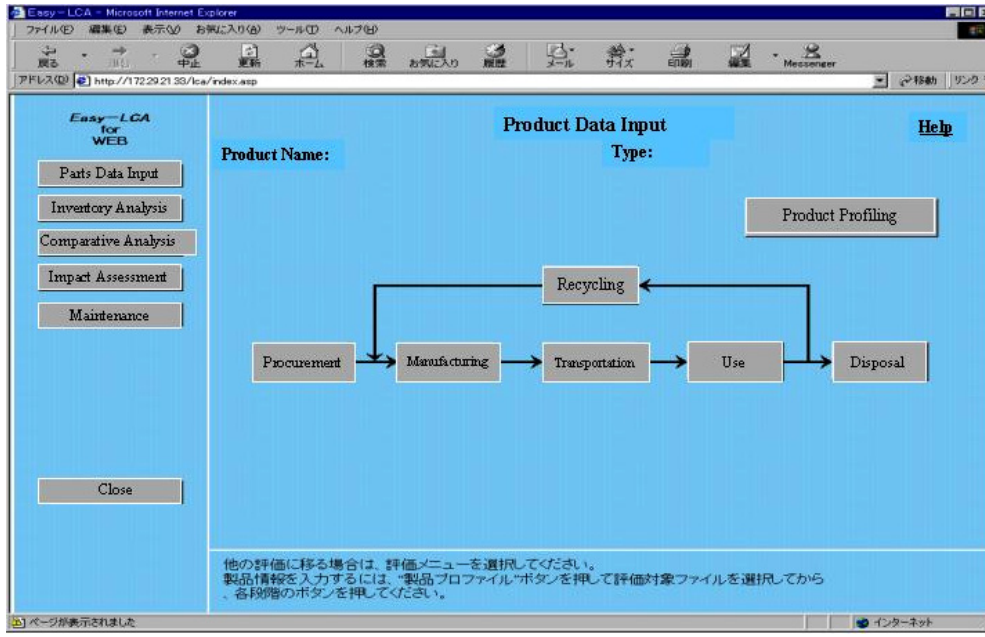



**Figure 7** Top screen of the Easy-LCA tool

Figure 7 shows the top screen of the Easy-LCA tool. The squares indicate each product's life cycle stage as mentioned above.

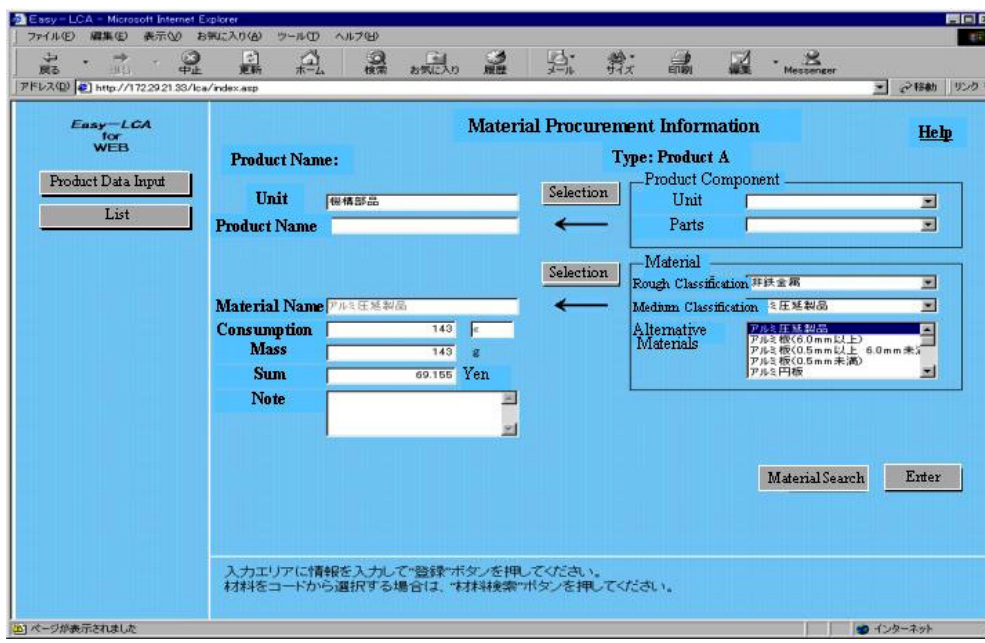



**Figure 8** The Easy-LCA tool input screen of material procurement information

Figure 8 shows the input screen of material procurement information. First, the user would fill in the unit and product name or may select from a list (on the right

window). The next step is to describe the material name and parts name or, again, select an item from the window on the right. Then these items are classified according to the input-output table following which the consumption materials or parts are input. For example, in the case of aluminum materials, non-ferrous metals are chosen and some secondary aluminum plates or pipes are chosen from the sub-classification.

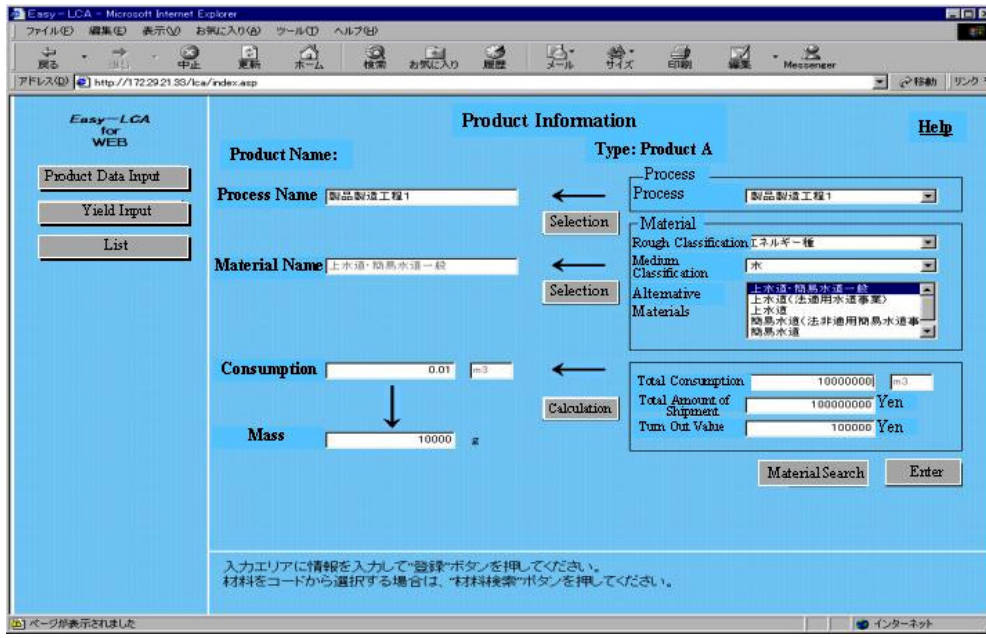



**Figure 9** The Easy-LCA tool input screen of product information

Figure 9 shows the input screen of products. Items are entered in the same manner as during the procurement stage.

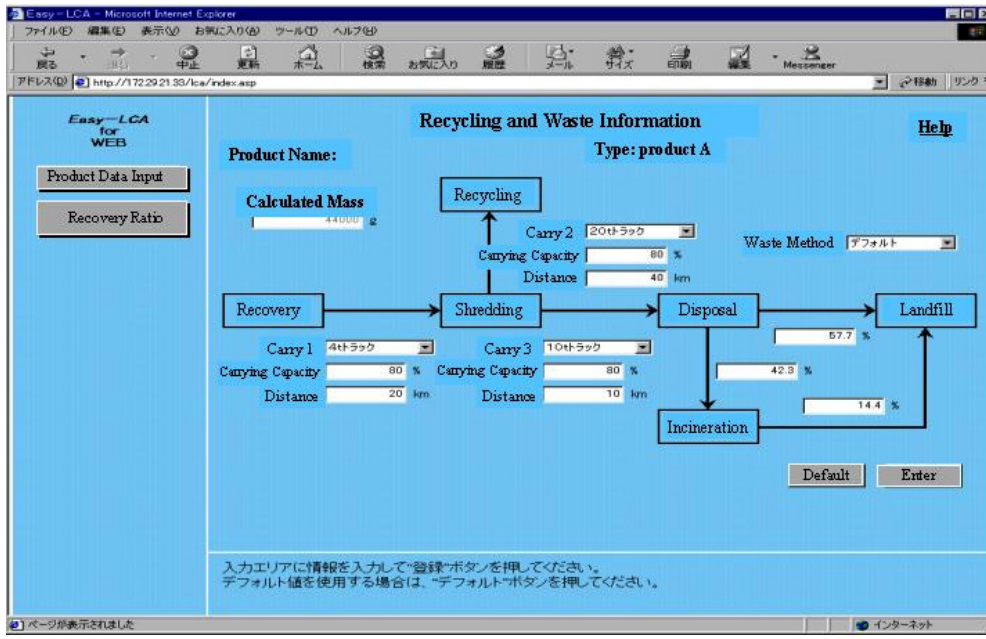



**Figure 10** The Easy-LCA tool input screen recycling and waste processes

Recycling and waste stages are modeled as shown in Figure 10. Wastage differs according to the nature of the product. Therefore, we assume a typical model for the waste procedure based on the application of various statistical data.

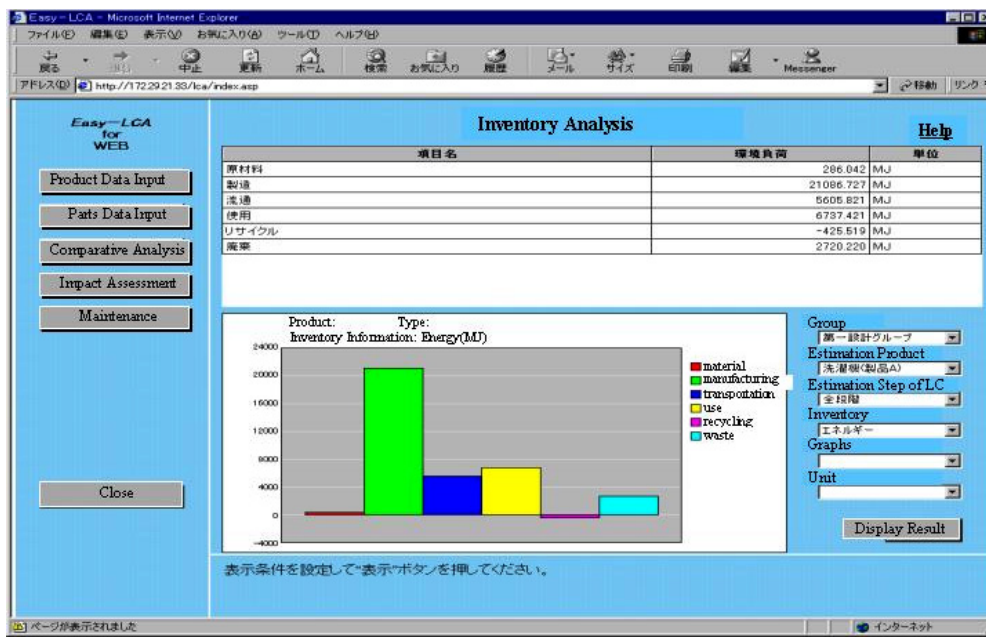



**Figure 11** The Easy-LCA tool screen of inventory analysis

Figure 11 is an example of inventory results. The vertical axis gives the

amount of emitted loads and the horizontal axis shows each life-cycle stage. The amount of energy consumed is shown in the vertical axis and this can be displayed also in terms of $CO_2$ and other emissions.

Following are some examples of LCA as applied to common Toshiba products.

Case 1: Washing machines

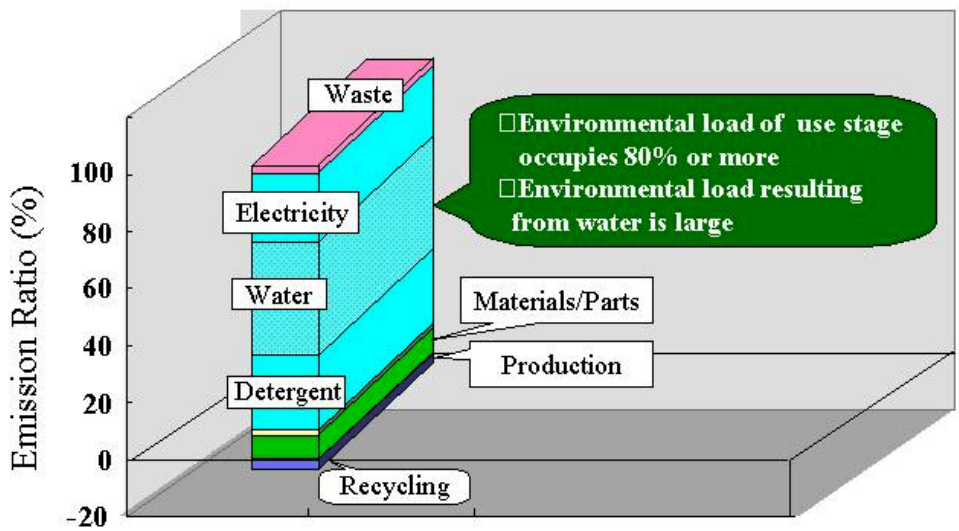



**Figure 12** Case 1: $CO_2$ emissions of a washing machine through its life cycle

Figure 12 demonstrates the amount of $CO_2$ generated over the life-cycle of a washing machine. We claim that the $CO_2$ emissions of washing machines are generated as follows:

- environmental load of consumers' use stage occupies 80 per cent or more of emissions
- environmental load due to water and detergent use is large

Therefore we improved the basket design to promote water-savings as shown in Figure 13. The basket materials in turn are now made of recyclable metal.

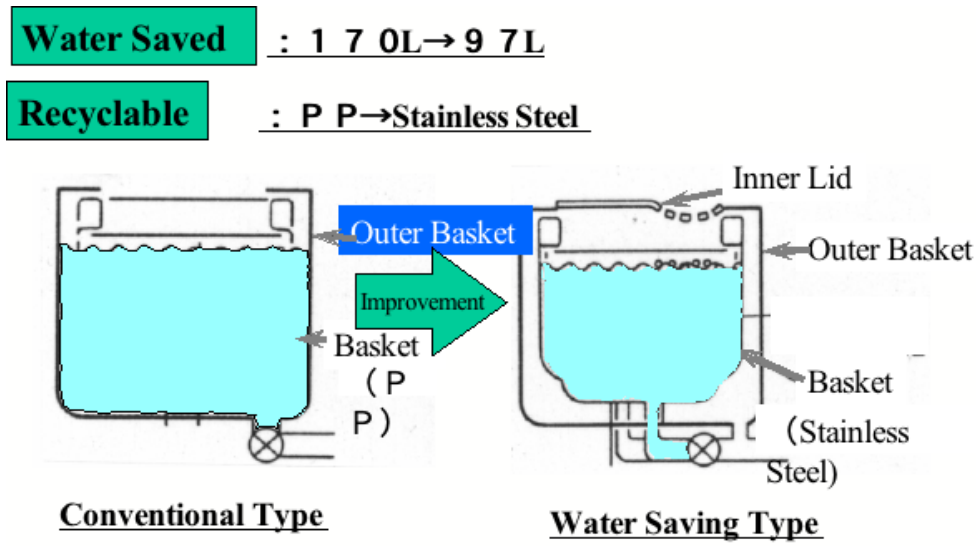



**Figure 13** Improvement in basket designs of washing machines

As Figure 14 shows, we have a variety of washing machines where the emission of $CO_2$ decreased by 30 per cent compared with conventional types.

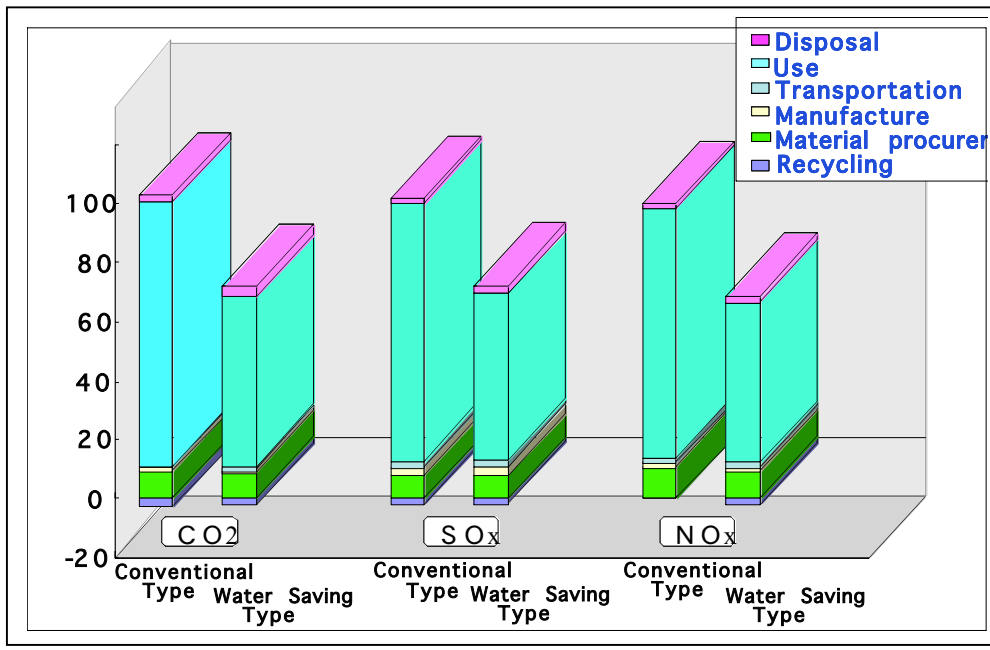



**Figure 14** CO2, SOx, NOx emission ratio of conventional and water saving types of washing machines

Personal computers

We turn now to the second case study showing $CO_2$, $SO_x$ and $NO_x$ emissions in

each stage of the life-cycle of personal computers, the Dynabook (see Figure 15). We found that the environmental load of materials and parts are all large.

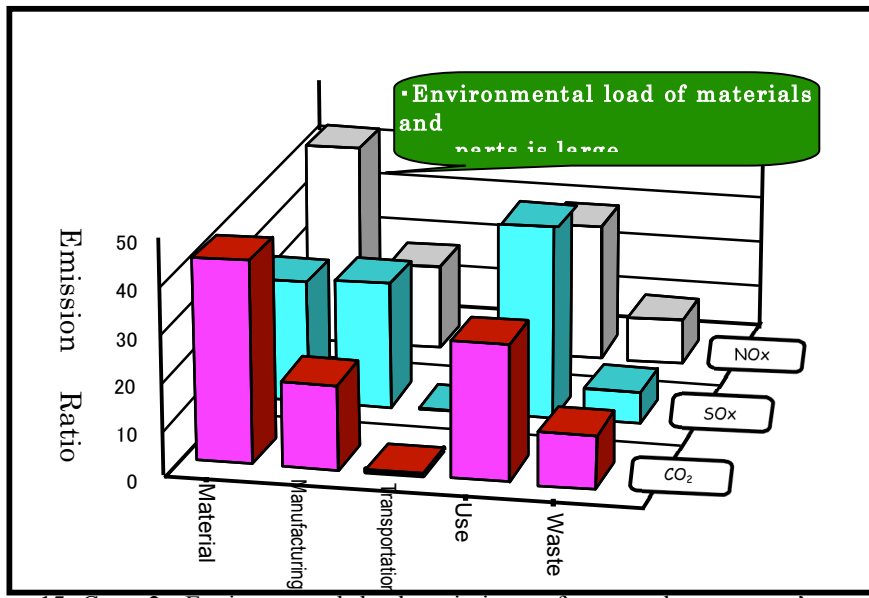



**Figure 15** Case 2: Environmental load emissions of personal computers' component materials and parts

When the environmental load is investigated for every conversion of materials and parts, we found that those of semiconductors and integrated circuits are large. As such, the integration of semiconductors is required in order to reduce the loads.

Vacuum cleaners

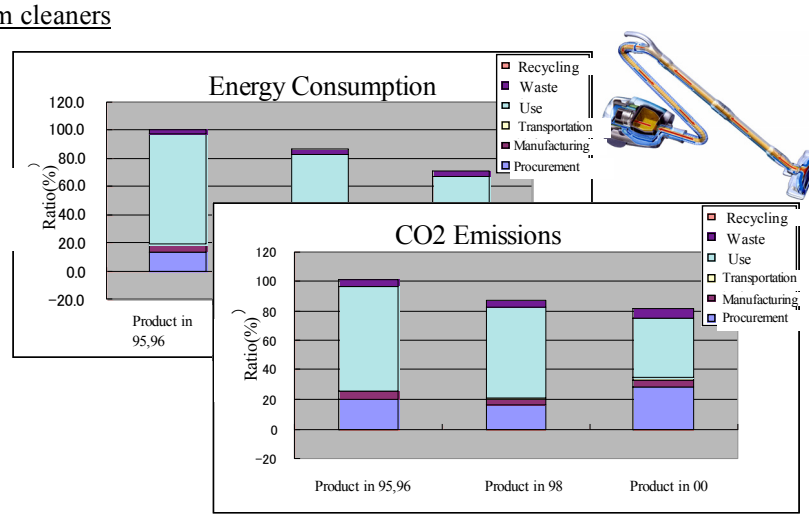



**Figure 16** Case 3: LCA results of vacuum cleaners

Figure 16 shows the case study of vacuum cleaners. This newer product has a

lesser environmental load. Designs targeted towards energy savings accomplished this improvement. LCA also indicated that the next step is the reduction of parts and materials. This example clarifies that LCA is very useful for eco-design.

## GREEN PROCUREMENT (GP) ACTIVITIES IN TOSHIBA

Since April 2001, Toshiba has been conducting green procurement throughout its operations. Now, Toshiba is encouraging its group companies to start green procurement and is working to synchronize green procurement with environmentally sound products. Information systems to support green procurement are being established.

The aims of green procurement in Toshiba are:

- To procure from suppliers that promote environmental protection.
- To procure products, parts and materials that have a low impact on the environment throughout their life cycle: from procurement to production, transportation, consumption, and final disposal.

### Basis of evaluation and criteria

The evaluation criteria of suppliers are as listed below:

1. Has received ISO 14001 or equivalent environmental certification or plans to do so.
2. Promotes Green Procurement or plans to do so.
3. In respect of environmental protection, the following measures are actively undertaken:

    a) There is an organization to promote environmental management
    b) The existence and functions of this organization islearly stated
    c) There is executive participation in this organization
    d) There is understanding of environmental regulations
    e) Consideration is given to using environmentally sound materials
    f) Environmentally sound manufacturing is actively practiced
    g) Employees receive environmental education
    h) No environmental penalties or guidance imposed in recent years
    i) The relevant people understand Toshiba's environmental policy
    j) There is a quick response to Toshiba's requests in connection with environment-related activities, such as use of controlled substances.

We formally evaluate suppliers according to the above criteria. Priority is given to those suppliers ranking high on our evaluation of their commitment to environmental protection activities based on these criteria, in addition to meeting the required quality, cost, and services.

The selection criteria for procured items are as listed below:

| | |
|---|---|
| **Resource conservation** | low consumption of resources |
| **Energy conservation** | low consumption of energy |
| **Potential for long-term use** | can be used for a long time |
| **Reusable** | can be reused |

| | |
|---|---|
| **Recyclable** | can be recycled |
| **Use of recycled material** | high proportion of recycled material |
| **Ease of disposal** | designed for disassembly or can be disassembled |
| **Content of environment-related substances** | the chemicals contained in the procured items are controlled according to their management ranking set by Toshiba |

The procurement process gives priority to products that fulfil the above selection criteria for reduced environmental impact in addition to quality and cost.

With respect to the definition of environmental related substances (the final item in the above list), Toshiba divides chemical substances management into three ranks:

- substances of Rank A are prohibited in Toshiba
- Rank B are substances whose usage is restricted
- Substances in Rank C are subjected to strict control on the volume of use.

Toshiba also defines 54 substances as environment related substances. Toshiba has developed an information system for green procurement (Figure 17).

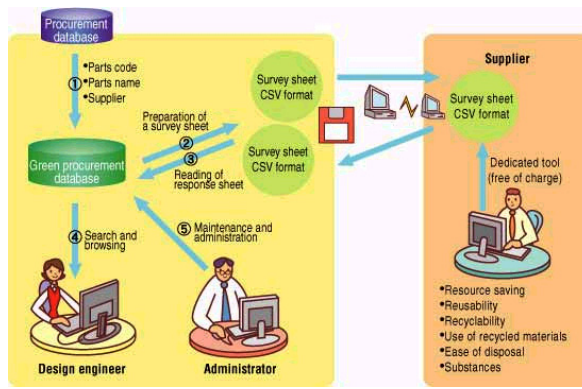



**Figure 17** Information systems for green procurement

Our supplier evaluation tool, green procurement database, and environmental performance service tool have been developed in-house for use within the Toshiba group. The environmental performance service tool allows the transmission and receipt of electronic data and thus enhances the efficiency of suppliers in responding to enquiries about substances with environmental impact and supports their effort to construct databases. To support green procurement of suppliers, Toshiba is ready to commercialize a software package containing green procurement related systems.

Using Vision technology, Toshiba has succeeded in developing an information sub-system that is a network-type LCA evaluation system. The following section introduces this sub-system.

**Bee-gent software**

When designers evaluate the LCA of products, the environmental data that they need (like products information, wastes information, usage information, and transport information) has to be obtained from a variety of database, such as from procured databases and transportation databases. Because these databases are located in different places, there must be a way to access the data effectively and efficiently.

We use a software called Bee-gent that is connected to many kinds of network resources such as databases, various application software, and so on. Vision identifies the resources, and the Bee-gent identifies the services using the resources. This process thus:

- dissolves difficulty of interconnection
- deals with resource changes
- uses alternative resources if necessary

In other words, Bee-gent allows for new functions to network under a certain command using the software and the databases that it has set down.

The technical components of Vision are:

- agent wrappers (common interfaces)
- mobile mediation agents (manage the coordinating interactions in a unified manner)
- uses a common language for agents (XML/ACL)

Bee-gent behaves as illustrated in Figure 18.

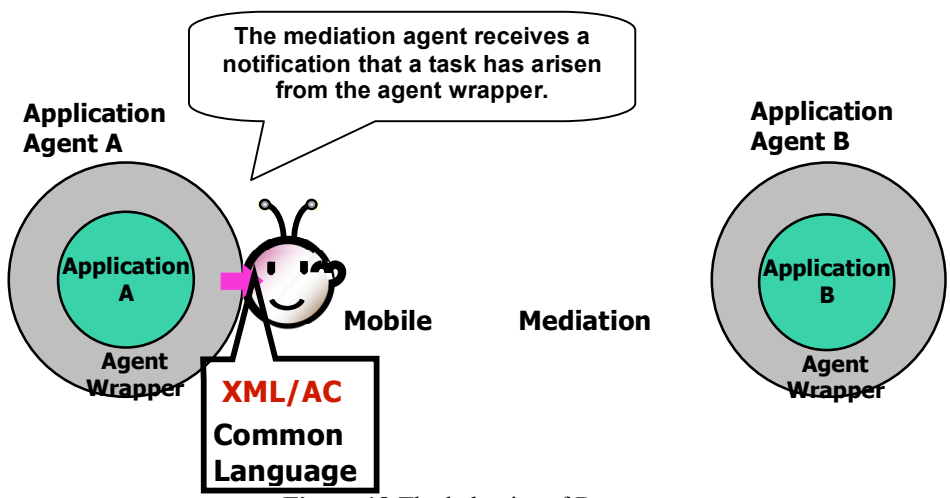



**Figure 18** The behavior of Bee-gent

In stage (I), the mediation agent receives a notification from the agent wrapper that a task has arisen. In stage (II), the administration agent decides to request the action of application B. Then, the agent wrapper receives the request for action from the agent, activates the process of application B according to the action, and returns the result to the agent.

**Environmental information system**

Toshiba developed its environment information systems with Bee-gent. Figure 19 shows the prototype.

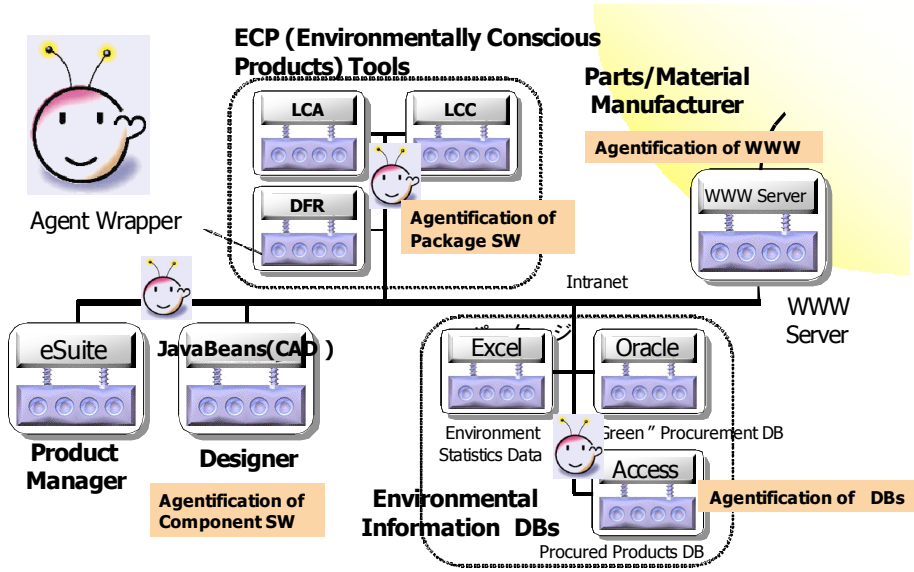



**Figure 19** Prototype environmental information system

As an example of the system's functions, I will describe the method of LCA evaluation with this system, step-by-step.

- Step One: the agent moves to the product management tool carrying the current design data.
- Step Two: the agent asks the product management tool software the target and after receiving the necessary information it will move to the databases or to other manufacturers' database
- Step Three: the agent moves around the other databases such as the green procurement database and Environment Statistics Data and obtains the information. Then the target agent goes to the ESP tools software such as LCA.
- Step Four: the agent starts the LCA software, calculates the life-cycle environmental impact, and shows them to designers.

To summarize, Bee-gent realizes the coordination of heterogeneously distributed applications and databases. Bee-gent reduces the development and maintenance costs of openly distributed systems and so will play a significant role in E2commerce.

**TOSHIBA IS "INTERNET-READY"**

Toshiba will be quick in creating internet-related systems that apply IT to all business processes across manufacturing, sales and everyday operations. Greater management efficiency and speed are why we are getting ourselves internet-ready. Internet-readiness also enables environmental protection activities.

5

# CONCEPTS AND PRACTICES IN ZERO EMISSION, ECO DESIGN AND ECO MANUFACTURING

***Hiroaki Koshibu***
*Corporate Statutory Auditor*
*Fuji Xerox Office Aupply Co., Ltd., Japan*

This discussion will focus on environmental activities at the Fuji Xerox parent company. As mentioned in my earlier paper, the Xerox Group is a joint venture between two companies, Fuji Photofilm and Xerox Corporation. We divide the world market into three geographic zones (see Figure 1). Fuji Xerox Japan employs almost 30,000 employees and its revenue this year approached 1,000 billion yen.

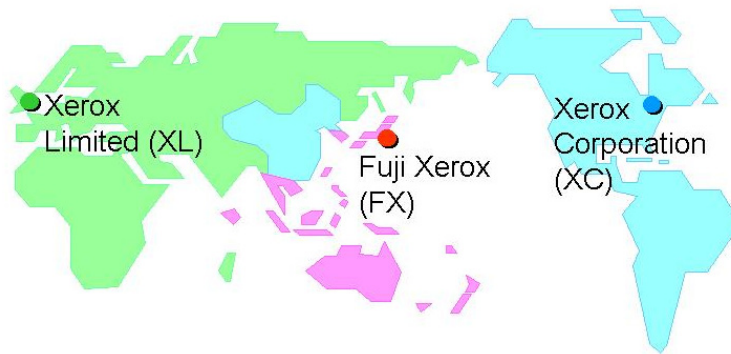



**Figure 1**. The Xerox Group

In terms of environmental activities, the three companies in the Xerox Group cooperate with each other through a committee called the Xerox Environmental Leadership Steering Committee (ELSC; see Figure 2).

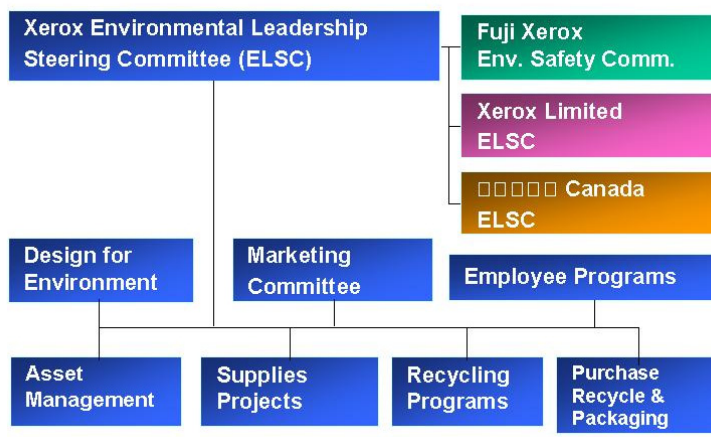


**Figure 2**. The Xerox Group's environmental leadership organisation and teams

The operating companies have representatives on the committee, which meets quarterly. The committee oversees design for green products; environmental marketing; and asset management.

## WHAT MANUFACTURERS SHOULD DO TO GREEN THE MARKET

There are three pertinent activities that in the Xerox Group come under the environmental committee, the ELSC. Asset management is the main one: through recycling products that have been returned by customers, we convert used products into assets. Recycling is an internal effort within the company. The manufacturing process consumes a lot of natural resources and results in a lot of waste. This fact is recognized by Fuji Xerox. We consider that greening the market demands two additional components:

1. a zero emission factory dealing with solid wastes to achieve zero landfills
2. green purchasing or green procurement through the organisation to enable effective cooperation for the improvement of the group's environmental performance

As other chapters in this volume also deal with green procurement, in the following, I focus on how we can develop the green concept and change the company's *modus operandi*.

### Green concept

On 7th March 1994, I submitted a proposal to the management on "green concept." When we initiate something new and important, it is essential to develop a good, clear-cut concept of what to do, what to achieve, and then to direct and lead the company staff accordingly. The proposal stressed *Quality Management and Environment Management*. This concept is illustrated in Figure 3. As shown there, the concept involves two pyramids or triangles: one for quality and another for the approach.

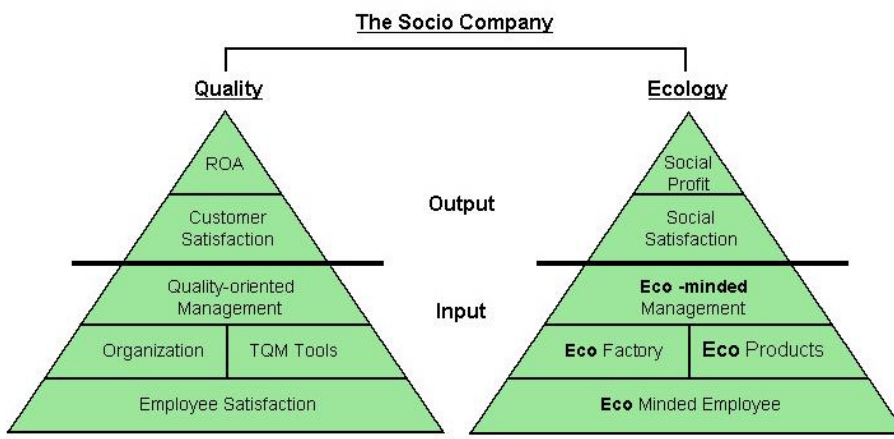


**Figure 3** . Quality Management and Environment Management

I adrew these triangles when I was managing Fuji Xerox in the United States and the United Kingdom. I was then part of a Xerox Corporation team set up to improve quality management in order to obtain a prestigious award, the Malcolm Fraser's Quality Award. While there I drew these triangles to illustrate to the Xerox people what the Quality system looks like using the chapter titles of the evaluation book of the Malcolm Fraser's Award. There are six boxes within each triangle, each representing a chapter title, which is assigned a certain number of units, like 100 for "customer satisfaction." The units are totalled up and when you reach a certain number, you may go on to the next stage following a visit by auditors to the site to see if what the evaluation book describes was correct.

The stages for Quality are:

- employee satisfaction: the people form the base.
- organisation promotes quality along with TQM (Total Quality Management) tools
- quality-oriented top management is an internal effort

Outputs are: improved customer satisfacti*on* that will lead to better business results such as ROA (Return on Asset).

In relation to environmental activities at Fuji Xerox, when I returned from the United States in 1993, I came up with the idea to do a similar training for Ecology. I felt that employees are important: we need to have eco-minded employees within the company so that the eco-factory can produce eco-products under an eco-minded management (see Figure 3). For outputs, since we are dealing with the ecology, it's *social satisfaction* rather than customer satisfaction that produces what I call *social profit*.

Combining the two triangles leads to the company objective of becoming a *socio-company*.

This proposal was accepted by the management. In essence, to be a "socio-company" we need both quality and ecology; these cannot be separated. And in order to improve the environment, we need technology.

## GREEN PRODUCT FACTORS

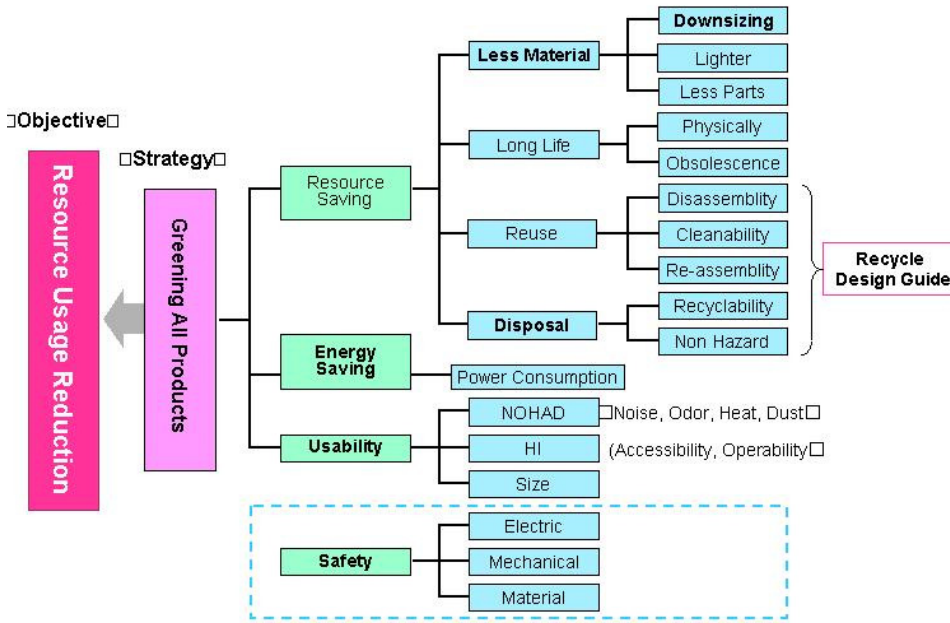



**Figure 4 diagrams green product factors.**

**Figure 4**. Green Product factors

As the diagram shows, the strategic objective is to *reduce the use of resources*. This is achieved by *greening all products* for the sake of *resource savings* and other factors. These issues are on top of the *safety* factor: productivity is also measured in terms of electricity, electric safety, material safety, mechanical safety, and so forth. To achieve (for example) resource savings, we decided not to use a lot of materials; we design the product by downsizing, i.e. make it lighter or using fewer parts, or by rendering it long-life and stave of functional obsolescence, i.e. maintain the usability or functionability of the product for a long time.

These technological issues, including *reuse* (disassembility, cleanability, reassembility) and *disposal* form the *recycle design guideline*. Recycling is only a part of all green products. Design engineers will then attempt to develop products using the currently available technology to green the products.

PHOTOCOPY MACHINES

Fuji Xerox's design of photocopy machines provides a good example of green design. As described in Chapter XXX, we conducted LCA analysis of $CO_2$ emissions for copiers over their life cycles. As can be seen in Figure 5, black and white copiers produce little emission of $CO_2$, with paper emitting the largest amount. For full colour copiers, "power in use" produces the most emissions because to obtain a full colour copy, we must process four times.

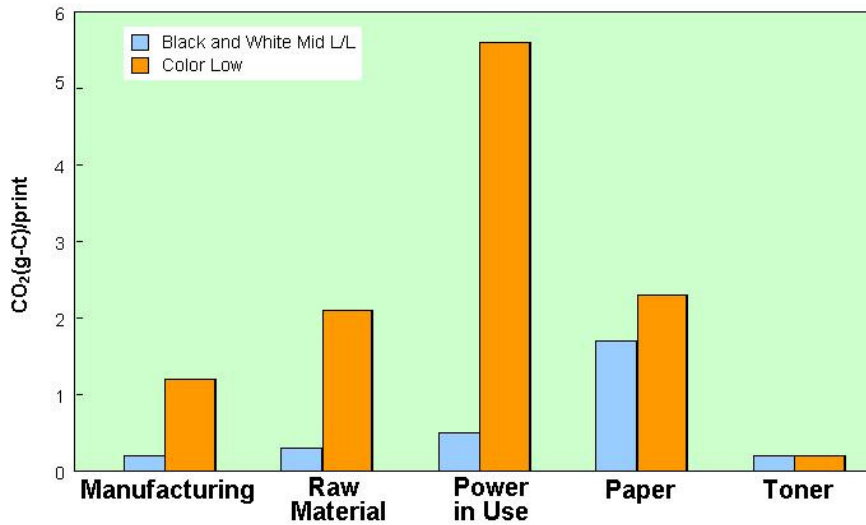



**Figure 5**. $CO_2$ emission of Fuji Xerox copies

The problem, as noted earlier, is the high emission factors of paper use. We needed to reduce its impacts. The common solution is two-sided photocopying. But two-sided capability in copying machines is manually awkward and time-consuming as it requires printing one side and then flipping the paper over and putting it in a duplex tray for the second copying. To ease the use of duplex, we exploited the new technologies in digitisation whereby copying machines function like cameras. Once you have succeeded in changing the image into digital signals and stored them in the machine's memory, you are able to make a second imaging, which will output simultaneously for both sides of the paper. What's needed is to have different cameras in the machine and copy digitally so that no efficiency is lost.

The following are some of our achievements in developing green products:

- Copier Eco-Mark: 6 models
- Energy Star Program: 56 models (no. 1 in Multifunctional Devices and Digital Copiers)
- J. D. POWER Printer CS Rating: No.1

- Award from the Energy Saving Minister: DocuColor 1250 was the first and only full-color Multifunctional Digital Device awarded in Japan

Product recycling

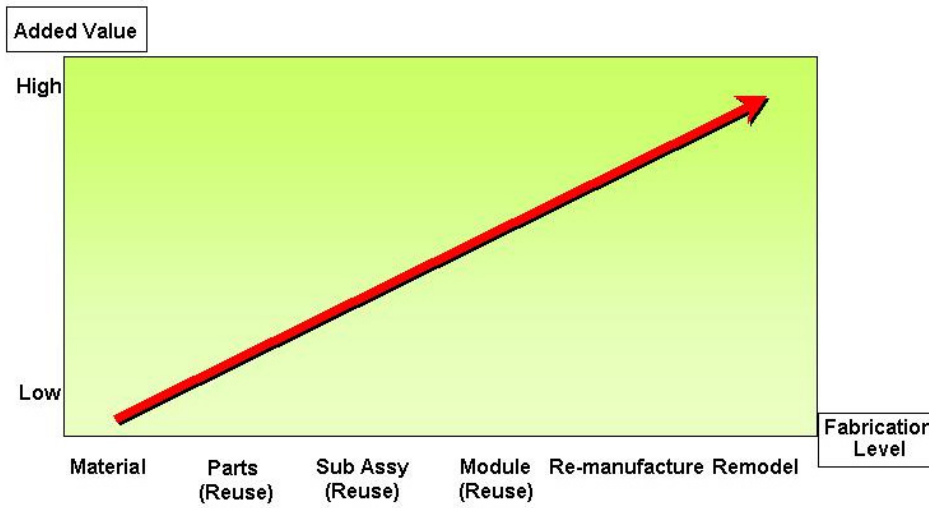



Figure 6 illustrates the Xerox Closed Loop Recycling Concept, which was taken fromthe brochure of Xerox Corporation that was advocating recycling.

Figure 6. Xerox Closed Loop Recycling Concept

"Closed-loop" means in *cooperation* with the main suppliers or vendors, but under our management or control or responsibility. We retain management control to ensure that everything works well. It has three components:

- Product reuse
- Component reuse
- Material recycle

Figure 7 illustrates the recycling spectrum.

**Figure 7. Recycling spectrum**

This graph was originally drawn up to explain the recycling concept to our management in April 1995; its objective is to explain why recycling should be a priority. The Y-axis shows added value. The X-axis shows lateral fabrication, starting from raw material fabrication onwards. As manufacturers, product costs in adding value to materials run into billions of yen every year. Recycling is not easy to rationalise economically. To return materials to their raw state requires money, energy, time, and effort. We decided to place our priorities on *reuse*-from high volume item back into high volume item-which makes more financial sense.

Figure 8 shows an LCA analysis by a study group, the Japan Business Machines Manufacturers Association (JBMMA).

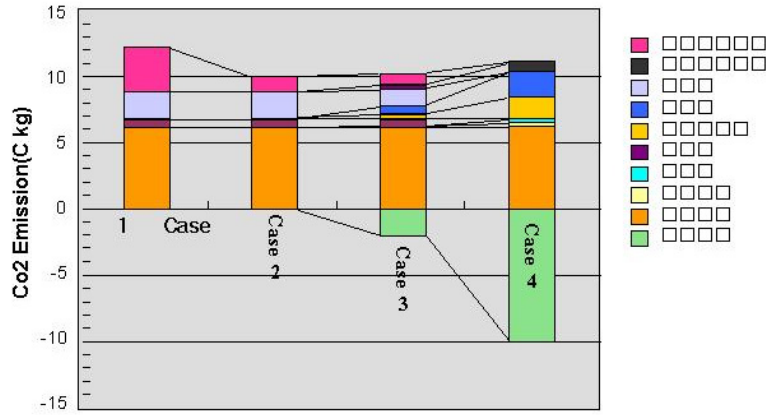



Figure 8. LCA analysis of copier recycling by JBMMA

The environmental committee of JBMMA formed a working group to conduct LCAs on Canon and Fuji Xerox copiers. The two companies came up with a report to compare $CO_2$ emission impacts for the reuse of products. Several cases were compared.

Case 1 No recycling

Case 2 Material recycling with zero parts reuse

Case 3 Material recycling and 20 per cent parts reuse
Case 4 Material recycling and 100 per cent parts reuse

The base case (Case 1; no recycling) shows $CO_2$ emissions over various phases, like manufacturing. Case 4 is the best: 100 per cent parts reuse by weight which would offset the emissions. So, according to these findings, environmentally and economically the *reuse* of parts and products is essential. Hence the focus on reuse rather than recycling.

Here are some examples of our achievements.

- Material savings: 31.6 per cent through the reuse of parts (DC605 as example)
- Energy savings: 16.1 per cent (ditto)
- $C_{o2}$ emission reduction: 18.3 per cent (ditto)
- Resource recovery ratio: 99.97 per cent (total)
-
- Awards: Science and Technology Minister Earth Environment Award for recycling operations; NIKKEI Technology Award for plastics recycling technology

## Zero Emissions factory

Ten years ago, the plant realised that landfill costs were becoming very expensive due to limited availability of sites. A decision was made to reduce these costs by recycling wastes. After seven years, 100% recycling and therefore zero landfill was

achieved, through the combined effort of all employees (see Figure 9).

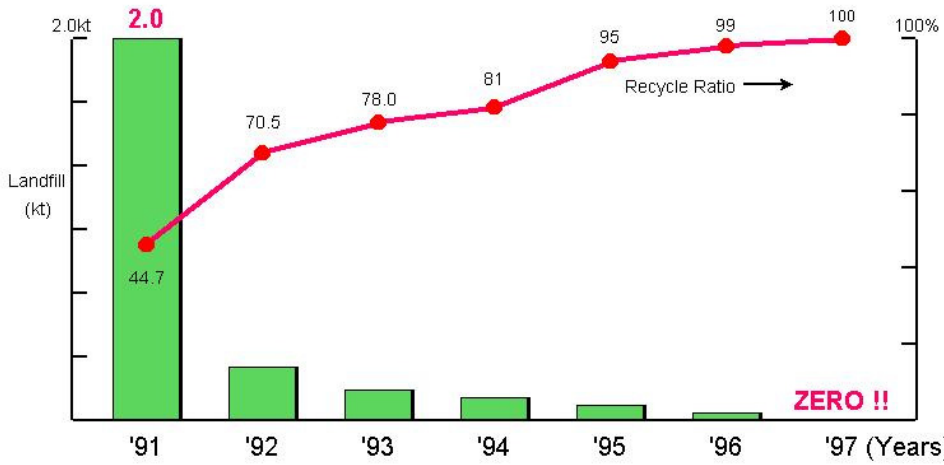



**Figure 9**. Zero emission at supplies plant in Japan

Waste is divided into 62 categories: for the 62 types of vendors who can recycle them. Figure 10 gives examples of how supplies (like toner cartridges and photo-receptive drums) are reused.

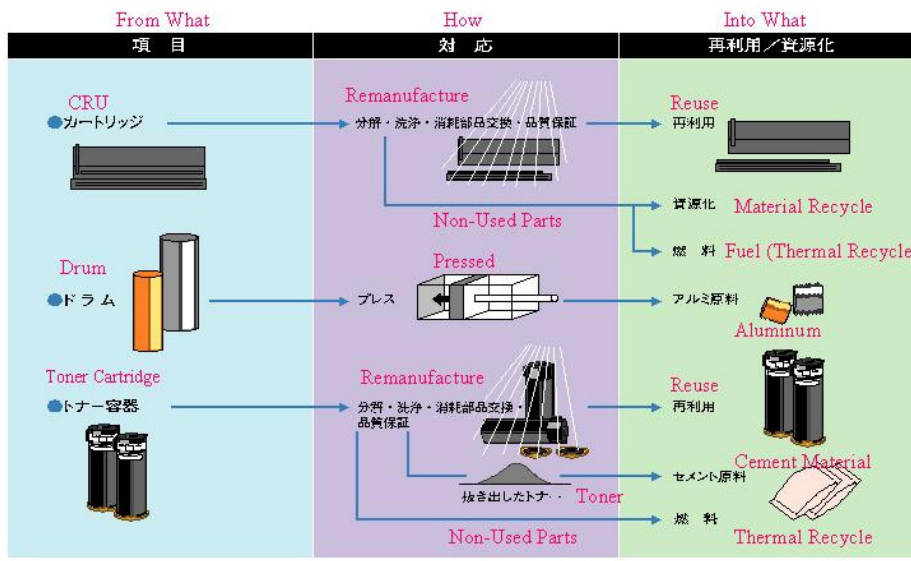



**Figure 10**. Reusing returned supplies

For example, the toner itself cannot be reused for the original purpose because it contains a lot of small paper products. If it is reused, it can deteriorate the image of the copy. But toner can be good in terms of energy; we therefore sell it as fuel. Through

similar efforts throughout the factory, 100 per cent recycling was achieved.

Here are some achievements:

- Zero landfill (100 per cent recycling): all three plants in Japan

ISO 14001 certified: all three plants in Japa
MITI Best Plant Award: Ebina
Energy-saving Plant Award: Ebina (Solar power system; recycling center)

The following is our mission statement:

- Build an environment for the creation and effective utilization of knowledge
- Contribute to the advancement of the global community by continuously fostering mutual trust and enriching diverse cultures and
- Achieve growth and fulfillment in both professional and personal lives

As shown in Figure 11, the main priority is customer satisfaction. But, environmental consciousness is placed only one step after customer satisfaction; it is high on the company's list of values.

The shared values of the company are shown in Figure 11:

**Figure 11**. Shared values

# 6 CASE 6 : CANON'S ACTIVITIES ON THE ENVIRONMENT

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**Abstract**

We, Canon interpret environmental activities as improvement of resource efficiency. We therefore conserve resources and energy and eliminate hazardous substances in every business activity and lifecycle of products. This paper reports on the outline of the activities and the recent topics such as environmentally conscious products, environment information management system and Type III eco-declaration.

## 1. Introduction

Settlement of global environmental problems has become widely recognized as an indispensable matter for our future. In order to construct a world of sustainable society, not only changing the structure of society and lifestyle, but also technological innovation is indispensable, making the role of companies bigger and bigger. And the possibility is becoming high that competitive power would be gained through environmental activities. Environmental activities are no longer just for corporate ethics but have become basic requirements for business development. Companies are now required to provide business activities, products and services with high eco-efficiency.

## 2. Basic Concept

### 2-1. Corporate Philosophy "Kyosei"

Corporate philosophy of Canon is "Kyosei". A concise definition of this word would be "living and working together for common good" while a more detailed version would be " all people, regardless of race, region or culture, harmoniously living and working together for many years to come." One of the factors hindering the achievement of "Kyosei" is a series of global environmental problems. Canon is trying to establish good relations, not only with our customers and the communities but also with the environment and the natural world, and we would like to fulfill social responsibility through our activities.

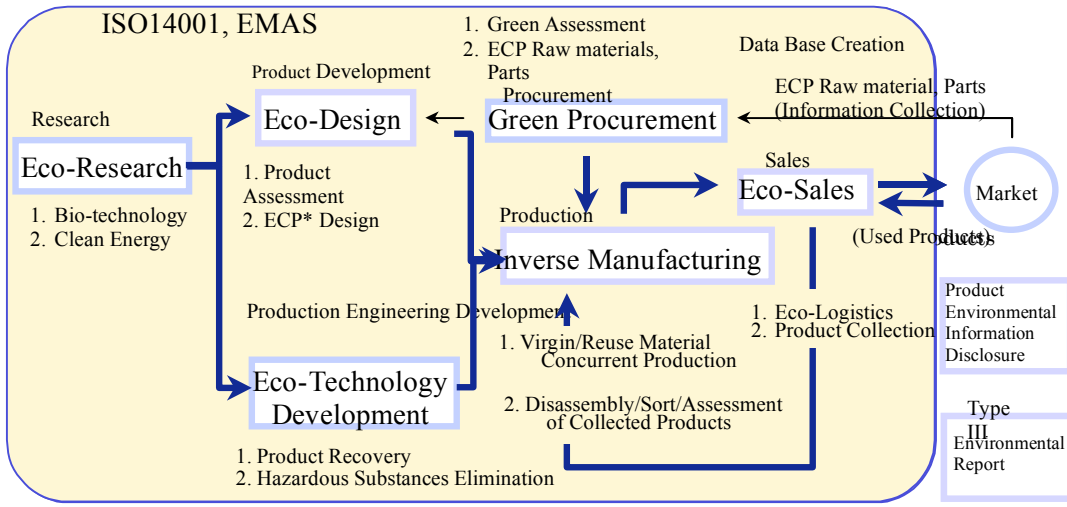
### 2-2. Environment Assurance Philosophy and Policy

Our environment assurance philosophy is "maximization of resource efficiency". This is to minimize the consumption of all resources and to promote their reuse and recycling while improving the quality of products and services, in other words, maximize efficiency in the use of resources. Maximization of resource efficiency is what Canon believes the way environmental activities should be carried out. Our environmental assurance policy is offering "Green Products". Canon's fruits of maximization of resource efficiency are provided through products to the society in the end. The key of green products is on innovative technical development. Another policy for our environmental activities is "EQCD Policy (see Figure 1). E (environment) is added at the head of QCD policy, the basic policy of companies

conventionally. E indicates that companies are not qualified to operate factories unless they can protect the environment of community nor manufacture products unless they are environmentally conscious. It also implies that all employees should think about E. This means that protection of environment is placed on the basis of all corporate activities and corporate management itself.

## 3. A System for Improvement of Resource Efficiency

Canon set conservation of energy and resources and the elimination of hazardous substances as basic measurements for improvement of resource efficiency. And we have been promoting these throughout its operating areas, from research and development, distribution, marketing and sales, and collection and recycling of used products. All activities are conducted in the environment management system with continuous improvement and its outcome is disclosed by environmental report and type III eco declaration (see Figure 2).




Note: ECP*: Environmentally Conscious Products

**Figure 2** System of Resource Efficiency Improvement

## 4. Main Activities

### 4-1. Production

Wastefulness in the production process not only results in higher environmental burden, it is the same as throwing profits away. We believe that eliminating

wastefulness thoroughly in the production process achieves reduction of environmental burden and creation of profits at the same time.

(1) Energy Conservation

Before: Production on Belt Conveyer

Now: Cell Production

Canon introduced the "Cell Production Method" from 1998 and has achieved remarkable result. By changing the production method from having workers line up and operate along a conveyor belt to having them work in "cells"(small units), a total of 380,000 m² of space and 16,000 m of conveyor belt was made redundant, 25 automatic warehousing facility abolished, and 80,000 m² of external warehousing space made unnecessary. This effect of environmental improvement resulted in the reduction of 8,000 tons of carbon dioxide, which is equal to 6.6% of Canon's total emission. Moreover, the number of units produced by each worker has increased. Reduction of work in process, approximately 28 billion yen in value was also achieved.

We have been actively pursuing measures to improve transport efficiency and reduce environmental burden too. Specifically, by joining forces with business partners and transport providers, Canon succeeded in improving the load efficiency of trucks and eliminating inefficient transport practices such as transporting small orders over long distances. Also, by grouping orders together to enable delivery to fewer sites and making tours to pick up parts for combined transport, Canon is deploying logistics that exerts smaller burden on the environment. In 2000, compared to the previous year, reduction of 572.1t-C of carbon dioxide, 1.7t of NOx and 0.7t of SOx was achieved.

(2) Greenhouse Gases

Greenhouse gases, namely PFCs, HFCs and $SF_6$, that became subjected to control at COP3, have extremely high global-warming coefficient, thousands to ten thousands of times more compared to that of $CO_2$. These three substances used to occupy approximately 40% of all greenhouse gases (including $CO_2$) at Canon in 1998. However by December 1999, all applications of PFCs in the production process except for manufacturing of semiconductors were eliminated. We are currently making progress in technology development of gases used in semiconductor manufacturing.

(3) Waste Management

Our basic policy of resource conservation is to practice the 3Rs - Reduce, Reuse and Recycle. To reduce waste, the process of business activities was reviewed to prevent generation of waste. Whatever waste generated is returned to the process for reuse. If not reusable within the company, it is recycled by a consigned agent. What cannot be recycled is properly disposed. Based on this policy, various efforts have been made, resulting in the following:

* 96% reduction of landfill waste in Japan. Also attained zero landfill waste disposal at 27 sites among 43 operational sites. As for the economic effects, sale of valuables and reduction of disposal costs due to recycling of landfill waste resulted in a profit of 340 million yen.
* 60 % reduction in the amount of export-use packaging materials of parts, compared to that of 1999, thanks to adoption of reusable materials/structure, unification of size and quality of materials.
* Introduction of a totally closed recycling system for reuse of water in newly established factories.

(4) Elimination of Hazardous Substances

Canon firstly listed 2,173 chemicals that are harmful to health and environment as substances that need to be managed. Then classified these substances into rankings of A, B, and C (eliminate, reduce and control discharge). According to the ranking, Canon took measures such as shift to a production that does not use hazardous substances, substitution by safe substances, installation of collection devices and development of technology that decomposes hazardous substances respectively.

(Result of elimination measures)
Designated CFCs (1992), 1.1.1.trichloroethane (1993), two-generation CFCs (1995), tetrachloroethylene(1997), trichloroethylene( 1997), and methylene chloride (2000)

4-2. Products

Refer Figure 3 in product development, Canon follows its "Two Principles and Eight Action Items for Product Environment standards" to reflect new social values prioritizing products' environmental consciousness. Manufacturers of products purchase parts and materials from those of

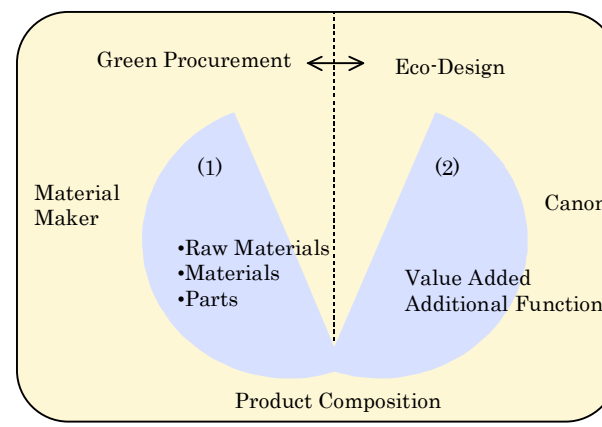



**Figure 3** Environmental Conscious Segment of Product

manufacturers and add functions to them and make products. We reduce environmental burden of function addition through the mechanism of eco-design, purchased parts and materials through green procurement. The figure 4 below shows an analysis in what parts of life cycle energy is used and carbon dioxide is discharged. More than half is occupied by the stage of use and it is the power consumption and consumables such as toners. They depend on the designing stage. The rest of energy is used while a product is made and most is used to manufacture parts and materials that are purchased. This means that the proportion Canon consumes, transports or disposes is quite small. In other words, most of energy consumption and $CO_2$ discharge are determined by the designing and procurement. Therefore we believe that it is important to build appropriate systems that meet environmental measures at the stages of design and procurement.

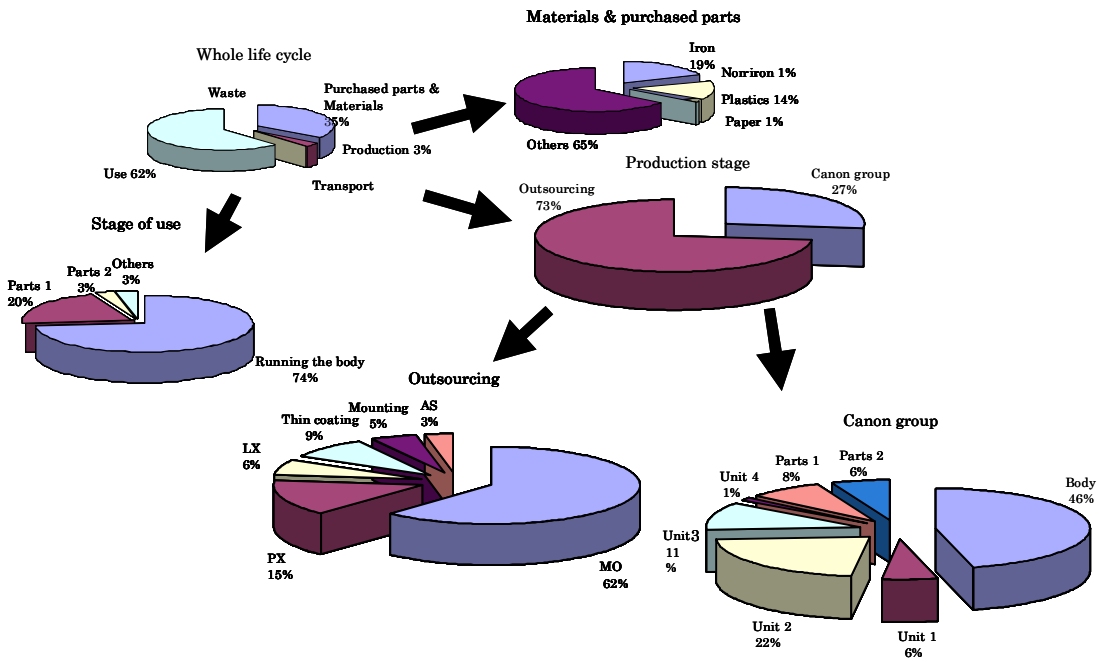



**Figure 4** Life Cycle Analysis of Copying Machines

(1) Eco-Design

Canon set "Product Environment Assessment Guideline" in December 1993 and has been using it for product development. The Guideline employs the LCA method to conduct detailed assessment of a product by dividing the process into three stages, namely, product planning, development and design, and the production of prototypes.
In Japan, systems for environmental consideration based on 3Rs (Reduce, Reuse and Recycle) were set. And Canon introduced a new Product Environment Assessment in April 2001, which was put into operation in July 2001. (See figure 5 on the next page).

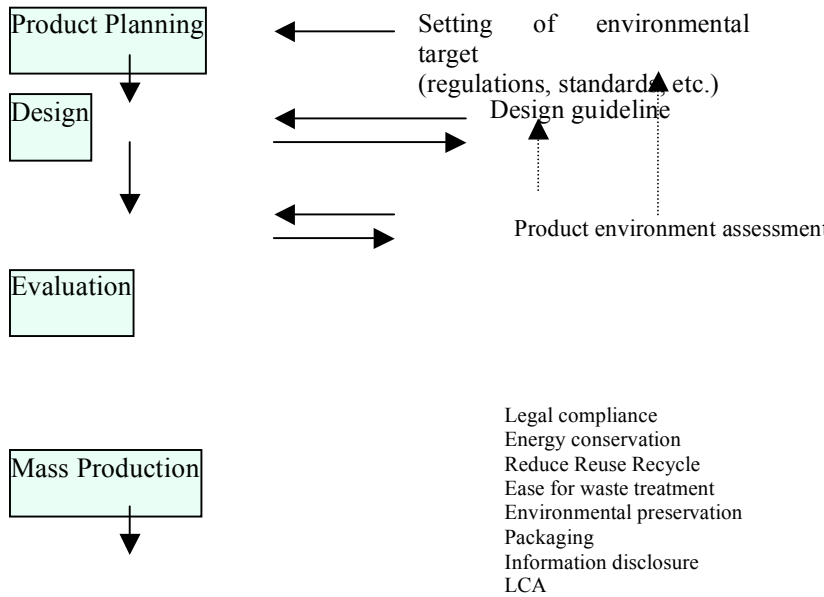
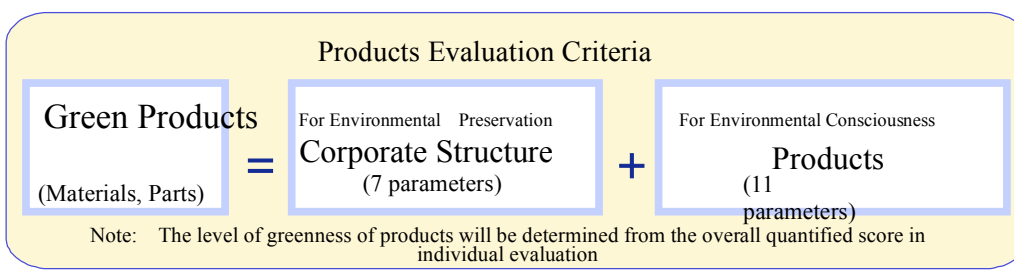



**Figure 5** Eco-design system

We also operate practical environmentally conscious design requirements as designing standards. For example, standardization of plastics to be used is provided in the assessment standards. And the designing standards provide the specific names of plastics for each product group in order to correspond to the assessment standards.

(2) Green Procurement

From 1997, with the idea that "procurement is a dialogue", Canon has carried out full-fledged green procurement activities in cooperation with suppliers aimed at conserving energy and resources and eliminating hazardous substances (items purchased in these activities include raw materials, parts and goods). In the selection of green products, we have set, based on the idea that " Green Products = Corporate Structure + Products Themselves", 7 corporate structure parameters and 11 product parameters to quantitatively determine the "greenness" of parts and products prior to procurement (see Figure 6).




Cooperate philosophy
Planning
Organizational
Structure
Systems
Evaluation
Information disclosure
Educational & training

Legal Compliance & voluntary regulations
Energy conservation
Resource conservation
Surrounding Environment
Chemical substance
Recycling
Waste
Packing materials
LCA
Eco-labeling
Information disclosure

**Figure 6** Green Procurement Standards

In 2000, a total of 784 suppliers were evaluated under corporate structure parameters and approximately 30,000 items of raw materials and parts under product parameters. Also, we hold environment seminars in major countries where we have business connections, to promote mutual understanding with our suppliers. Already, a total of 1,500 companies, 1,100 in Japan, 200 in North America and 200 in Southeast Asia, have joined in our efforts and support green procurement.

Currently an initiative is moving toward the standardization of companies' green procurement standards. The standardization aims at increasing the efficiency of survey and thus promoting the development of environmentally conscious products. This kind of activity indirectly improves both resource and eco-efficiency.

(Results of green procurement of parts and materials)

Introduction of non-brominated plastic flame-retardants (1989)& lead-free glass materials (1993), lead-free solders (2001), lead-free PVC, (2001) and chromate-free steel sheet (2001). We are also advancing toward unification of kinds of plastics from 1999, in order to expand recycling.

(3) On-demand Fixing Technology

For printers and copying machines that use toners, when fixing characters and images to paper, it is necessary to melt toner with heat. It was therefore difficult to cut power consumption. Canon focused on this fixing process and developed totally innovative on-demand fixing technology.

Typical roller fixing methods require that an entire metal roller be heated to a certain temperature for printing. This requires both energy and time. With the on-demand fixing method, only the part where the paper comes in contact with the fixing mechanism is heated up when necessary. This technology eliminates warm-up time and results in time and energy savings. The key parts for this technology are the ceramic heater that heats up instantly and the polyimide film that can tolerate rapid temperature changes. With over 150 patents, the technology can be called the jewel of Canon's environmental technology (see Figure 7).

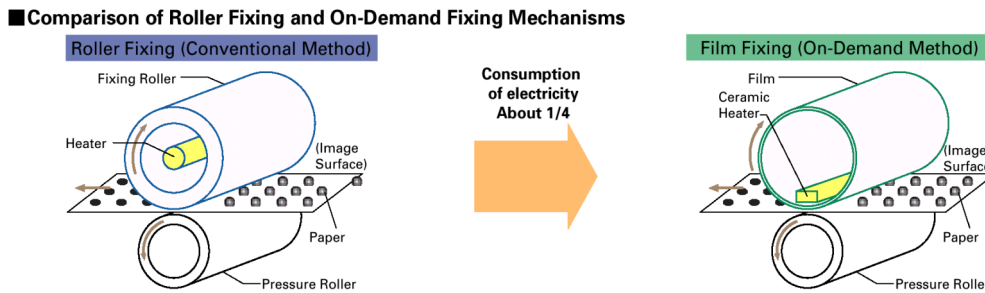



**Figure 7** Comparison of Roller Fixing and On-demand Fixing Mechanisms

Roller fixing uses radiated energy from the heater to warm up an aluminum roller that has a comparatively high heat capacity. Due to this, the heating process is slow and it takes time to reach the necessary temperature (200°C). Since the on-demand fixing

uses a ceramic heater to directly heat the small heat capacity polyimide film, the necessary temperature can be reached in a short time. This method consumes only one-fourth of the energy required by the roller fixing method. Both energy efficiency and convenience for use improved. The on –demand fixing technology has already been widely used in Canon LBP, copying machines, faxes, and digital multifunctional systems (see Figure 8).

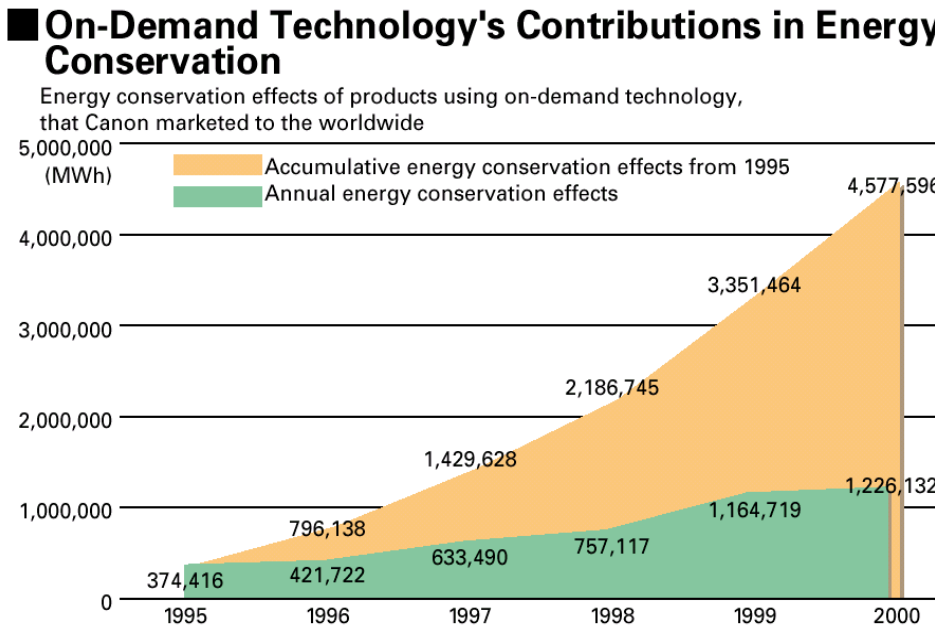



**Figure 8** On-Demand Technology's Contribution in Energy Conservation

(4) An example of environmentally conscious products in copying machines- iR 3300 series

The iR3300 series comes with a number of leading-edge technologies developed during Canon's relentless pursuit of more efficient use of energy, which entailed the reworking of existing technologies. Some of the technologies are presented below:


*Energy-saving technology (On-demand fixing technology)*
Canon's proprietary on-demand fixing technology has reduced power consumption to about one-fourth that of conventional methods. In Sleep Mode, power consumption is a mere 5W, while recovery from Sleep Mode takes just six seconds. Resulting energy conservation far exceeds the copying machine standard required by the International ENERGY STAR Program (132W in Sleep Mode and Recovery time from Sleep Mode of 30 seconds for copying machines of the iR3300 class).

*Resource conservation technology (Design for reuse and recycling)*
To ensure that Canon products won't burden people or the earth, the company practices product designing with reuse and recycling in mind, which entails incorporation of resource conservation technologies in all aspects of the product's lifecycle, from parts and raw materials to production processes, and to use and disposal of the product. Under Canon's recycling program, collected products are disassembled and only those components that have passed rigorous inspection are put back into the production process for reuse. Rejected parts undergo through material separation processes to be reused as resources.

*Clean technology (Elimination of hazardous substances)*
To eliminate the need of discharge control and treatment for lead, chrome and zone during manufacturing, use and disposal stages, Canon has adopted lead-free lenses, soldering and wiring. Also adopted are steel plates with coating that contains no chrome. Furthermore, the ozone-free electrical charging technology developed by the company has cut ozone generation to less than approximately 1/1,000 of the previous level (based on comparable in-house data).

(5) An example of environmentally conscious products in BJ printers
All BJ printers are environmentally consciously designed like the picture down below (see Figure 9). PWB with lead-free solders, chrome-free steel sheet and lead-free PVC were adopted in BJF 9000, which went on the market from October 2001.

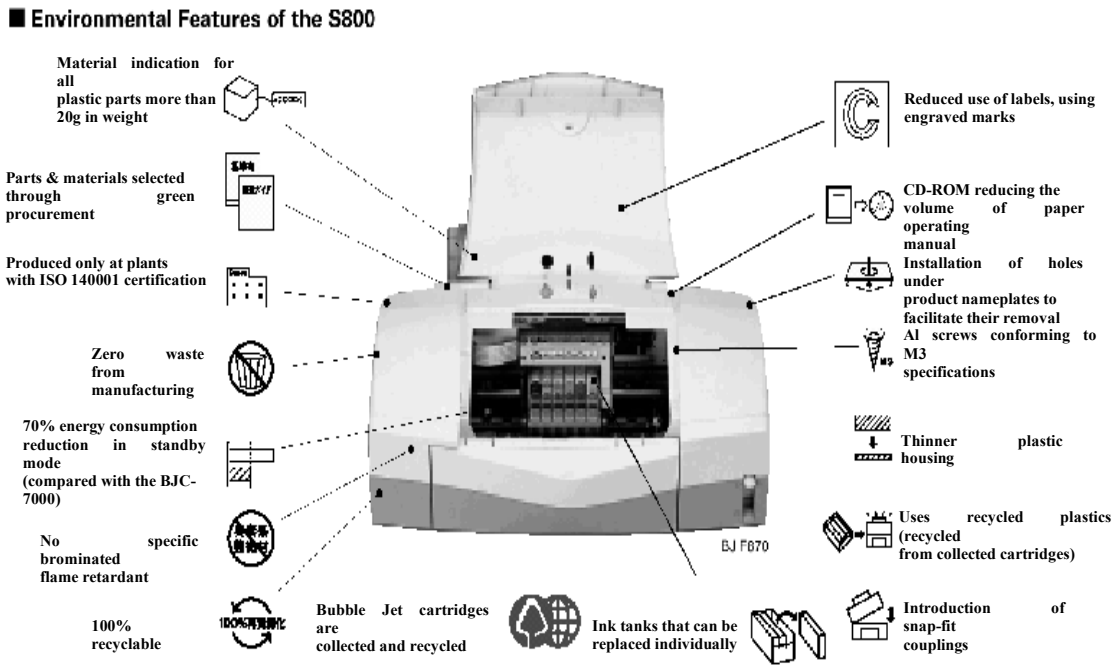



**Figure 9** Environmental Features of the S 800

4-3. Distribution

*We are currently trying to improve transport efficiency and reduction and recycling of packaging.*

(1) Transport Efficiency

Generally, in case of import, a container is usually returned to the port after the cargoes are unloaded at the warehouse. In case of export, an empty container is transported to the warehouse for loading before it is returned to the port. By utilizing the import container after loading for export use, transport of empty containers would be eliminated, thus unnecessary $CO_2$ emission can be avoided and transportation costs reduced at the same time. By systematizing the scheduling operations and shared information about container availability and schedules with companies outside the Canon Group, approximately 3,500 of 40-ft containers were realized last year. Also in intra-regional transport, we are constructing an information system for loading returning trucks.

(2) Packaging

In 1990, Canon started to take measures to reduce the use of expanded polystyrene, such as changing the design and replacing it by pulp molds and cardboard. As a result, by 1997, the amount of expanded polystyrene used was halved (1990 as the base year.). At the end of 1997, Canon introduced an expanded polystyrene closed recycling system within the Group. We recycle not only expanded polystyrene collected in-house, but also actively recycle expanded polystyrene from other sources (see Figure 10).

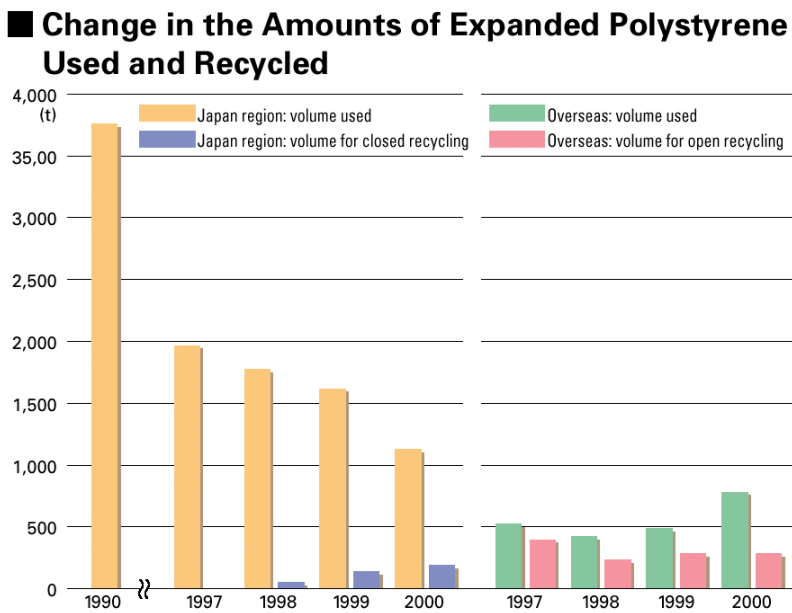



**Figure 10** Change in the amounts of expanded polystyrene used and recycled

We are expanding the use of recycled expanded polystyrene as shock-absorbing materials for all Canon products.

4-4. Recycling

Canon adopts a tri-region structure and sets up recycling bases in Asia, Americas and Europe to minimize burden on the environment (see Figure 11). Canon identified the following priorities for reusing and recycling materials to achieve the goal of zero landfill waste.

(1) Remanufacturing of products by replacing parts, Reusing of parts
(2) Material recycling: Recycled into raw materials
(3) Thermal recycling: Use materials as fuel

Utilizing the used products and consumables in this order can help cut cost on raw materials and realize value-added recycling, improving both environmental and onomic efficiency as a result.

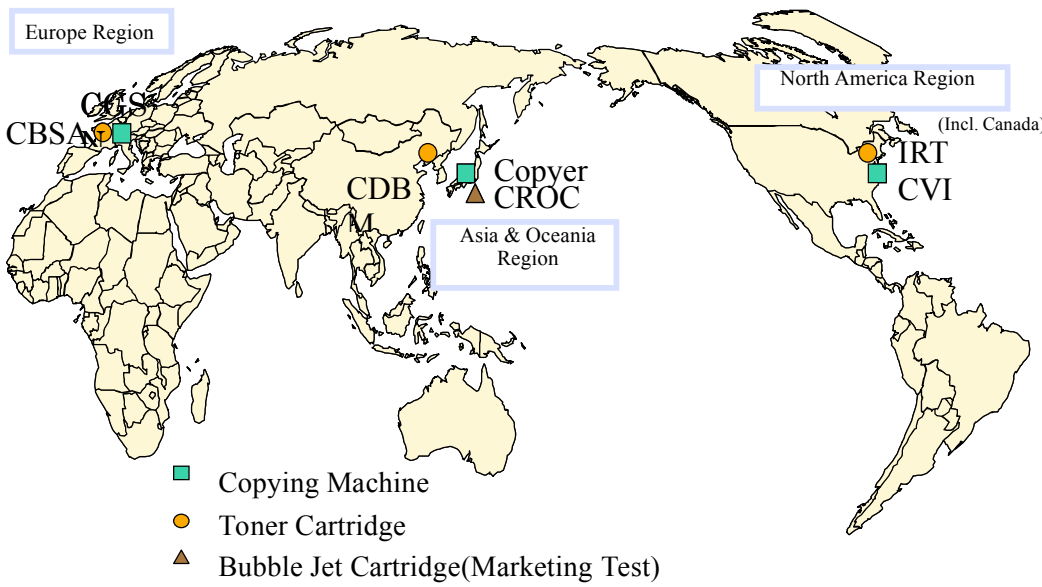
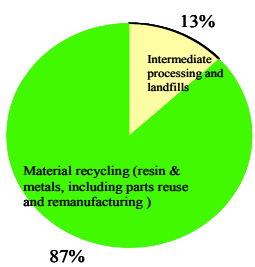


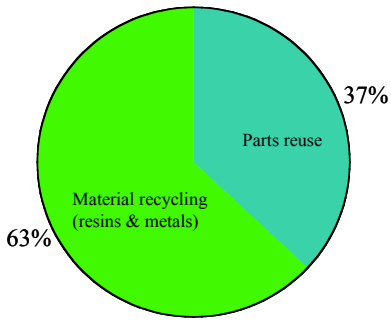

**Figure 11** Product recycling centers




(1) Copying Machines

Canon manufactures copying machines replacing worn parts in used copying machines with new ones, in the United States, Europe and in Japan. Recently, Canon is devoting its efforts to utilize parts recovered from copying machines for new products.

**Figure 12** Rate of Recycling in 2000 Worldwide




(2) Toner Cartridges (Figure 13)
Canon started the toner cartridges collection and recycling program in 1990. At the recycling centers, the toner cartridges are disassembled and sorted into parts for reuse and parts for recycling. Parts for euse are cleaned and subjected to stringent quality inspection before being reassembled into new toner cartridges. Parts for recycling are destined for material recycling, after considering the environmental burden that these parts produce in their product life cycles.

**Figure 13** Rate of Toner Cartridge Recycling in 2000: 100% at Canon Dalian

(3) Bubble Jet Cartridges and Ink Tanks
Canon started collection and recycling of BJ cartridges and ink tanks in Japan from 1996. Some resins from the ink tanks are reused through closed recycling as raw materials for making the body of BJ printers. Other resins and metals are reused from other purposes through material recycling. In sum, Canon has achieved 100% recycling.

(4) Sandwich Molding Technology (Figure 14)
As most materials are degraded during the recycling process of plastics, virgin material is usually mixed in before making them into pallets. Unfortunately, the heat necessary for this process further deteriorates the properties of recycled material. In addition, if the material is not thoroughly cleaned before recycling, black spots and other irregularities make the recycled material inappropriate for use as housing material for aesthetic reasons.

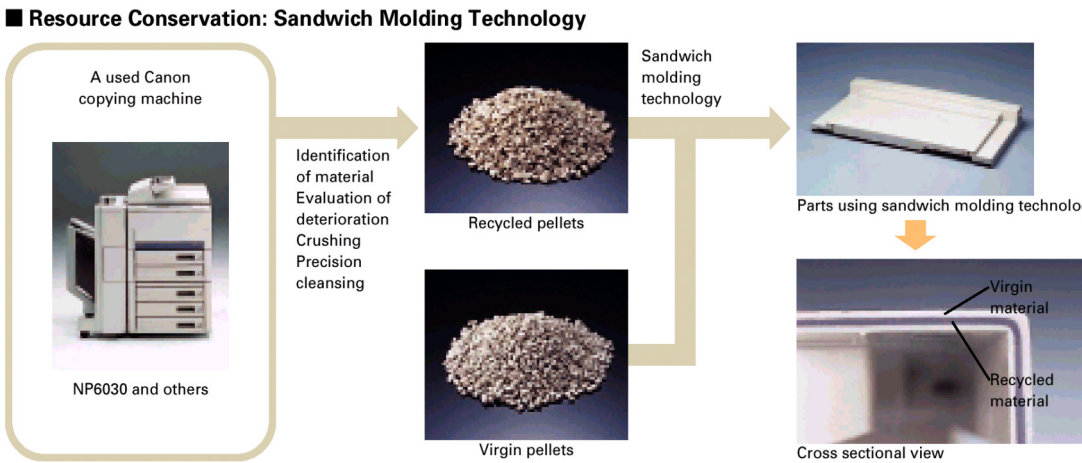



**Figure 14** Resource Conservation

Canon's sandwich molding technology uses recycled plastics between two layers of virgin plastics, creating the appearance of 100% virgin material.

Furthermore, this technology skips the pallet making process that requires heating, therefore preventing the material degradation and reducing overall costs.

(5) $CO_2$ Dry Cleaning Technology (Figure 15)

Until now, disassembling and cleaning product parts for reuse have presented difficulties. The $CO_2$ dry cleaning technology, which Canon developed in conjunction with equipment manufacturers, made it possible to clean parts by units as they are, after they are disassembled from collected products. Compared to manual cleaning, this method reduces cleaning time by 40% and cost by 20%, largely improving efficiency.

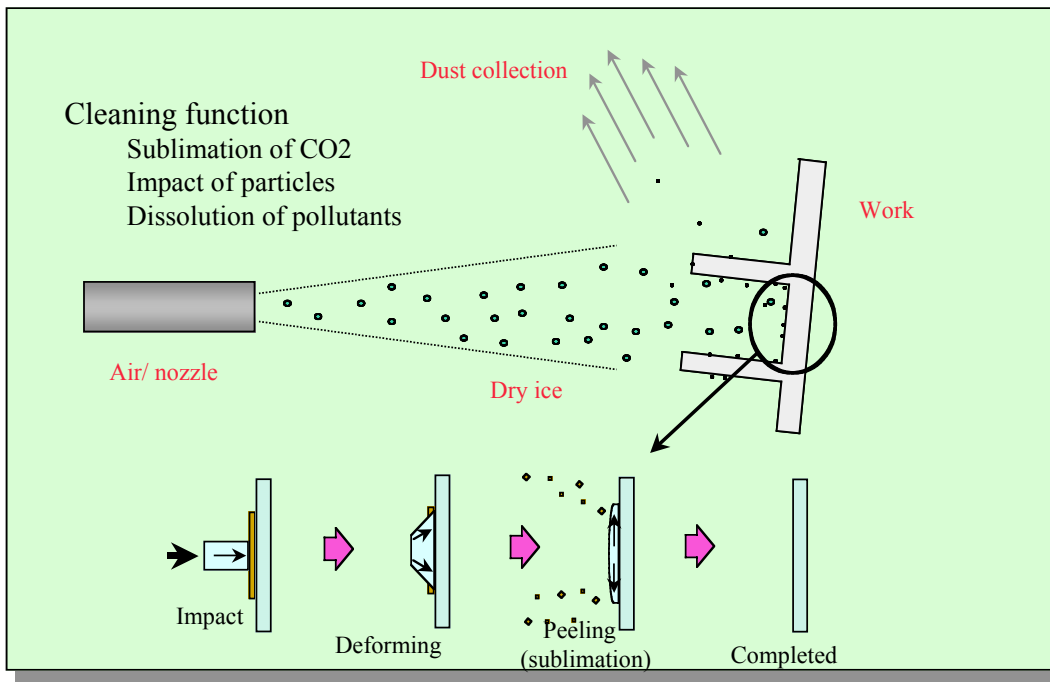



**Figure 15** Highlights of the $CO_2$ Dry Cleaning Technology

4-5. Information Disclosure (Figure 16)

At Canon, as a means of disclosing products' environmental information, we became the first in Japan to introduce Type III eco-declaration (JEMAI program by The Japan Environmental Management Association for Industry of Ministry of Economy, Trade and Industry), an international environmental labeling. The reason why Canon embarked on the introduction of this method is that we thought this method showed the eco-efficiency most appropriately, so that Canon's activities on resource efficiency would be reflected. Type III eco- declaration divides the lifecycle into four stages, "production", "distribution", "use& consumption" and "disposal & recycling". And the eco- declaration discloses input and output from the viewpoint of environment in numerical value. As of end of October 2001, data on 13 models of copying machines, 1 model of laser beam printers and 23 models of Bubble Jet printers are offered on our website.

**Product Environmental Information Data Sheet (PEIDS)**

| Product category | Electrostatic photocopier | Product model | Canon MEDIO iR3300 |
|---|---|---|---|
| Product units | 1 unit(s) | Product weight | 93 (kg) |

| | Function item | Quantity | Unit | Supplementary explanation |
|---|---|---|---|---|
| Main | Copy Speed | 33 | sheets/minute | A4, widthwise feed |
| Sub | two-sided copying | Yes | | |
| Sub | Automatic document feed | Yes | | |
| Sub | Maximum original size | A3 | | |

| Scope | Product | Body | Drum | Toner | Manual | Packing material | |
|---|---|---|---|---|---|---|---|

| Input/Output item \ Life cycle stage | | | Unit | Production | | Distribution | Use/ Consumption | Disposal/ Recycling | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Raw materials | Fabrication | | | | |
| Consumption impact | Energy | | MJ | 6.93E+03 | 7.91E+02 | 2.04E+01 | 8.03E+03 | -4.99E+03 | 1.08E+04 |
| | Energy resources | Coal | kg | 5.65E+01 | 5.95E+00 | 4.76E-05 | 3.51E+01 | -4.39E+01 | 5.36E+01 |
| | | Crude oil | kg | 6.39E+01 | 6.76E+00 | 4.44E-01 | 6.91E+01 | -3.95E+01 | 1.01E+02 |
| | | Natural gas | kg | 1.13E+01 | 3.14E+00 | 6.87E-03 | 1.73E+01 | -3.95E+00 | 2.78E+01 |
| | | Uranium ore | g | 1.31E+00 | 4.03E-01 | 3.22E-06 | 1.89E+00 | -1.91E-01 | 3.41E+00 |
| | Water resources | Surface water | kg | 1.53E+04 | 2.50E-04 | | 6.25E+03 | -6.52E+03 | 1.51E+04 |
| | | Groundwater | kg | | | | | | 0.00E+00 |
| | Material resources | Crude oil | kg | 2.88E+01 | | | 2.70E+01 | -3.56E+01 | 2.01E+01 |
| | | Iron ore | kg | 6.60E+01 | | | 6.11E+00 | -6.75E+01 | 4.52E+00 |
| | | Copper ore | kg | 1.47E+00 | | | 1.49E-02 | -2.26E-01 | 1.26E+00 |
| | | Bauxite | kg | 6.22E-01 | | | 2.05E+00 | -2.40E+00 | 2.69E-01 |
| | | Nickel ore | kg | 7.56E-03 | | | 4.71E-03 | -1.21E-02 | 1.84E-04 |
| | | Chromium ore | kg | 1.02E-02 | | | 6.38E-03 | -1.64E-02 | 2.50E-04 |
| | | Manganese ore | kg | 2.77E-01 | | | 2.63E-02 | -2.84E-01 | 1.89E-02 |
| | | $CaF_2$ | kg | 1.26E-01 | | | 1.17E-02 | -1.29E-01 | 8.63E-03 |
| | | Limestone | kg | 1.21E+01 | | | 9.93E-01 | -1.08E+01 | 2.28E+00 |
| | | Rock salt | kg | 1.69E+01 | | | 2.47E+00 | -1.47E+01 | 4.66E+00 |
| | | Silica sand | kg | 2.75E+00 | | | 7.35E-02 | -6.31E-01 | 2.20E+00 |
| | | Pulpwood | kg | 2.90E+01 | | | 4.39E+01 | -6.46E+01 | 8.28E+00 |
| Environmental emission impact | Into atmosphere | $CO_2$ | kg | 3.82E+02 | 4.68E+01 | 1.44E+00 | 3.50E+02 | -2.40E+02 | 5.40E+02 |
| | | SOx | g | 2.28E+02 | 3.53E+01 | 1.76E+00 | 2.70E+02 | -1.70E+02 | 3.64E+02 |
| | | NOx | g | 4.10E+02 | 2.88E+01 | 2.20E+01 | 3.81E+02 | -2.83E+02 | 5.60E+02 |
| | | $N_2O$ | g | 3.21E+01 | 1.07E+00 | 2.59E-02 | 3.12E+01 | -2.69E+01 | 3.75E+01 |
| | | $CH_4$ | g | 3.49E+00 | 1.08E+00 | 8.61E-06 | 5.01E+00 | -4.77E-01 | 9.10E+00 |
| | | CO | g | 5.21E+01 | 6.92E+00 | 8.78E+00 | 5.85E+01 | -4.14E+01 | 8.49E+01 |
| | | HFC | g | | | | | | 0.00E+00 |
| | | PFC | g | | | | | | 0.00E+00 |
| | Into water | COD | g | 3.57E+00 | | | 1.70E+00 | 5.41E-03 | 5.27E+00 |
| | | BOD | g | | | | | 2.23E-03 | 2.23E-03 |
| | | T-N | g | | | | | | 0.00E+00 |
| | | T-P | g | | | | | | 0.00E+00 |
| | Into soil | Total emission | kg | 1.93E+01 | 2.81E-04 | 2.26E-09 | 7.10E+00 | -2.15E+01 | 4.88E+00 |

**Figure 16** Type III eco-declaration

The biggest characteristic of this method is that it is based on LCA data. Not only this method makes it possible to compare products in the whole life cycle, but also to compare new products with the old and utilize it for the judgment of changeover. The Figure 17 shows the comparison of Canon products. This indicates that it would be better to switch to new products with technological innovation rather than continue to use old products or recycle them from the viewpoint of total energy/ $CO_2$.

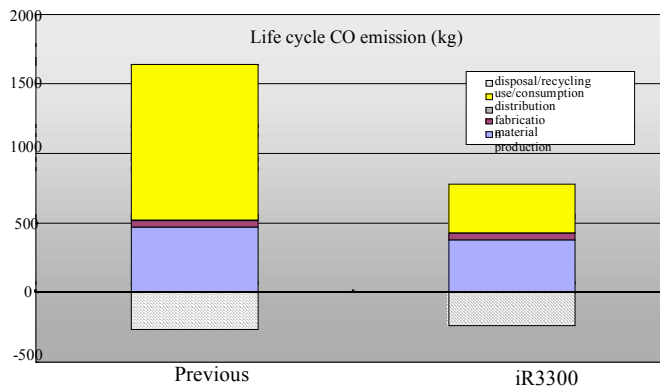



**Figure 17** Comparison using LCA

One of the problems with LCA, the basis of Type III declaration is that enormous labor is necessary for collection of data. Especially in case of a copying machine, its number of parts would be thousands. The Japanese method of Type III declaration firstly determines processes with big environmental burden (ex. toners, carriers and photo conductors) according to I/O analysis based on the LCA case examples in the past. And then just collect those necessary.

## 5. Environmental Information Management System

When we think of improvement of resource efficiency, we also need to make the activity itself more efficient. We are constructing a system that collects and manages environmental information using IT as one of the ways to improve efficiency. The figure 18 shows an ideal picture of future management system and, currently we are constructing a database of information of corporate activities in general, from product development through production, distribution and collection.

(1) Official Operation of Environmental Information Database System

This is a system that controls environmental information of outside such as legal regulations and social trend. The system was constructed to connect 26 countries in five regions, promoting environment activities around the world. Using the system, we can quickly collect and share environmental information.

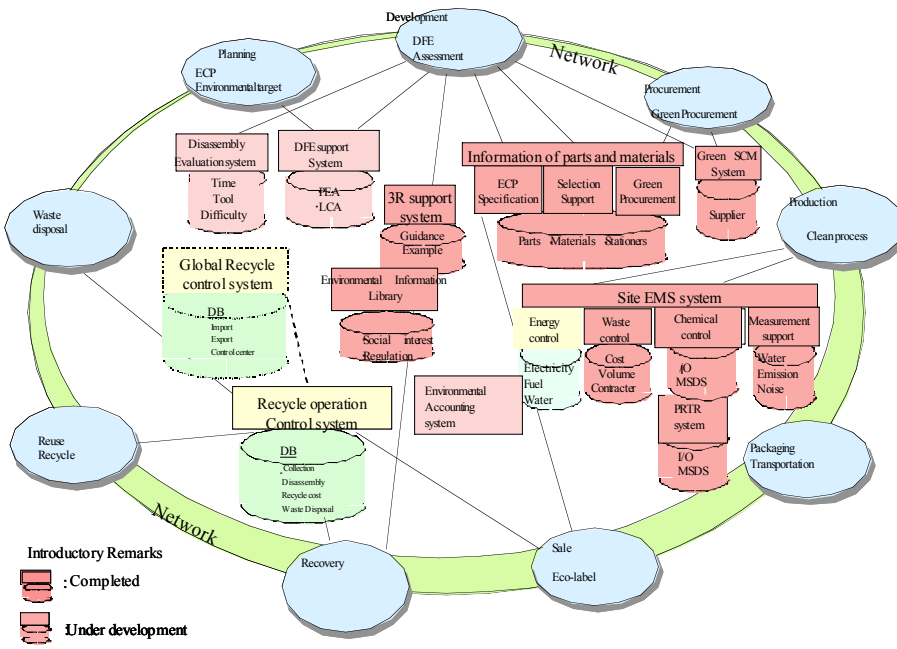



**Figure 18** Environmental Information Management System

(2) Waste Management System
This system manages performances of waste, costs, records, information of consigned agents and manifests.

(3) Chemical Management System
Canon uses as many as some 12,000 kinds of chemicals in its production. In 1997, Canon put into operation an online database system for information retrieval. The system has facilitated checking, at in-house computer terminals, Material Safety Data Sheets (MSDS), the current usage and emissions of a specific chemical, and the amount of chemicals stocked or consumed at individual operational sites. The database system has come to be widely used within Canon for daily management as well as provision of information on hazardous substances to development divisions.

(4) Environmental Analysis Support System
Measurement plans at all operational sites, data on wastewater, soil, air, odor, noise, and vibration, and response to any abnormality in measurements are controlled.

(5) Support for Selecting Parts& Materials/Green Procurement Management System
Environmental information of parts and materials obtained from suppliers is categorized by some parts and materials and filed. The information is utilized for selecting parts and materials by departments of development, design and procurement. As for information of chemical substances, the system has function that refers to legal regulations that apply.

(6) Product Environment Specification Management System
This is a database system that unifies environmental information of containing chemical substances and energy consumption of Canon products. It links with databases such as green procurement database and parts composition database and functions as described below:

- Search parts and materials that contain specific chemical substances
- Compile the amount of specified chemical substances contained in products and parts
- Search chemical substances covered by legal regulations
- Search products and parts that uses recycled materials and reused parts
- Search products that acquired eco-labels such as Blue Angel
- Reference to product assessment information

The system aims to speed up applications of eco-labels that are increasing rapidly for the past few years and promptly respond to customers' inquiries. It is also used for reference to information of existing products when conducting environmentally conscious designing in-house.

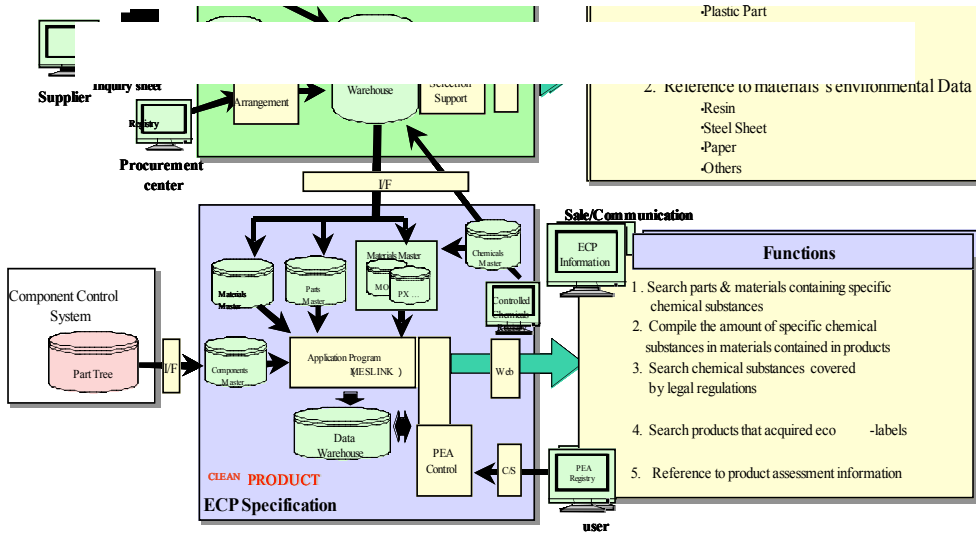



**Figure 19** Green Procurement & ECP Specification

(7) Others (Figure 19)

Construction of system that compiles evaluations of ease of disassembly and LCA-Type III eco-declaration based on CAD is planned to finish by the end of this year. Also, we will start off construction of database that unifies recycling information of worldwide along with the expansion of recycling of copying machines and printers.

## 6. Conclusion

Guided by the corporate philosophy of "Kyosei", we are continuing to completely eliminate wastefulness in every business activity, every life cycle of products, with an understanding that the essential theme of companies for the purpose of environmental protection is improving resource efficiency. The further challenge for Canon is to speed up environmental activities and to increase their efficiencies. We would like to invigorate the Group companies by actively introducing new concepts such as environmental performance assessment and environmental accounting. In addition, Canon plans to launch environment-related businesses to share with the society the various advanced technologies that the Canon Group has developed.

# 7 CASE 7 : ECO-CITY 21: CONCEPT, PRINCIPLES AND PRACTICES

***Takashi Kiuchi***
*Chairman*
*E-Squarec., Japan*

The subject of this chapter is E-Square's mission, principles, and actual business practices.

## MISSION

This new company was started in September 1 2001. Its mission is to be a leading player in the green economy: through business, to create a bridge to a future green sustainable society. The company motto is "Business For A Better Tomorrow".

## PRINCIPLES

We have four principles.

1. propose eco-life and eco-lifestyle
2. through providing eco-contents and eco-consultation, we support corporations, companies, and industries, toward creating a green economy. This entails doing research: gathering information, theories, academic data and so on. The purpose of such information is to provide meaningful consultations, whether to companies, corporations, industries, groups, the NPO, or NGOs, in building a green economy
3. creating eco e-commerce: a new business style so that economy and ecology—a sustainable economy—can co-exist
4. to establish green alliances among NGOs, NPOs, companies, and organisations in order to promote a green economy.

## BUSINESS PRACTICES

### B2B: Eco-City21

We have created Eco-City21 website on the internet (www.Eco-City21.com; an English version is in progress).

On Eco-City, we have four town pages:

1. For clothing: Fashion Town
2. For eating: Food Town
3. For living: Living Town
4. For information: Info Town

We also have a few centres like:

- the Green Purchase Scheme Centre so that we have access and a good connection with the Green Purchase Scheme
- Recycle Centre

Eco-tainment Centre: this is for those interested in ecology.traveler

The main thing is that through the four towns and centres, we let society know what kind of products, eco-products, and eco-services are available. People do not have the access or don't know how to get to know those eco-products, eco-services, or eco-friendly companies. Through Eco-City21, you can get to know all those things, including eco information. For example, some local governments are interested in ecology and need a continuous supply of statistics. Since they have to talk to their citizens, they have to have persuasive and good data and we are trying to supply that through Eco-City21.

We try to tie-up with all kinds of eco events and exhibitions. These are listed on Eco-City21 but at the same time, we would like to be part of those events. With some retail or even department stores or some chain stores we help them develop eco-products. We have quite an extensive network throughout Europe, North America, and Asia; we have the knowledge to help people create eco-products or eco-services.

Eco-marketing is one of the subjects that we try to do. We provide talks on how we can give our audience, our clients communications tools. Sometimes we help them create meaningful homepages. When people create homepages, sometimes they don't know how to express and present their eco-contents, the ecology side of the business, so we help them. Sometimes we help create novelty shops or products. Sometimes we monitor and do surveys for them. That's all Eco-City21 B2C business.

**B2B**

Recently, at the OECD 2001 Forum in Europe, the theme was 'Development of Products Towards Sustainable Economy'. Their initial question was "Are we sustainable or not?" and naturally our answer was "No, we are not sustainable." Then they discussed necessary changes. As far as we are concerned, the challenge to sustainability means business opportunities. That's what B2B means.

Another popular tool we give to our customers and corporations is a scenario of planning using the Shell model. This was developed by Shell Oil Company in the early 1970s: they took social, economic, political, technology and all those factors into consideration and custom-made the scenario for their customers, companies, and corporations. One of these scenarios was to expect that OPEC countries would use their political power to raise the price of petroleum-two years afterwards in 1973, this did happen in real life. So Shell Oil, with their scenario prepared, were able to adjust their corporate strategies to the new oil crisis within just 18 months or so. But other oil companies, according to case studies, took eight years to adjust their corporate strategies to these new prices. Our argument to the companies is this: environment is another factor when you think about the future of your own company.

What are the driving forces in our society? We must identify them in order to create our own foresight and vision. Companies need a compass to show them the direction but many are navigating without a compass. They don't know where they're heading. But if you take all these key factors and driving forces systematically

following the Shell model, you can produce a good business model for yourself. If you take all those ingredients into consideration you can be pretty persuasive. So that's what we do. We call it Scenario Planning using the Shell model and the environment is something new when you think about middle to long-range business plans.

**B2S**

This is a new terminology. We came up with this concept two months ago: it means Business to Society. We need business-to-society because I am a strong believer that society-the group of citizens-is the driving force to make change a reality. We have to work with society very closely to develop sensitivity to it is reacting, how it is moving, what is the new fashion, and so forth. Business-to-society is becoming very important to all of us.

Future 500 is exactly for that-business to society. Ten years ago when I was leading Mitsubishi Electronics' business in North America with seven production facilities, 4500 employees and so forth, I started receiving a lot of postcards and mail from grade school students. Mitsubishi Motors—the automobile wing—received the same thing. Altogether we received about 12,000 letters and so forth. I wanted to meet the people who are behind that campaign and movement; my business motto is "I have nothing to lose". At the same time, I formed a working group to decide who is right, who is wrong, what the corporation should and should not do. After three to four years, we started saying "we got to know so much, so let's share our technology, our expertise, our know-how". At that time, some guy said, "Until now, all of us are talking about Fortune 500. Fortune 500 is bragging about the size of the business, but from now on, bigger is not necessary better". We had the same idea as E. F. Schumacher in his book *Small is Beautiful*. If you care about the future generations, if you care about the health of the planet, then you change your behaviour, your business practices. So we said, let's identify those companies, those corporations, those groups and instead of Fortune 500, if we network with 500 companies who are interested in ecology and create Future 500, maybe we can do something meaningful.

At Rocky Mountain Institute, Emory Lawrence was my mentor and host. And at the opening table, with sixty-three people present, I started my remarks by saying this: "If you read the Old Testament of the Bible, the creation part talks how people got together and built this high tower. God was very embarrassing, got mad and destroyed that tower." Having been to the supposed location of this Tower of Babel, I can visualise it. God gave us hundreds of different languages so that human beings cannot cooperate. So I told that story but I said my message was even if we have a different language, even if we have a different culture, we must cooperate to preserve this planet. The 62 Americans liked that story and since then, we've been working pretty cohesively.

Anyway, so we do things and at the same time we have started an online eco magazine—*The Bridge* (www.thebridge21.net). At the same time we have www.future500.org. Since my return to Japan four years ago, we've been trying to establish Future 500 in Japan. The first symposium was on *Frontier of Industrial Ecology* to tell the Japanese audience how industrial ecology is working. Last year, the theme was *Learning from Nature*. My theme was nature could be our teacher and mentor. So I wrote this book titled *New Advocacy of Learning*. If we observe what nature does, we can learn so much. The third symposium in Tokyo was on *Building A Green Economy*. One of the themes was on new indicators to measure our living

standards, level of happiness, or our affluence. I am personally very much against the GDP yardstick. 'P' represents *products* and products cannot measure my living standard, quality of education, the safety level, or level of security. We must come up with new indicators; one is a yardstick developed by this think tank in California-Redefining Progress (www.redefiningprogress.org). One of the issues we discussed at our third symposium was to introduce this new yardstick. The media entirely focuses on raising the GDP as though such a rise would be good for us and our material concerns will go away. To me, it never happens. Next year's theme will be *Consumption for a Better Future*.

Since this is a business-to-society group, we organise once-a-month a little gathering. For example, recently the leader of Seacology Organisation, Paul Cox, spoke at the gathering. This is the type of activity we provide to our members: a sort of interactive dialogue among participants and speakers. We would like to create a square, which means a place, so that opinion leaders can come and they know where to go so that they can share their ideas. And it's a two-way street: if we can give speakers a chance to mingle and interactively exchange ideas, they appreciate that.

## CONCLUSION

We strongly believe that the householder, the family, is a basic unit in any national strategy. It constitutes more than 90 per cent of public consciousness to buy products that are durable, repairable, and recyclable. We must work with the public. We must work with citizens. We believe that's the only way we can move toward a green economy.

# 8 CASE 8 : THE DEVELOPMENT OF ENVIRONMENTALLY-CONSIDERATE PRODUCTS

***Koji Yamaguchi***
*Vice President, Environmental Affairs*
*NEC Corporation, Japan*

NEC is a manufacturing company of IT products, providing IT-related information devices and social services. Since last year, NEC has three in-house companies: NEC Network, NEC Solution, and NEC Electro-devices. We design, manufacture, and sell IT devices and software device services as well as electronic component works and semiconductors. We have global networks with developing, manufacturing and sales locations and a total of 247 companies in the world-140 all in Japan and 107 overseas, with 56 companies in 11 Southeast Asian countries.

These three companies-Network, Solutions and Electro-Devices-are working on products development that can reduce environmental impacts, such as reducing power consumption to prevent global warming, reducing the use of chemical substances, and enhancing recycling.

This chapter describes such environmental activities, particularly with reference to environmentally sound products. The discussion is organized around the following topics:

- recent environmental trends
- the development of eco-products
- green procurement
- evaluating with LCA
- environmental technology
  - development of new materials and processes
- disclosure of environmental information

## RECENT ENVIRONMENTAL TRENDS

Environmental trends can be divided into two parts: before 2000 and at present. The nature of environmental activities has changed drastically since the 1992 Earth Summit in Brazil. The driving force behind environment programs in the 1990s was improving the prevention of pollution, like the air and water programs. Now, environmental activities that target sustainable development are desired to strengthen management, products, and services, in response to current pollution programs and having being asked to come up with specific plans for improving corporate values and image. At present, environmental activities are required; i.e. an environmental response group must be built into corporate management. We call this the Environmental Management Systems based on ISO14001.

Future society must be a recycling-based one, that improves resource utilisation and efficiency. The rule of business in the recycling-based society is not only for conventional manufacturing process but also requires the life-cycle approach from

products development, the customer use, and right up to the reuse of products and resource recycling product.

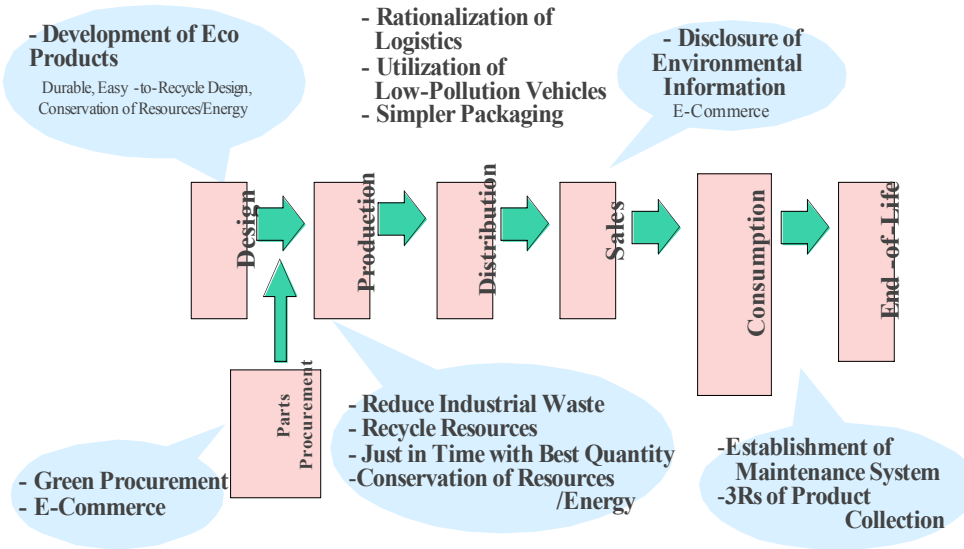



**Figure 1** The company's role in building a sustainable society

Environment activities are now conducted in all business units. Figure 1 shows a life cycle flowchart for environmental protection. So this has also grown into the responsibility of the manufacturer, which we call EPR (Expanded Producer Responsibility). We carry out environmental assessment at the design stage and green procurement at the parts procurement stage. These stages are especially vital in making eco-products.


**Figure 2** Deployment of measures for the development of eco products in all business areas

Figure 2 introduces the measures we have taken for promoting eco-product development. During the design stage, we focus on environmental design assessment. Life-cycle assessments for evaluating the impact of global warming as well as collecting data on chemical substances in green procurement are essential tools for managing

value assessment. We establish assessment items and standards to be implemented and that are useful in obtaining good environmental performances. At the manufacturing stage (production), we need to achieve energy and resource savings as well as recycle 100 per cent of waste, so we call these the Zero Emission activities. The major activities for being environmentally sound when we sell products are such things as transport efficiency, simplification of packaging, as well as removing plastic from use. So now we are trying to change materials from plastic to paper, especially in packing. At the sales stage, we support recycling by our customers; it is essential that we join together with consumers to recycle the products.

## DEVELOPMENT OF ECO PRODUCTS

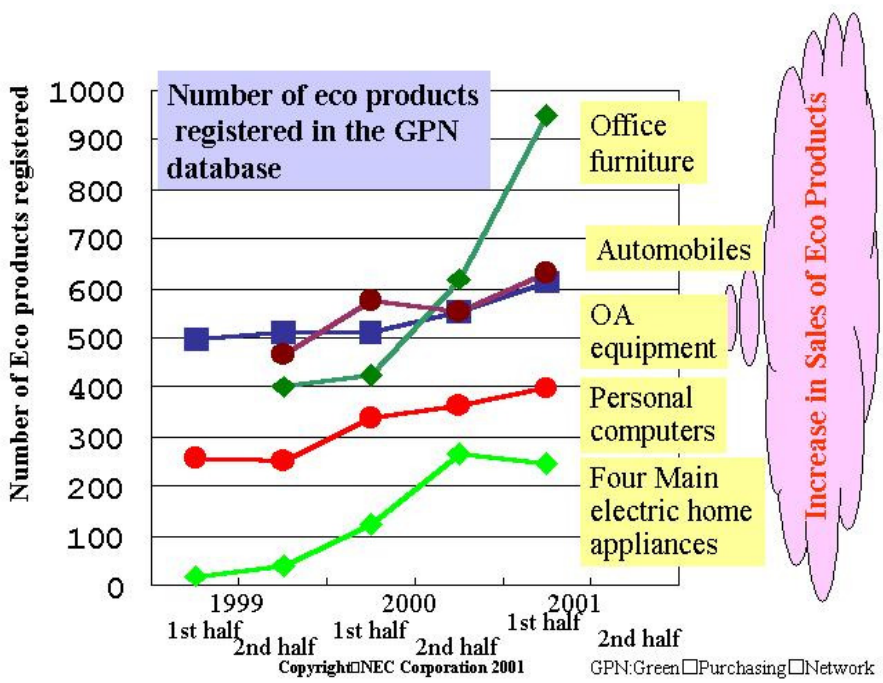



**Figure 3** The development of eco products promoted by companies in Japan

Figure 3 shows the situation of eco-products development in Japan. This data was gathered from one of the green procurement networks related to green purchasing in Japan. These green purchasing networks is an NPO started about five years ago to promote green purchasing; it consists of businessmen, municipalities, and consumer groups. The graph shows the number of registered products considered as eco-products and charts increases in the number of products over the past two years.

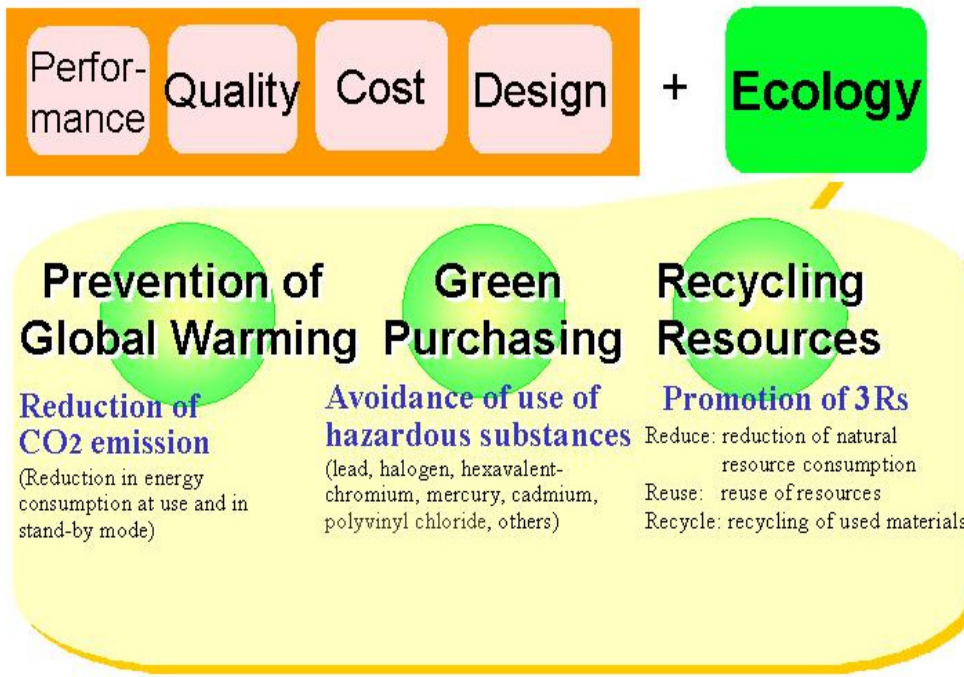



**Figure 4** NEC's concept of eco products

In order to promote the development of eco-products in NEC, an important step is to change the product engineer's awareness and before that, during the design stage, to main performance in terms of quality, cost, and design, with environmental concerns being integral to the process (see Figure 4). Most of the engineers' or employees' consciousness of environmental issues is very limited. That is why we have to show the engineers the concept of eco-products. Three major items are emphasized:

1. prevention of global warming
2. green purchasing or green procurement
3. recycling resources and save the resource

For designing eco-products (see Figure 5), it is necessary to prepare some of the tools, for example the assessment tool, material development to ensure that purchases from external vendors are selected for environmental qualities, information disclosure to inform consumers, and the recycling system.

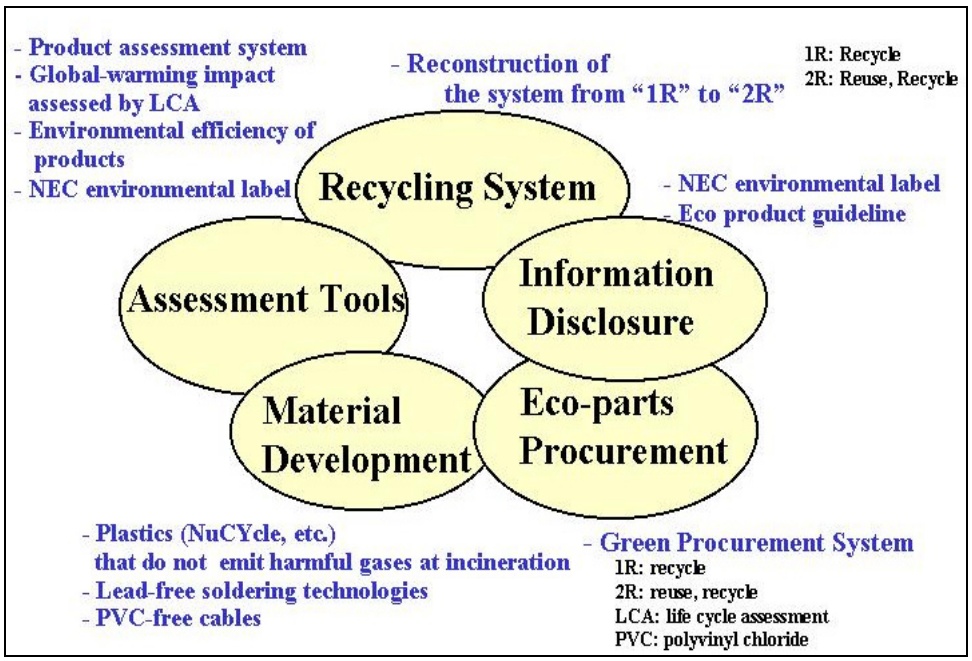



**Figure 5** Mechanisms of eco product development

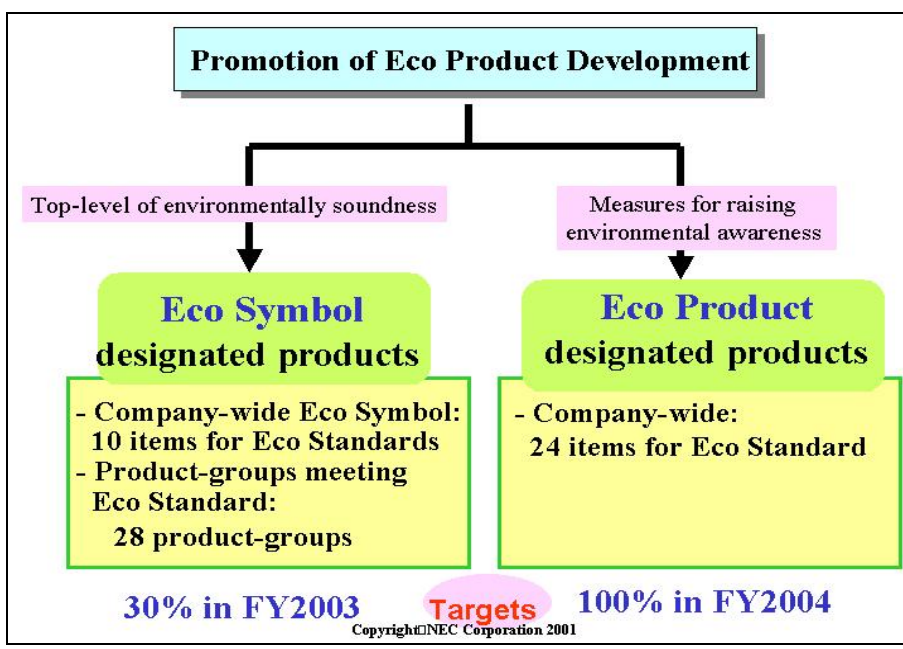



**Figure 6** Promotion of eco product development

We have classified that there are two types of eco-products, as shown in Figure 6: the *eco symbol product* (top level of environmentally sound products) and, slightly more advanced than current products, the *eco-products*. To develop these top-level eco-products, we have developed an *eco-level system* (the eco-symbols system set for ten standards for the entire company). We have set a target for eco-symbol applicable products for the entire company at 30 per cent by the end of FY 2003 (see Figure 7).

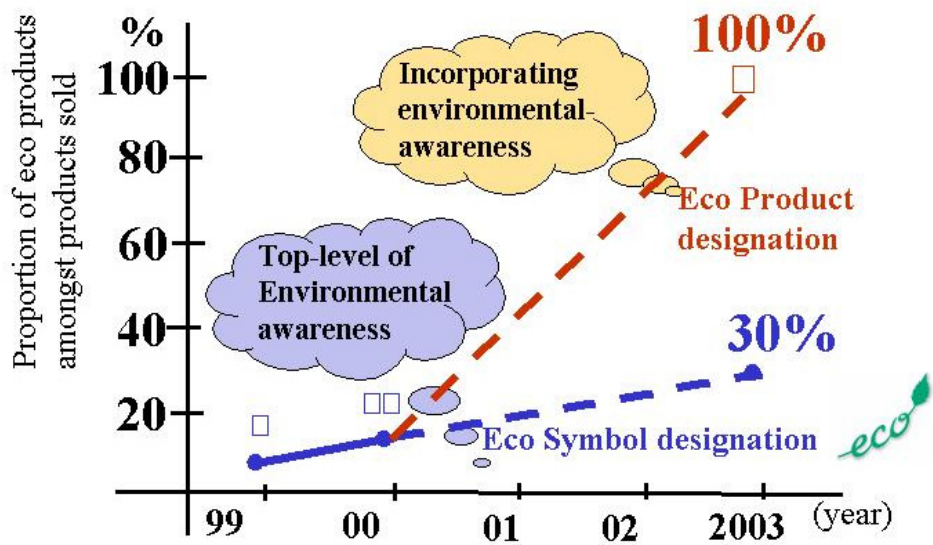



**Figure 7** Product Development Strategy: To increase the proportion of eco products

Using the new eco-symbol system, in 1999 seven products were registered as eco-symbol products but in 2003 we have a target that 30 per cent of our products comprise top-level environmentally sound products.

The above was the outline for NEC's own original labeling system started in February 1998, which declared that our products are ISO14020. We follow our eco-product and eco-symbol system which meets the criteria for ISO14021. Our goal is to make the environment a priority for our products to show our customers that our products are environmentally sound. So through our own environmental labeling system, conducted under very strong and strictly applicable conditions, we primarily cover such areas as hazardous chemical substances that have been disposed of life-cycle assessment; banning use of ozone structure materials; green procurement implementation; introduction of ISO14001; protection of forests; and so on. Some of our actual products are shown in Figures 8 and 9.


**Figure 8** Products with the Eco symbol

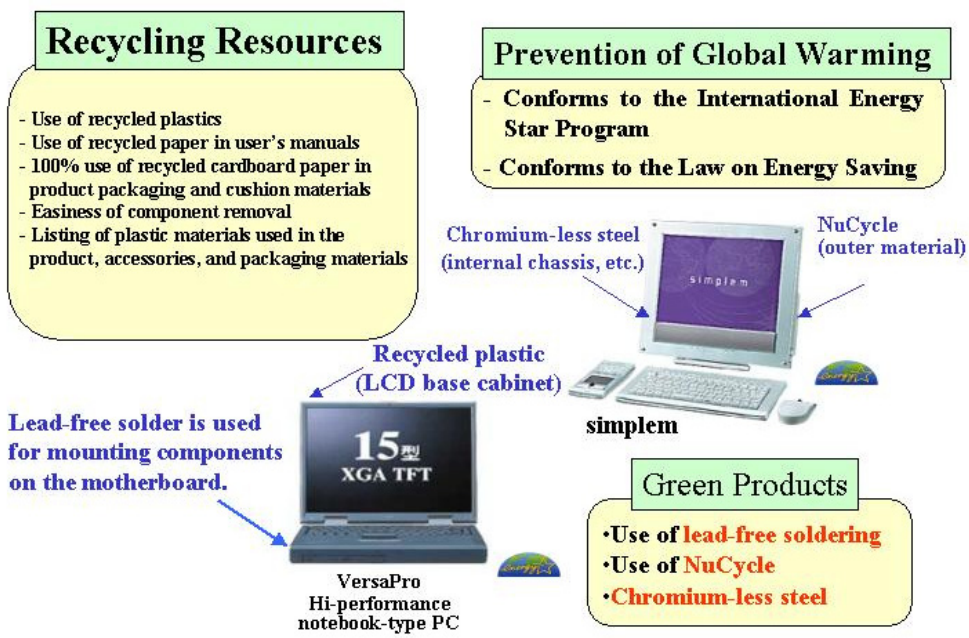



**Figure 9** Examples of Eco PCs

**GREEN PROCUREMENT**

From now, when we buy parts or units from outside vendors, we have to add the word *environment* to the design concept. Environmentally sound product procurement is vital for sustainable product development. This is called the green procurement. The primary reason for green procurement of parts is to reduce harmful substances, which helps to prevent global warming and raise the utilization efficiency of resources and so on. But most important point is how to minimize the harmful chemical substances that come with the parts purchased from outside vendors (see Figure 10).

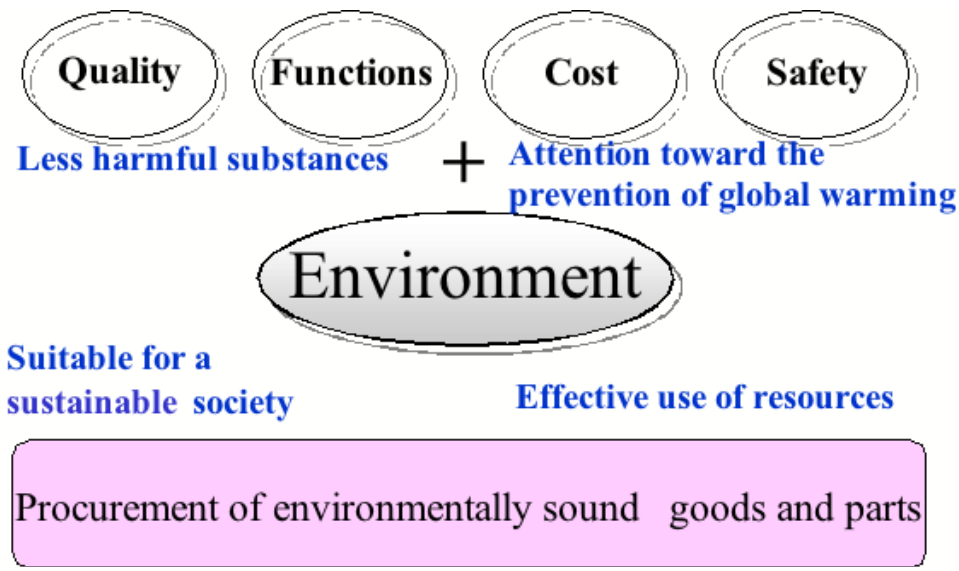



**Figure 10** What is green procurement?

This is why we have introduced the concept of green procurement. There are four objectives:

- To promote the development of eco products: innovation in environmental goods / services
- To verify the risk and business attitude of a business partner's environmental activities: vendor selection
- To meet the customer's needs (governmental agencies, corporate customers, general consumers): need for a new sales strategy
- To contribute to the expansion of the market for eco products: build a sustainable society

Figure 11 shows the information we need to procure green products; when we proceed with procurement, we average the three items of goods, company, and manufacturing process; we collect the necessary data.

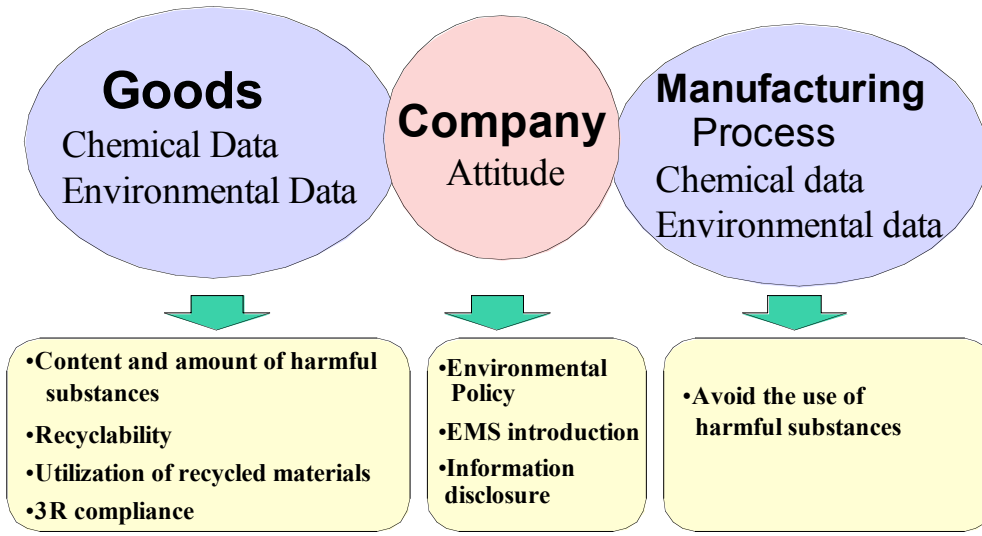



**Figure 11** Information necessary for green procurement

Management items and standards for chemical substances are categorized as follows:

- prohibitive (if parts contain any of the five substances listed under this category, we do not buy them irrespective of the quality, cost, or performance of the part)
- avoided and controlled substances
- banned substances

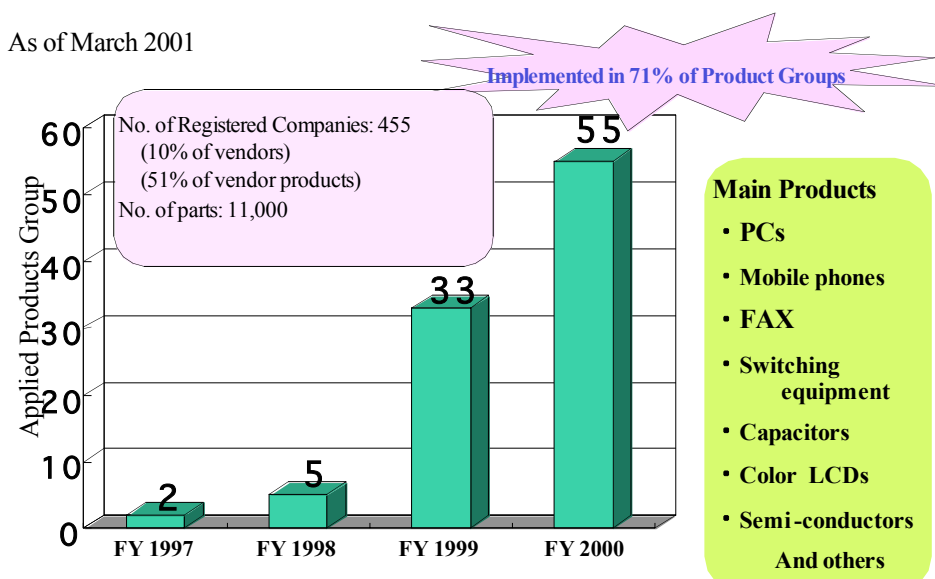



**Figure 12** Current implementation of green procurement

Figure 12 shows the state of our green procurement from June 1997. It shows an upward curve. The green procurement system has been introduced to 71 per cent of our products at the moment. We will also apply this system to overseas suppliers in the future.

## EVALUATING WITH LCA

The expected effects of evaluating with LCA are:

- ability to quantitatively understand the effects of global warming clarification of points that need to be focused on
- ability to quantitatively evaluate the results of design changes
- incentive to design energy-saving products
- additional expectation of results in production cost reduction
- ability to demonstrate product strength

Almost 90 per cent of our products are evaluated using LCA. Figure 13 shows the LCA analysis results of the main NEC products.

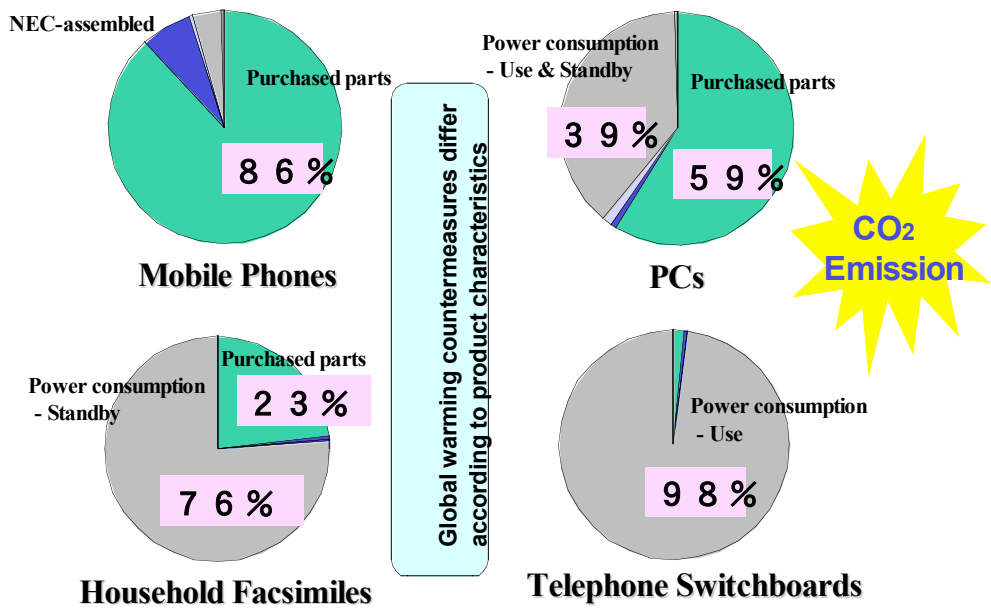



**Figure 13** LCA analysis results of the main NEC products

From the LCA we are able to recognize that the situation varies by product. After we introduced the LCA, we can understand what intervention point in the manufacturing process is most efficient for addressing global warming.

## ENVIRONMENTAL TECHNOLOGY: DEVELOPMENT OF NEW MATERIALS

One of the keys to eco-product development is to develop new materials, such as new plastics that produce no poison gas when incinerated. The following are

examples of such new materials being developed at NEC. Figure 14 shows an example: development of retardant plastics for personal computers to prevent dioxin problems. Figure 15 shows a new material, the NuCycle-used for film transparency-made of silicon. Figure 16 shows the target area of lead-free soldering, an example of lead-free technologies which we expect to fully develop in a few years.

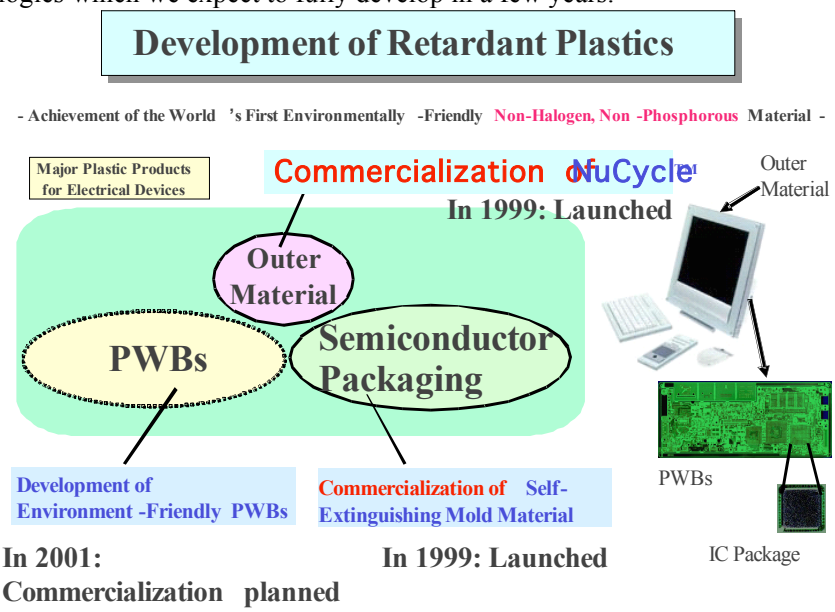



**Figure 14** Development of retardant plastics for personal computers

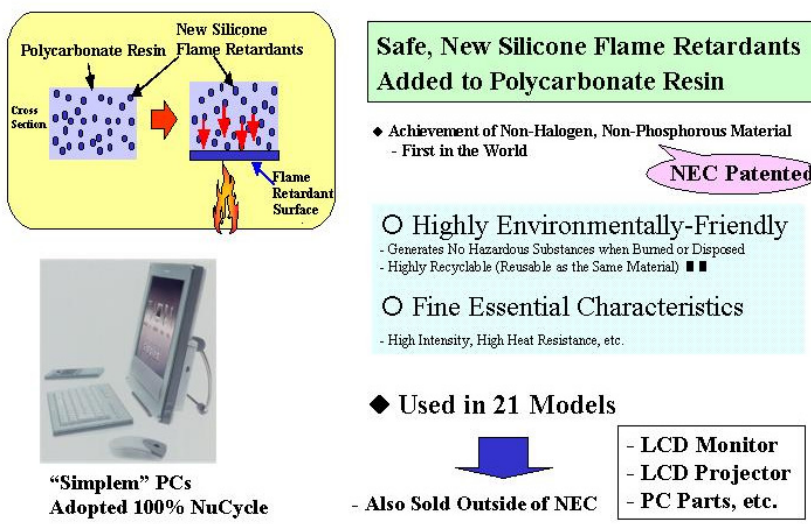



**Figure 15** Development of new material, "NuCycle"

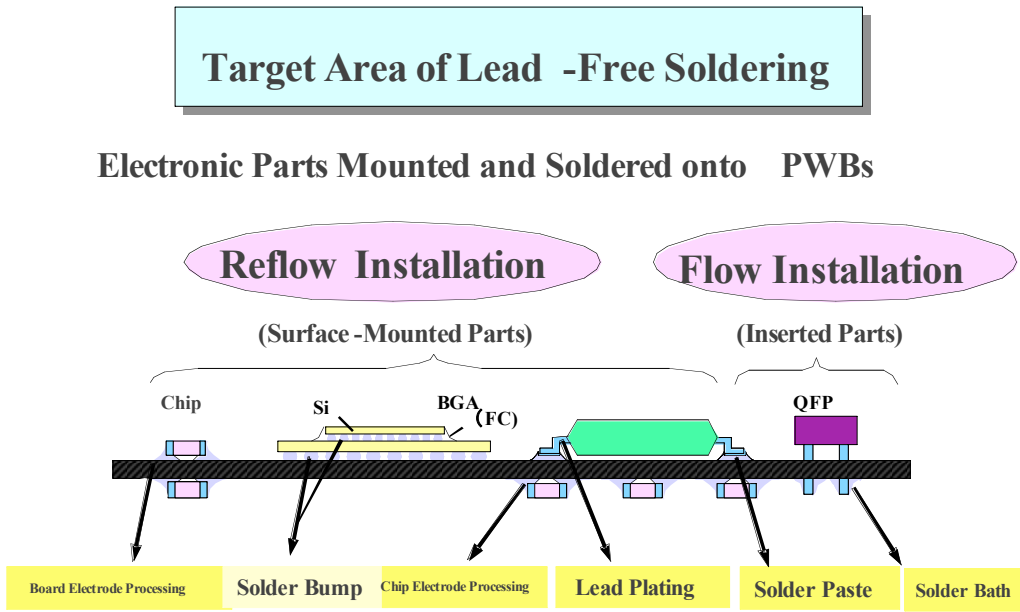



**Figure 16** Target area of lead-free soldering

**DISCLOSURE OF ENVIRONMENTAL INFORMATION**

To encourage eco-products development, it is necessary to give information or disclose the information to customers. Disclosure of environmental information is indispensable for widespread use of products. We have a number of information disclosure media like our homepage, pamphlets, or so on (see www.nec.jp). We also advertise in the newspaper.

# 9 CASE 9 : ENVIRONMENTAL ACTIVITIES, CONCENTRATING ON GREEN PURCHASING AT OVERSEAS AFFILIATES

***Nobuo Hashizume***
*Director*
*Seiko Epson Corporation, Japan*

This chapter's discussion is organized around the following topics:

- Company Outline
- Environmental Protection Activities at Seiko Epson
- Green Purchasing Activities:
    - Green Purchasing Activities for production Materials
    - green purchasing Activities for general Supplies
    - issues and Future Trends

## COMPANY OUTLINE

| | |
|---|---|
| Company Name: | Seiko Epson Corporation |
| President: | Saburo Kusama |
| Head Office: | Suwa, Nagano, Japan |
| Capitalization: | 12,531 million yen |
| Date established: | May 1942 |
| Employees: | 69,000 (consolidated global) |
| Affiliated companies: | 92 |

*Epson is a progressive company, trusted throughout the world because of our commitment to customer satisfaction, environmental conservation, individuality, and teamwork. We are confident of our collective skills and meet challenges with innovative and creative solutions*

## ENVIRONMENTAL CONSERVATION ACTIVITIES AT SEIKO EPSON

Environmental Management

Our corporate culture has always stressed the importance of environmentally sound business practices. In 1993 Seiko Epson won worldwide acclaim for successfully eliminating the use of CFCs and other designated ozone-depleting substances from all of its manufacturing processes. The success of this effort gave both top management and employees a boost in confidence, and launched a series of progressive efforts to address global environmental concerns. The Seiko Epson group is carrying out a variety of environmental programs under the following publicly declared environmental philosophy (see Figure 1). This philosophy was influenced by the spirit of Seiko Epson's management philosophy which urges us to be an open, progressive company, trusted throughout the world because of our commitment to environmental conservation.

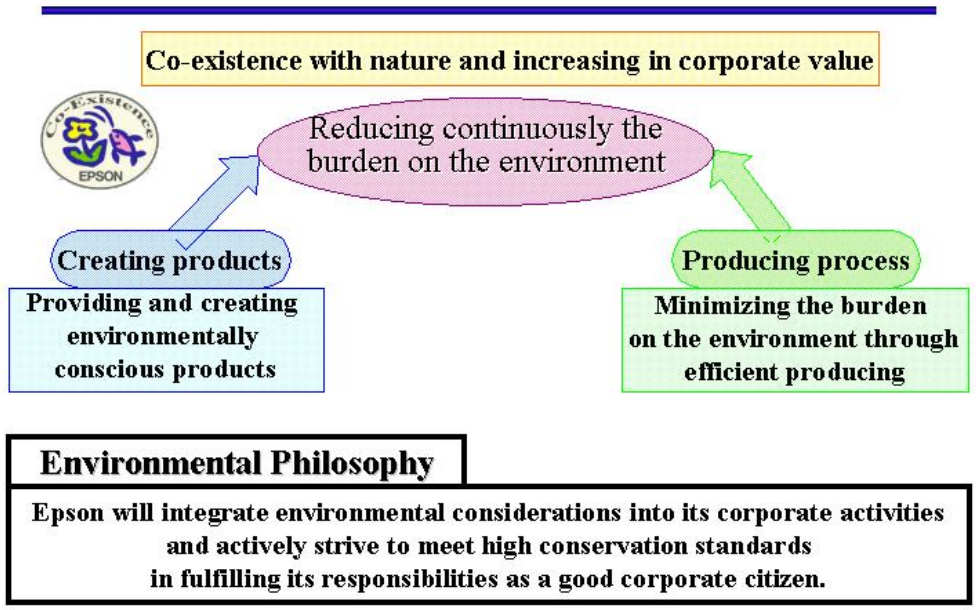



**Figure 1** Environmental management

Major activities

The following activities will be pursued by the entire Epson Group in keeping with the Environmental Philosophy:

1. Creating and providing Earth-friendly products
2. Transforming all processes to reduce the burden on the environment
3. Recovering and recycling used products
4. Sharing environmental information and contributing to regional and international conservation efforts
5. Continually improving the environmental management system

We established a general environmental policy in 1998 based on the above. The framework of our environmental management system is illustrated in Figure 2. We established and deployed our business and management plans based on the management philosophy. At the same time, we established parallel environmental programs based on our general environmental policy, which is part of our mid-range group-wide strategy. When we implemented the environmental plan, we turned the PDCA cycle to effect continuous improvement. This is promoted through an organizational structure as diagrammed in Figure 3. Our organization for implementing these programs is headed by a vice-president, who serves as Senior Director of Environmental Activities. The Environmental Committee, which is made up of the heads of divisions and group companies, establishes the overall direction of activities. The Environmental Affairs General Managers, who report directly to the division heads, form a committee and

assist in running the Environmental Committee. These people also serve to effectively implement decisions in their respective division or organizations. Also, the experts who make up the Environmental Affairs Meeting manage the various Expert Committees and other implementation groups, examine the implementation of overall activities, exchange information with the various promotion groups, and so forth. We have also established an Environmental Management and Auditing Committee. The seven expert committees conduct key environmental programs that transverse the group. One of the expert committees is the green purchasing committee. Groups tasked with implementing activities have been established in every R&D, manufacturing, and sales organization in Seiko Epson, as well as in the co-op and labor union.

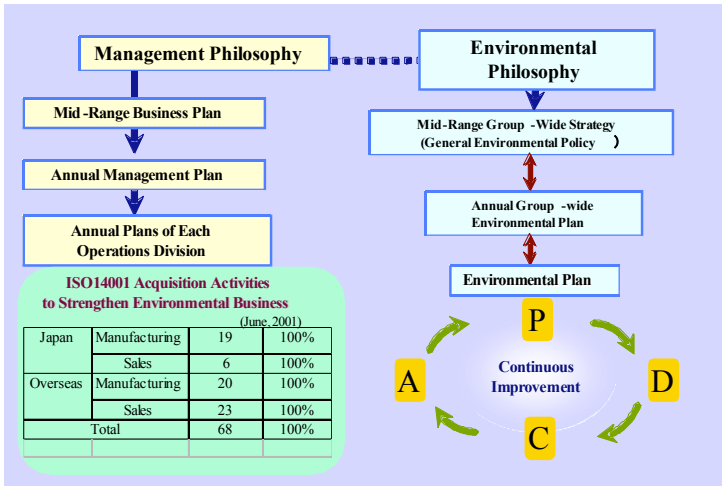



**Figure 2** Environmental management system

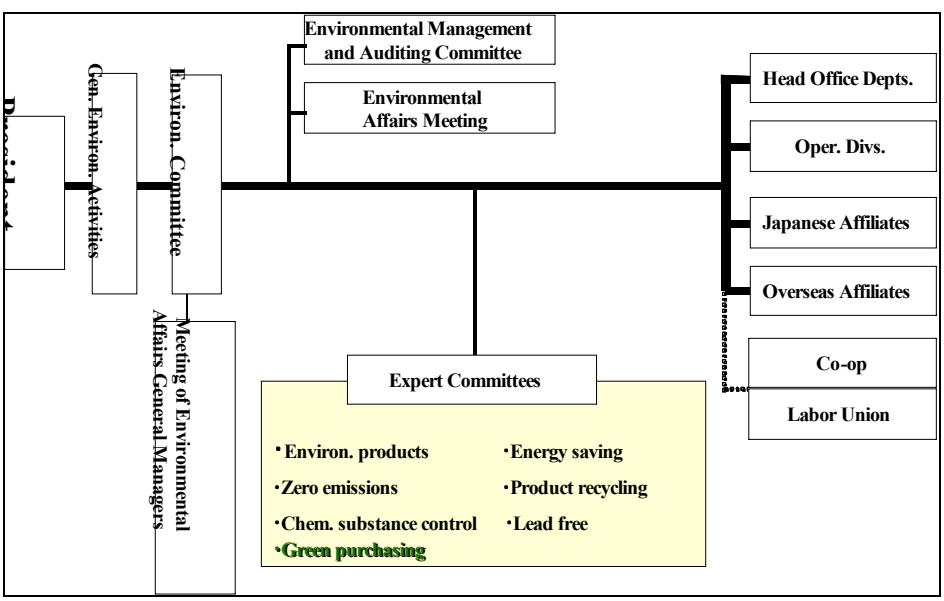



**Figure 3** Promotion organization

One of Seiko Epson's management goals is to develop environmental programs that will help establish what the Japanese government calls a recycling-based society. We strive through whole company involvement to be an eco-conscious company that addresses environmental issues and hits its environmental targets. We have raised a company-wide effort to minimize the burden we place on the environment. To realize our environmental goals, we have identified specific themes and implemented programs based on a general environmental policy. The framework of our programs is based on products, manufacturing, and an ISO 14001 EMS system that guarantees continuous improvement and manages environmental risks. I will speak specifically about green purchasing a little later, but as indicated by Figure 4 chart, Seiko Epson places major emphasis on developing eco-conscious products.

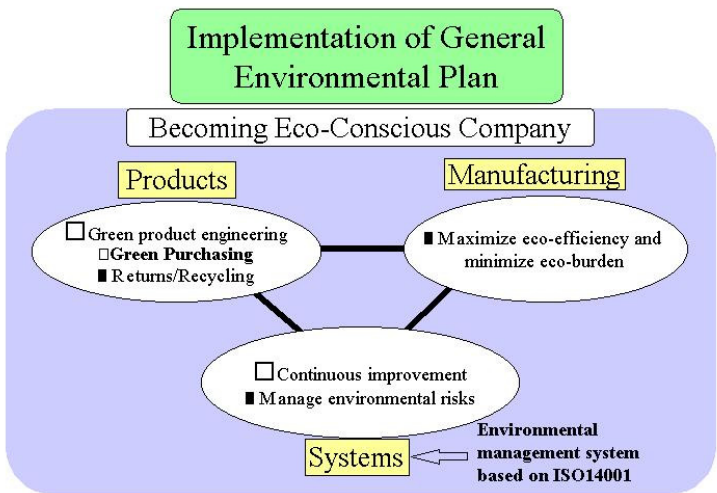



**Figure 4** Overview of environmental activities

Creating and providing environmentally conscious products is one of our top objectives over the mid term. These are the three main action items to achieve that.

- We intend to reduce the environmental burden of each product throughout its life cycle
  - Make 50 per cent of products qualify for Epson Ecology Label by FY2003 (aim for energy, resource saving, elimination of harmful substances)
  - Eliminate banned substances
  - Eliminate lead-containing solder by fiscal 2001
  - Promote environmental design through LCA
- Publicly disclose product environmental information
- We have pledged to work toward achieving a 100 per cent green purchasing rate by the 2003 fiscal year.

Figure 5 schematically represents how we are striving to create environmentally conscious products. At the core of our activities is the idea that we want to reduce the environmental burden of a product throughout its life cycle by

implementing green purchasing and a variety of other activities that save energy, save resources, and eliminate harmful substances.

The timeline in Figure 6 shows the types of environmental programs we have implemented over the years. Twelve years ago, in 1988, we launched a program to eliminate ozone-depleting substances from our operations. We call this Environmental Benchmark Year One. Several years later we initiated programs to address global environmental problems, eliminate chlorine-based solvents, acquire ISO14001 certification, and so on. We made 1998, which marked the end of the first decade since we initiated environmental programs, Environmental Benchmark Year 2. We revised our Environmental Philosophy, reaffirmed our commitment, and made a fresh start to aim for the next level. 1998 was also the year we formed a purchasing committee and launched a full-scale green purchasing program. This year we were honored by the Green Purchasing Network with the Fourth Green Purchasing Award.

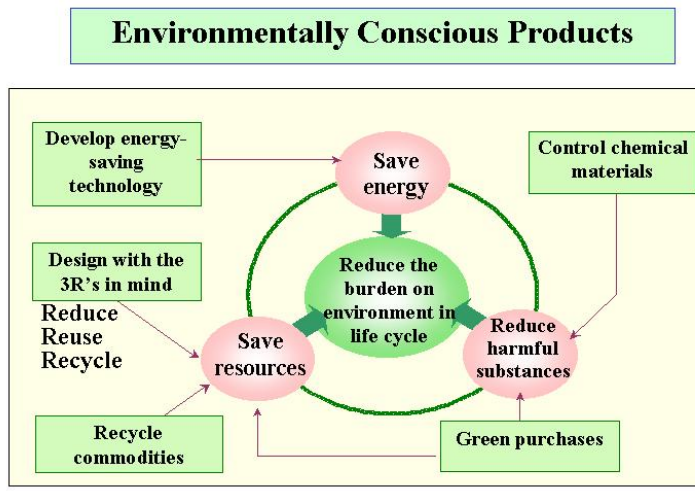



**Figure 5** Environmentally sound products

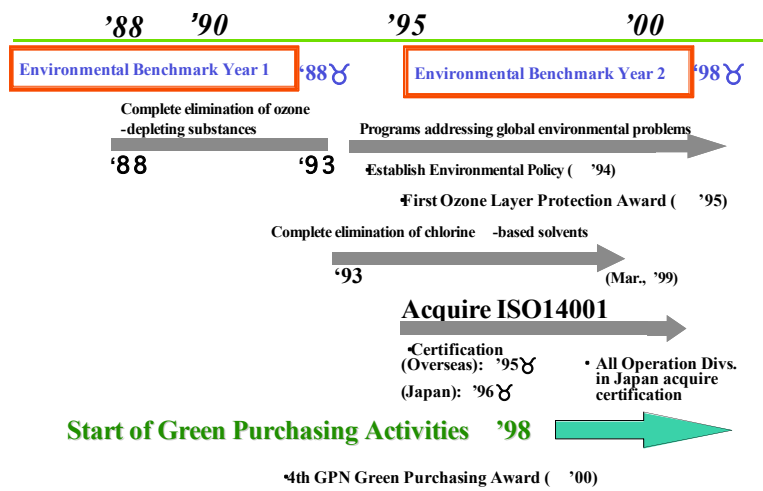



**Figure 6** Environmental program milestones

## GREEN PURCHASING PROGRAMS

Seiko Epson is first and foremost a manufacturer. As a manufacturer, we consider bringing environmentally conscious products to market to be an important mission. To achieve this, we have introduced green purchasing programs that make the purchase of parts and materials having a low environmental burden a priority. The basic concepts are outlined in Figure 7.

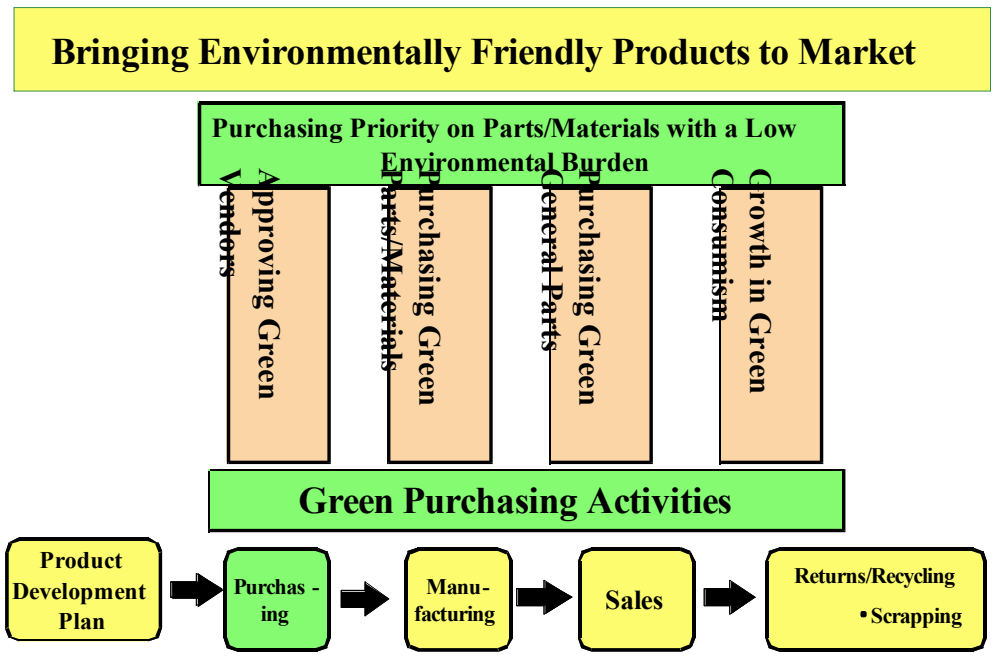



**Figure 7** Basic concepts for green purchasing programs

This made it necessary to assess the environmental systems and performance of the vendors who sell us parts and materials. In addition to purchasing green direct materials, we consider purchasing of green indirect materials to be essential, as well. Indirect materials include office supplies, factory supplies, and all other general items used when manufacturing environmentally conscious products.

Seiko Epson's green purchasing activities revolve around these four basic principles: approval of green vendors, purchase of green parts and materials, purchase of green general parts, and growth of green consumerism. The product life cycle starts with product development planning and ends with product recovery, recycling and scrapping. In Figure 7 purchasing appears to come after the product development plan is complete. In reality, however, the decision as to whether to use green parts and materials has already been made at the planning and design stage. Seen another way, therefore, the data obtained from green purchasing activities can be used by design engineers to contribute to the manufacture of environmentally conscious products.

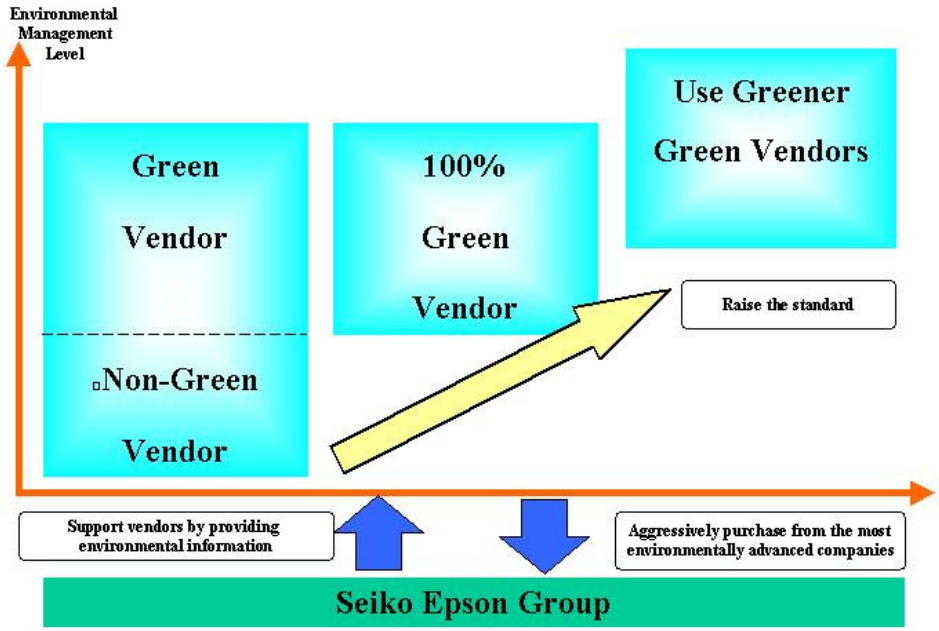



**Figure 8** Targets for green purchasing

Figure 8 shows the Seiko Epson group's target for green purchasing activities. Green purchasing rules apply to all purchases, but the environmental management level of vendors varies quite a bit from country to country, as well as from vendor to vendor within the same country. The standard is not high, but our first objective is to achieve a 100 per cent green vendor rate. Once they are all green, we can raise the standard. Toward that end, we are supporting vendors by providing them with information on our environmental activities. This will enable us to procure green parts and materials from environmentally advanced companies.

We have two general categories of items that are subject to green purchasing rules. They are *production materials* and *general supplies*. Since our objective is to deliver environmentally conscious products to our customers, all parts and materials included in a product are subject to green purchasing rules.

We are rolling out our activities in steps to ensure the best results. First the operations divisions are making success stories and accumulating know-how. These are then rolled out horizontally across the organization, to our domestic Japanese affiliates and to our overseas companies.

Green purchasing program for production materials

There are three keys to conducting these activities. The first is that there be a single, universal program for purchasing green materials. Seiko Epson has deployed its green purchasing programs at 29 sites around the globe, including its nine operations divisions and five related companies in Japan, and its 15 overseas affiliates. Since our programs are designed to enable us to produce the same environmentally conscious product regardless of location, every plant and company within the Seiko Epson group

conducts an identical survey of vendors and products. The second key is that purchasing departments across the group work together and share information when evaluating a vendor's environmental management and products anywhere in the world. The third key is that, if we find that a part or material is not green, we will work with the vendor to take corrective action to make that product green.

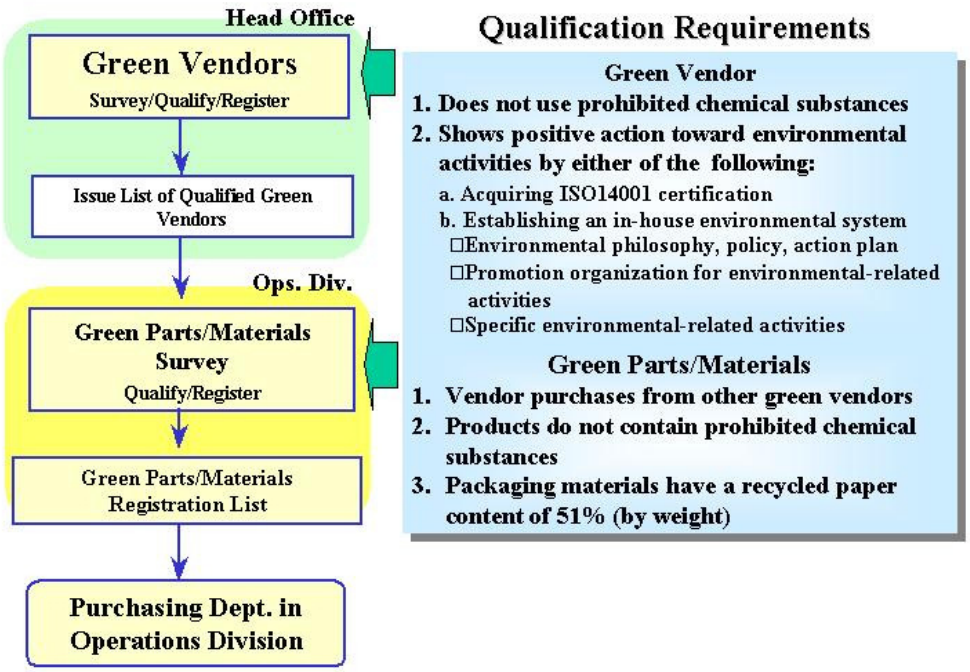



**Figure 9** Flow of green purchasing

First, the head office evaluates all of our vendors on the basis of a green vendor survey (see Figure 9). Qualified vendors are registered on a green vendor qualification list. This list is provided to all purchasing departments in Seiko Epson. Next, the various purchasing departments in the operations divisions use a survey to evaluate the parts and materials supplied by qualified green vendors. Qualified parts and materials are included on a green parts and materials registration list. The list is sent to all relevant departments within the division. Parts are purchased from among the items on this list. Some operations divisions have begun using the green parts and materials registration list when making purchases. Every month each of the operations divisions and group companies calculates its green purchasing rate, which is one of the important management benchmarks.

To qualify as a green vendor, the vendor must satisfy two requirements. To qualify as a green part or material, the product must satisfy three requirements. To qualify as a green vendor, the vendor must not purchase or use any of the 31 types of prohibited chemical substances. The vendor must also have a clearly defined, proactive stance with regard to environmental conservation. This latter requirement is somewhat broad, as it ranges from ISO 14001 acquisition to some kind of in-house environmental system or program. But we don't see that as much of a problem, because we believe that the key to an effective environmental conservation program, one that reduces the burden

on the environment, is not necessarily speed but continuous effort and improvement. This is because we believe that all important changes start with the first step. For parts and materials to be considered green they must have been purchased from a qualified green vendor, must not contain prohibited chemical substances, and must be packaged in materials containing at least 51 per cent recycled paper by weight. Although there may be some leeway on the first and third items, the second item is mandatory. No green part or material may contain or be manufactured using amosite or any of the other 30 prohibited chemical substances.

Next, I want to talk about Roles and Responsibilities and progress in Japan. First, the roles. We have clearly defined the roles and responsibilities of the Head Office and those of the operations divisions up front. Normally, the purchasing departments in each division handle all purchasing-related duties, such as vendor management and selection of parts and materials. When it comes to green purchasing, however, the purchasing departments need to work with the Head Office. The Head Office performs and centrally controls vendor surveys, while the purchasing department handles parts and material surveys. Centralized control of vendor surveys is preferred because multiple operations divisions may use the same vendor and we want to avoid duplicating work. We also want the center function to understand each vendor's level and how that vendor deals with green issues. This information can be used to further develop our activities. New vendors are surveyed in the course of normal business within operations division purchasing departments. The Head Office provides support as necessary. Our progress in green purchasing is summed up in Figure 10.

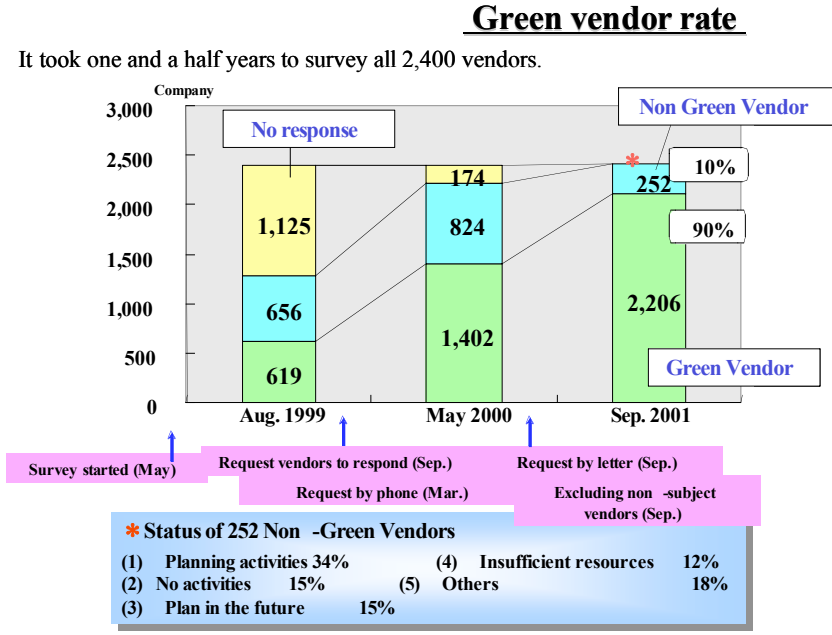



**Figure 10** Progress in green purchasing

In 1998, with some help from environmentally progressive companies, we began our green purchasing program by preparing regulations and guidelines. The following year, we formally established green purchasing regulations and Green Purchasing Guidelines. We then began surveys. Our first step was to survey vendors. Our second step was to

survey parts and materials. In 1999 we also began setting fiscal year targets. The first year we worked toward a green purchasing rate of 30 per cent, and the next year a 70 per cent rate.

This graph (Figure 10) shows the vendor survey trends since 1999. At Seiko Epson we began conducting surveys because we wanted to partner up to promote environmental activities, and not just with the vendors who manufacture or supply products to us but also with the trading companies and manufacturers further up the value chain. This desire to work with all those who supply us with goods has not changed. It has not always been easy to get vendors to respond to our survey. Some vendors had to be reminded repeatedly. In took a year and a half, but by December 2000 we were finally able to complete our survey of all 2,400 vendors. At the present time, 10 per cent of our vendors are not green. The status of these vendors is as follows. As you can see, nearly half of the non-green vendors are either currently planning green activities or are planning to introduce green activities in the future. We have high hopes that these vendors will be qualified as green vendors in the near future.

Figure 11 shows, briefly, what we have accomplished in Japan through our green purchasing program.

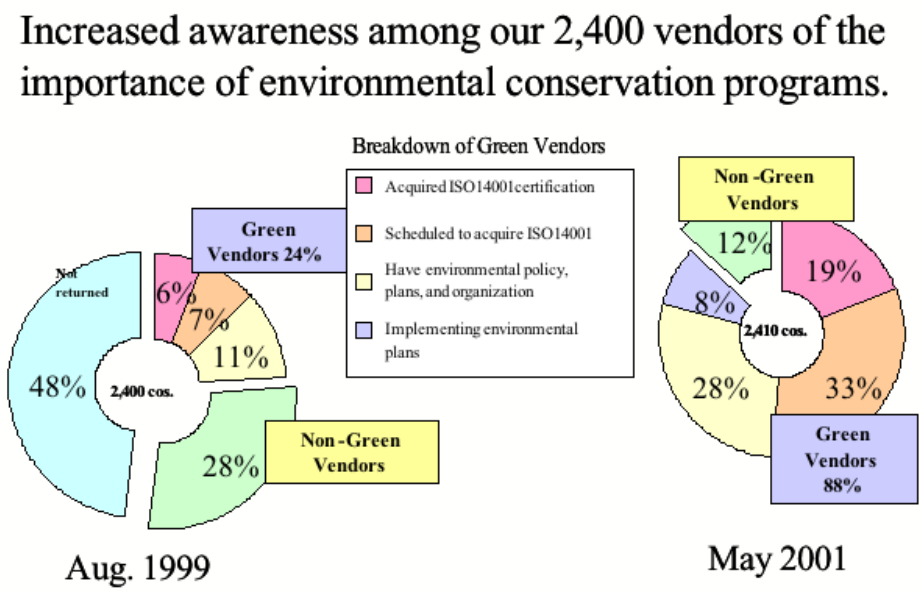
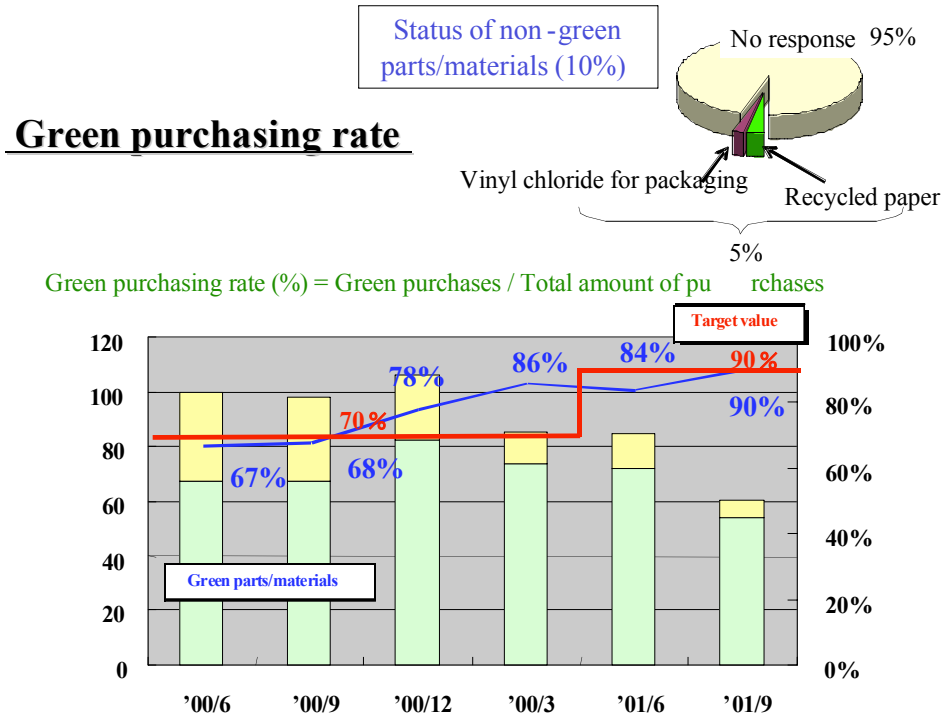



**Figure 11** Vendor survey results (I)

As can be seen from these two graphs, in a little more than a year and a half we have raised our green purchasing rate from 24 per cent to 88 per cent. I think this is strong evidence of the steadily growing awareness of the importance of environmental conservation. Although it has not been easy for them, in some sense I think Seiko Epson's activities have also helped vendors. Many of our vendors are small or medium sized, so our repeated requests for survey responses had to have placed an additional burden on them. Seiko Epson is particularly appreciative of the positive response from them.




Note: Plot status of Green Purchasing rate compare to the purchasing amount to June 2000

**Figure 12** Vendor survey results (II)

Figure 12 shows the trend line for green purchasing rate, which we use as a benchmark. The green purchasing rate is expressed as a percentage of the value of green purchases to the total value of purchases. In September of this year the green purchasing rate was 90 per cent against a 90 per cent target for the fiscal year. That means that 10 per cent of total purchases are classified as non green. However, the vast majority, fully 95 per cent, are classified as non-green because we have not yet received a response to our parts and materials survey from the vendor. Strictly speaking, however, a certain percentage of our purchases are from non-green vendors. The remaining 5 per cent of parts and materials have been classified as non-green because the packaging materials or containers that they are shipped in contain non-compliant materials.

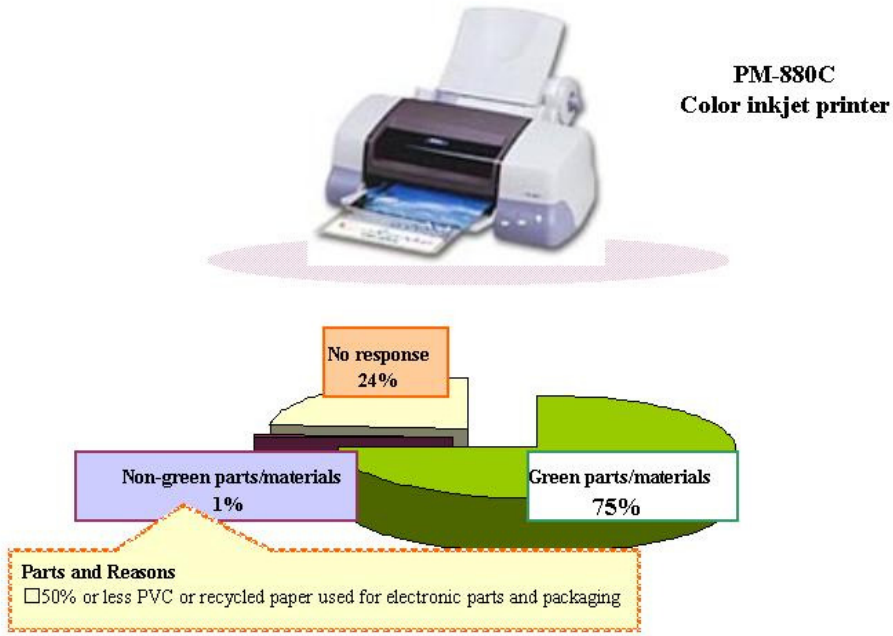



**Figure 13** Example of green purchasing rate

Let's look at the green purchasing rate calculated for a specific product, an Epson color inkjet printer (see Figure 13). The green purchasing rate is 75 per cent. 1 per cent of parts and materials are not considered green, because even though 100 per cent of the electronic parts themselves are green, the packaging materials used for shipping are not.

The main reasons for non-green parts are:

- packaging materials containing poly-vinyl chloride are used for ICs and other electronic parts
- the wrapping paper for parts contains less than 51 per cent recycled paper by weight

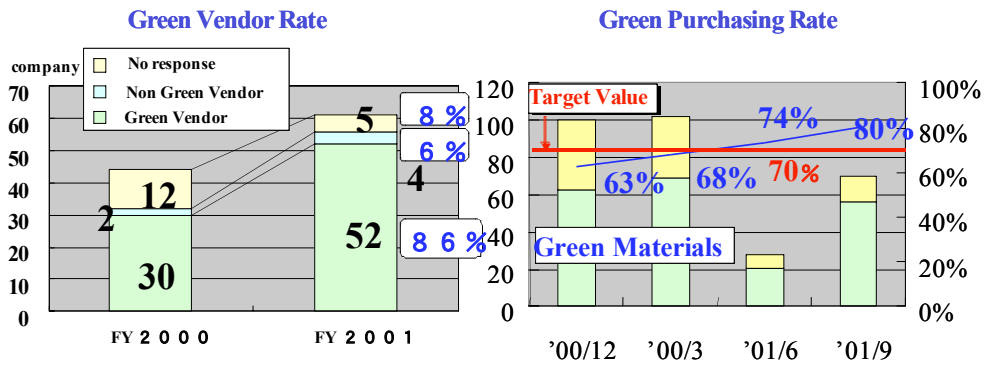
The counteractions were taken as follows:

- packaging materials containing poly-vinyl chloride are collected and reused instead of being incinerated or carried to a landfill. This has reduced annual industrial waste by 12 tons
- we replaced paper packaging materials with plastic packaging materials, making containers returnable. This reduced costs and had a number of other benefits, as well.

Next, I will explain the activities at our overseas production centers. We have 15 production centers that are implementing green purchasing programs. Eleven of these centers are in Asia and Oceania, and six are in China. The remaining four overseas production centers are in America and Europe. All parts and materials purchased locally

by our overseas affiliates are subject to surveys. The content of the surveys used is identical in every country. The surveys are simply prepared in English and Chinese. The planning of green purchasing activities overseas started about one year later than in Japan. The planning phase started in July of last year. As was the case in Japan, the survey step started with surveys of vendors themselves, followed by surveys of parts and materials. In contrast to Japan, however, the purchasing departments in the overseas bases handle all of the work, without assistance from the Head Office. At the start of activities, members of the green purchasing committee in Japan went to all 15 bases overseas to see first-hand how they had organized and systematized their activities. They built a consensus about the direction of activities with the green purchasing team at each company, the local responsible person, and so on. The green purchasing rate target for overseas companies was set taking a variety of local factors into account. Because they got a later start and have different levels of environmental preparedness, the overseas companies are working toward a 70 per cent green purchasing rate in fiscal 2001.

As of September 2001, vendor surveys were completed by the more than one thousand combined vendors serving our overseas bases. The green vendor rate was an average of nearly 50 per cent. Parts and material surveys are just complete, the green purchasing rate averages 61 per cent.




Note: Plot status of green purchasing rate compared to the purch asing amount to June 2000.

**Figure 14** Results of a green production material purchasing program in Taiwan

Figure 14 shows the results of a green production material purchasing program at one of our affiliates in Taiwan. We have an LCD factory in Taipei that manufactures small and medium sized panels. Last year, 30 of its 44 vendors were green. This year, the number of vendors increased to 52, and the number of green vendors increased along with the total number of vendors, reaching 86 per cent. The green purchasing rate has also climbed steadily, and has already surpassed the 70 per cent target for the year, reaching 80 per cent. The environmental awareness of manufacturers in Taiwan is quite high, partly because of government guidance.

An analysis of the efforts being conducted overseas to date turns up some problems. First, we found that few vendors had established an environmental policy, plan, organization or system. Next, we found that not all parts and materials can be purchased locally. For example, in China it is difficult to obtain packaging materials

that have a 51 per cent or greater recycled paper content. In addition, awareness of environmental issues and the level of enthusiasm for addressing them differs from country to country. Due to this situation, we need to accept the fact that surveys will take longer overseas, but that we need to be patient.

Many of the vendors used by our overseas production bases are Japanese companies. For these vendors, we once again have gone to their head offices in Japan to ask for their cooperation in our green purchasing program. We are increasing awareness and understanding of our efforts among local makers by holding individual interviews and giving presentations. We are also sharing our know-how with regard to substitutes for non-green items.

## GREEN PURCHASING PROGRAM FOR GENERAL SUPPLIES

Now I would like to talk about our green purchasing program for general supplies.

We began by developing basic guidelines in July of 1998, one year before the start of the green production material purchasing program. A little more than one year later, in September of 1999, we replaced these basic guidelines with separate guidelines for 12 categories of general supplies. Then, in April of this year, we revised these separate guidelines to ensure compliance with the newly enacted Green Purchasing Law. Although we began such things as using recycled paper for making copies and business cards in 1992, we did not make a concerted effort to promote green product purchasing until after we had established guideless in 1998. In 1999 we began setting and working toward achieving annual value-based purchasing rate targets of 50 per cent, 70 per cent and so on. In addition, in fiscal 2000, to further fuel our activities, we established plans to ensure 100 per cent green purchasing of five common categories of office supplies.

Let me describe in more detail the twelve categories of general supplies subject to green purchasing guidelines. At Seiko Epson we believed that one of the keys to the success of this program would be to look at the broad range of what we consider to be indirect materials and then clearly define and categorize those so-called general supplies that would be made subject to green purchasing guidelines. The items identified as general supplies were selected on the basis of their commonality and frequency of use. Here is a list of the twelve categories of general supplies that we buy green.

- PC / PC peripherals
- Office equipment
- Copiers, facsimiles, hybrid machines
- Electric appliances
- Office furniture
- Vehicles Heavy oil, gasoline
- Tape, packing, packing items
- Miscellaneous home products / personal cosmetic items
- Stationery
- Uniforms
- Plastic transport boxes

Purchasers follow these steps when ordering general supplies (see Figure 15). First, in order to try to reduce waste and save resources, they ask themselves whether

the item is really necessary. If the item is necessary, then they check a list of idle assets that are available in the company to see whether there is a similar product. In other words, they see whether they can reuse items. If the item is not on the list, then they can search for and order a green product on the Green Purchasing List. This list is on the ordering system and is available to all. The aim of using this process is to foster an awareness of green consumerism among employees and to reduce costs.

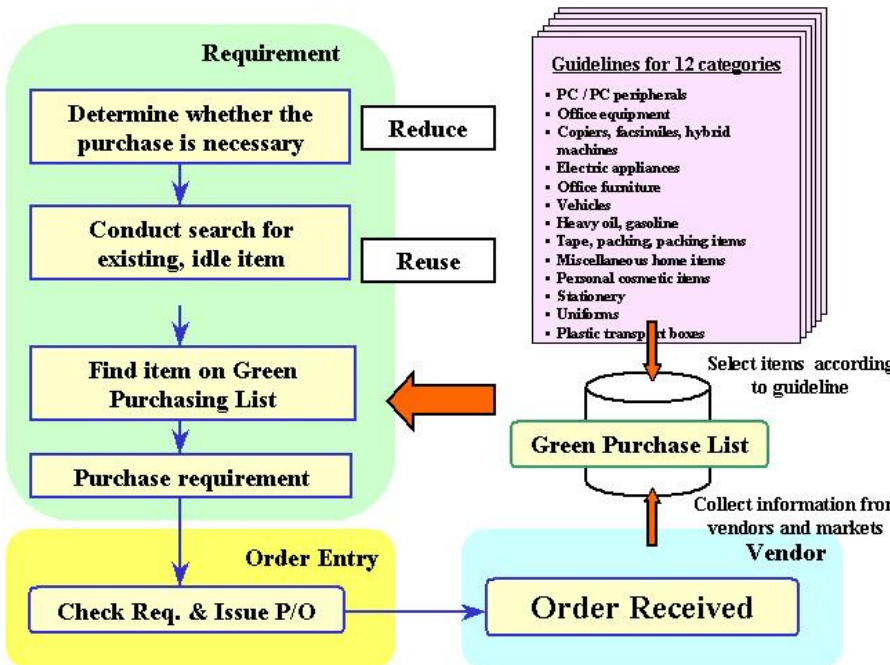



**Figure 15** Steps in ordering general supplies

General supplies are requisitioned and ordered using an electronic centralized purchasing system. Each of the 1,050 departments in Seiko Epson and its domestic affiliates has access to this system, and the requisitioner places a purchase order for green products on the Head Office server following the procedure that I described earlier. From the Head Office server order forms and requests for quotes are automatically sent by fax to vendors. The system is set up so that vendors provide green product information and register it on the server. This type of centralized purchasing system makes it possible to expand green product purchasing and reduce costs by purchasing in large quantities.

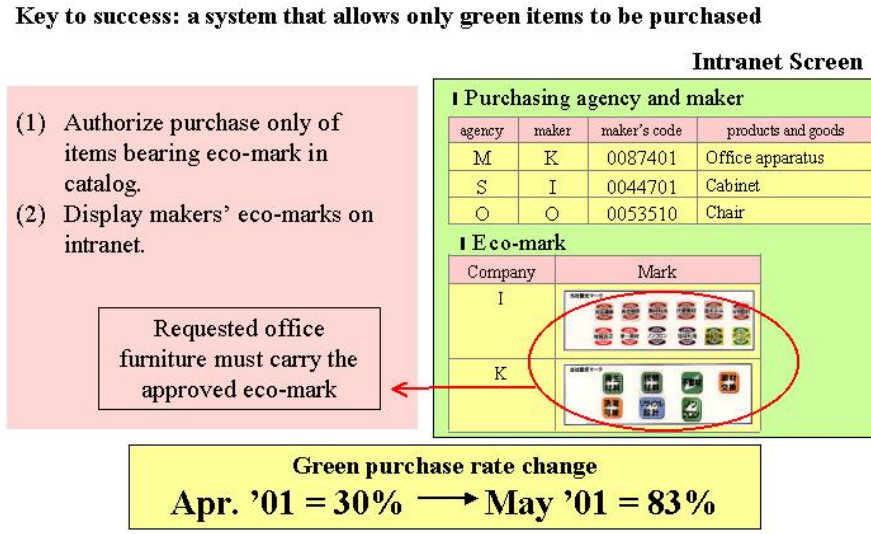
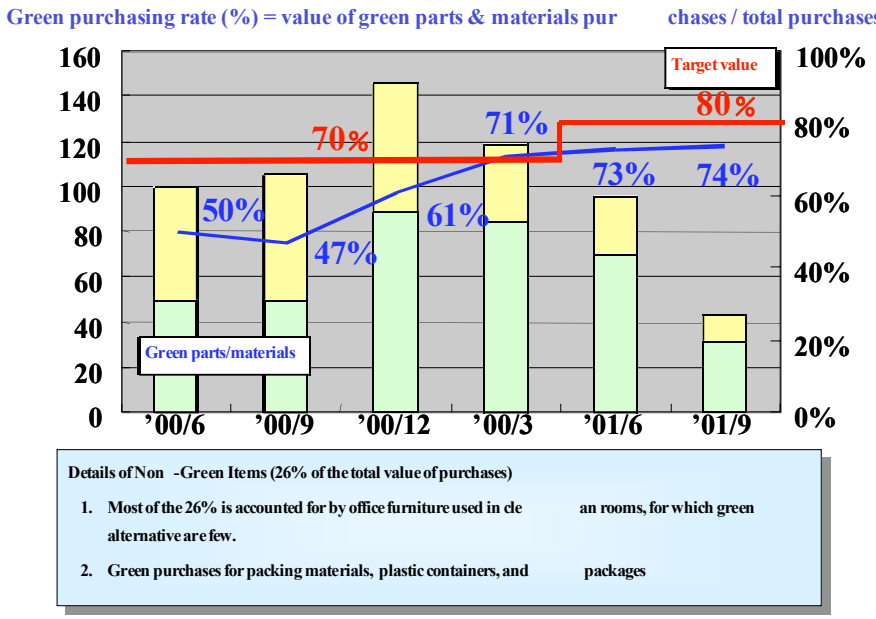



**Figure 16** Case study: Improving the green purchasing rate of office furniture

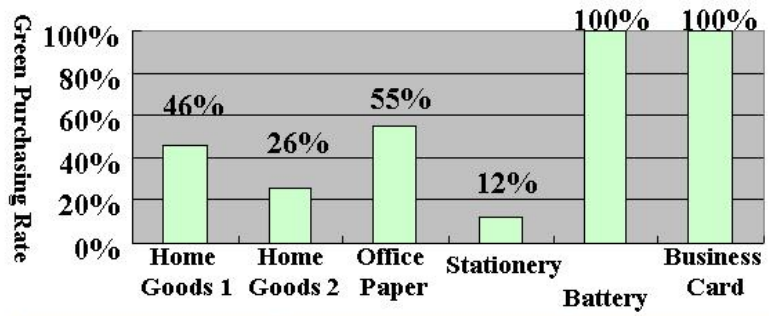
Figure 16 is a case study from FY 2000 that illustrates some of the things we have done in our green purchasing program for general supplies. This first case study involves a campaign to make 100 per cent of office furniture purchases green. For this campaign, we decided to build a closed system that would offer and enable the purchase of nothing but green products. We started by making a list of office furniture products that bear the manufacturer's eco-mark in its catalog. We then put pictures of each vendor's eco-mark on the company intranet and handed out catalogs to each division. Purchasers were instructed to look for office furniture that bore the eco-mark. Next, we had a meeting with multiple furniture vendors where we asked for their cooperation in ensuring 100 per cent green purchasing by returning any P/Os that were for non-green items. Green purchasing of office furniture then began in August of 2000. The green purchasing rate, which started out at 30 per cent, has risen to about 80 per cent today.

Figure 17 shows how the rate of green purchasing of general supplies as a whole has changed. Our efforts paid off in early 2001 when the rate of green purchases for office furniture exceeded the 70 per cent we set for fiscal 2000. We may have achieved a 74 per cent green purchasing rate, but that means 26 per cent of our purchases are not green. This indicates that we still have a lot of issues to solve with our office furniture system, which was supposed to be a closed system.




Note; Plot status of Green purchasing rate compare to the purcha sing amount to June 2000.

**Figure 17** Green purchasing rate




| Item | Problems | Action |
|---|---|---|
| 1. Home goods 1 (paper cup etc.) | No vendor produces recycled paper cups. | Use own cup instead of paper cup |
| 2. Home goods 2 (toilet paper etc.) | Recycled roll paper is not suitable because the quality is bad | |
| 3. Office paper (paper for copying machine etc. ) | Paper consumption was reduced 2.8% compared to last fiscal year | Each offices should use the reverse side of a paper |
| 4. Stationery | Few green supplies in Taiwan (Green folder, Magazine rack, etc.) | Find goods that meets green standa in the future |
| 5. Business Card | Recycled paper is expensive | Be made from recycled paper (pric environment) |

**Figure 18** Green Purchasing Rate in Taiwan sales company in September

This is an example of a program to purchase green general supplies at Seiko Epson's sales affiliate in Taiwan (Figure 18). This graph shows the green purchasing rate for different categories of items. The green purchasing rate has not risen as high as we had hoped because there are fewer green products on the market in Taiwan than there are in Japan, but they are coming up with other ideas, such as promoting the use of personal cups instead of paper cups and making double-side copies. The company has been recognized by the government for its efforts.

We were able to build awareness of our green purchasing efforts in-house by publishing the *Green Purchasing News* and by using other in-house communications. The paper version of the *Green Purchasing News* was eliminated in FY 2000 and is now available for viewing on the Seiko Epson intranet. The readership of this four-page publication is gradually growing.

I will now talk about issues and future trends in the area of green purchasing of production materials and general supplies. We have set our sights on feeding back green purchasing information to product designers and engineers.

First, we have built and are implementing a system that prioritizes purchasing from green vendors. Presently, before buying an item from a new vendor, in addition to conducting a traditional new vendor evaluation, we have to conduct a separate green vendor survey. In the future we are planning to merge the content of the green vendor survey into the normal new vendor evaluation. This would streamline work and make green evaluations routine. We are also considering developing tools to facilitate the exchange of information with vendors in Japan using information technology. The aim would be to increase survey and evaluation efficiency and speed. We will continue to work persistently with non-green vendors to achieve a 100 per cent green vendor rate.

The next step is to build and implement a system for prioritizing the purchase of green parts and materials. The purpose of this system is to establish an environment that enables the Seiko Epson group as a whole to give priority to green parts and materials through the use of the green parts and materials list in the product planning and design departments and by sharing information throughout the group. Since the systems differ slightly from one operations division to the next, to ensure success we first assessed the state of affairs in each division. Then, after developing a successful model, we roll it out across the entire group. On the other hand, since we believe that replacing non-green parts and materials is extremely important, the divisions and engineering departments work cooperatively with vendors.

The third step is to purchase green parts and materials in the amounts required, and to offer the market environmentally conscious products manufactured using 100 per cent green parts and materials.

Our campaign to purchase green general supplies whenever possible supplements our environmentally conscious product manufacturing efforts. We promote the green purchasing of general supplies not only to make our offices and factories more eco-friendly but also to help foster consciousness of green consumerism among Seiko Epson's employees.

In order to promote green purchasing of general supplies in compliance with new laws, we first had to learn about the green products market, then we had to build a centralized ordering system with green product offerings. To learn about the market, we studied it to find green products and substitutes. To build up the number of green products offered on our system, we are sometime link up with new vendors who proactively buy green themselves. In short, we believe that the key to successful general

supply green purchasing is to make green products our in-house standard by providing buyers with an extensive choice of products on our centralized ordering system.

We also have to build a system that makes it easier to purchase green products. To do so, we think it is important to provide more product pictures and product catalogs so that people who are interested in buying a product can easily see what it looks like and check its specifications, thus making it easier to choose a green alternative. We are also planning to work with vendors to aggressively expand the type of closed system we started for office furniture purchases.

In addition, we hope to actively promote the creation of green products and the effective use of idle items already on hand. These activities require joint development between vendors and manufacturers. Rather than only making proposals to manufacturers, we need to get our people involved in the actual development.

# 10 CASE 10 : MEASUREMENT OF SUSTAINABILITY AND ECO-EFFICIENCY

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**ABSTRACT**

This paper discusses measurement of sustainability, emphasizing indicators applicable to describe the progress toward environmental sustainability for a nation. Among the numerous sustainable development indicators proposed in last two decades, the environmental sustainability index (ESI) developed by the World Economic Forum (WEF) was selected for performing quantitative analysis based on local data and characteristics of Taiwan.

The ESI score of Taiwan in the year of 2001 was derived according to its computational framework and the result was 60.4, which would be ranked the 23rd in 123 countries all over the world. As the correlations between environmental sustainability and economic competitiveness have been of major concern, the ESI was also compared with measures of economic performance such as the WEF Current Competitiveness Index and per-capita income. High correlations between Taiwan's ESI score and the WEF Current Competitiveness Index score were also found, which is consistent with the analysis performed for other countries.

Eco-efficiency, a management philosophy which supports business to search for environmental improvements while making economic profits at the same time, was selected as one of the indicators contributing to the component of "social and institutional capacity" in the framework of ESI. In practice, measuring and reporting eco-efficiency are of critical importance to a company as the elements and processes for carrying out them can aggregate necessary concepts while reducing the risk of missing key messages needed to be presented to the stakeholders.

Thus, the measurement framework of eco-efficiency was discussed in this paper. The sound principles and practical concepts were stressed to help readers understand the fundamentals and executive approaches with relatively limited time. Generally applicable and business specific indicators, together with the guidance on selecting the later were also examined. The basic important practical implications for preparing an eco-efficiency profile of a company or operation, issues to be considered inside and outside companies when reporting eco-efficiency were also introduced.

At last, the elements of a company's eco-efficiency profile were outlined and several local case studies were presented as examples for illustrating the powerfulness of eco-efficiency in helping local business attain both the economic and the environmental goals.

## INTRODUCTION

The idea of sustainability development has been launched for decades. It was further promoted through the publication of "Our Common Future" by UNWECD in

1987 and the most prominent consensus reached in the 1992 Rio World Summit. Since then, sustainable development has been intensively incorporated into the frameworks of indicators in environmental, economic, social, and many other aspects. In general, sustainable development indicators must encompass three fundamental functions: (1) to simplify complex phenomena; (2) to quantify various development scenarios; and (3) to carry out the mission of communication [1].

Many sustainable development indicator systems have been projected through international collaboration. Of importance among them include the PSR (pressure-state-response) index system of UNCSD [2], the similar PSR system of OECD [3], the European sustainability development index system for environment and space [4], Sustainable Seattle [5], etc. In Taiwan, research efforts have also been conducted in the last decade. A few indicator systems have been constructed, mostly abiding by the PSR framework [6~8].

However, indicators really measuring sustainability in the scale of a nation are rare, especially at the international level where data gaps could overwhelmingly destroy the effort of trying to compare environmental circumstance and performance among countries [9]. Hence, the Environmental Sustainability Index (ESI) was created in a systematic, transparent, and reproducible manner so that it is capable of being employed scientifically and relevant to policy debates. Also, as the correlations between environmental sustainability and economic competitiveness have been of major concern, the ESI was also designed for comparing with measures of economic performance such as the WEF Current Competitiveness Index and per-capita income.

It should be noted that Taiwan has gained good scores in these economic measures and hence rated as a country with considerable economic competitiveness. However, the ESI scores for Taiwan were not computed by the WEF due to its poor accessibility to local data. Thus, in this study, the ESI was introduced and the ESI score for Taiwan in the year of 2000 was derived using the data of necessary variables for Taiwan as well as other countries.

The ESI scores are based on five “components” relevant to environmental sustainability composed of a set of 22 core “indicators”, each of which combines two to six variables for a total of 67 underlying “variables”. Eco-efficiency was selected as one of the indicators contributing to the component of “social and institutional capacity”. This is a management philosophy that supports business to search for environmental improvements that make economic profits at the same time.

Since its was first used in 1990 by the Basel based researchers Schaltegger and Sturm in 1990, the concept of eco-efficiency has been taken by the World Business Council for Sustainable Development (WBCSD) and implemented in many companies in its constituency countries. In the last decade, eco-efficiency has been widely spread in both developing countries and the industrialized world and helped business from eliminating risks and finding additional savings through to identifying opportunities and realizing them in the marketplace [10].

Measurement and reporting how “eco-efficient” a company is, are of major concern as the elements and processes for carrying out them can aggregate necessary concepts while reducing the risk of missing key messages needed to be presented to the stakeholders. Thus, the measurement framework of eco-efficiency was discussed in this paper. The sound principles and practical concepts were stressed to help readers understand the fundamentals and executive approaches with relatively limited time.

Generally applicable and business specific indicators, together with the

guidance on selecting the later were also examined. The basic important practical implications for preparing an eco-efficiency profile of a company or operation, things to be considered inside and outside companies when reporting eco-efficiency were also introduced. At last, the elements of a company's eco-efficiency profile were outlined and several local case studies were presented as examples for illustrating the powerfulness of eco-efficiency in helping local business attain both the economic and the environmental goals.

## ENVIRONMENTAL SUSTAINABILITY INDEX

### Framework of the Environmental Sustainability Index

The Environmental Sustainability Index (ESI) is a measure regarding overall progress toward environmental sustainability. It was the result of collaboration among the World Economic Forum's (WEF), Global Leader for Tomorrow (GLT) Environmental Task Force, the Yale Center for Environmental Law and Policy (YCELP), and the Columbia University Center for International Earth Science Information Network (CIESIN). Firstly introduced to the public in the WEF annual meeting in the year of 2000, the brand-new ESI was designed to allow international comparison of environmental progress systematically and quantitatively. Based on the executive report of ESI [9], the ESI enables the following:

- Identification of issues where national environmental results are above or below expectations;
- Policy tracking to identify areas of success or failure;
- Benchmarking of environmental performance;
- Identification of "best practices";
- Investigation into interactions between environmental and economic performance.

In constructing the ESI, the working group confined the focus in the scope of environmental sustainability, ignoring topics having no significant or quantifiable connections to it. Nevertheless, the concept is still quite complicated and multi-dimensional. Eventually, the ESI was referred to five dimensions as the core components of environmental sustainability [9]:

- Environmental Systems: the extents that a country's vital environmental systems are maintained at healthy levels and to which levels are improving.
- Reducing Environmental Stresses: the levels of anthropogenic stress to endanger demonstrable harm to a country's environmental systems.
- Reducing Human Vulnerability: the extent that people and social systems are not vulnerable to environmental disturbances; becoming less vulnerable is a sign that a society is on a track to great sustainability.
- Social and Institutional Capacity: the extent that a country has underlying institutions and social patterns of skills, attitudes and networks that foster effective response to environmental challenges.
- Global Stewardship: the extent that a country cooperates with others to manage common environmental problems.

The idea of incorporating these five "components" relevant to environmental

sustainability was carried out using a set of 22 core "indicators", each of which combines two to six variables for a total of 67 underlying "variables". The choice of these indicators and variables was driven by a consideration of the theoretical logic and relevance of the indicator in question, data quality, and country coverage [9]. The building blocks containing the components, the corresponding indicators and variables were listed in Table 1.

**Table 1** The Building Blocks of Environmental Sustainability Index

| 5 core components | 22 indicators | 67 variables |
|---|---|---|
| Environmental Systems | Air Quality | Urban $SO_2$ concentration |
| | | Urban $NO_2$ Concentration |
| | | Urban TSP Concentration |
| | Water Quantity | Water Availability per capita |
| | | Water Inflow Availability per capita |
| | Water Quality | Dissolved Oxygen Concentration |
| | | Phosphorus concentration |
| | | Suspended Solids |
| | | Electrical Conductivity |
| | Biodiversity | Percentage of Mammals Threatened |
| | | Percentage of Breeding Birds Threatened |
| | Terrestrial Systems | Severity of Human Induced Soil Degradation |
| | | Land Area Impacted by Human Activities as a Percentage of Total Land Area |
| Reducing Environmental Stresses | Reducing Air Pollution | NOx emissions per populated land area |
| | | $SO_2$ emissions per populated land area |
| | | VOCs emissions per populated land area |
| | | Coal Consumption per Populated Land Area |
| | | Vehicles Per Populated Land Area |
| | Reducing Water Stress | Fertilizer consumption per ha of arable land |
| | | Pesticide Use |
| | | Industrial Organic Pollutants per available freshwater |
| | | Percent of Country's Territory Under Severe Water Stress |
| | Reducing Ecosystem Stress | Change in forest cover |
| | | Percentage of Country with Acidification Exceedance |
| | Reducing Waste & Consumption Pressures | Consumption Pressure per Capita |
| | | Nuclear Waste generated |
| | Reducing Population Pressure | Total Fertility Rate |
| | | Project growth rate, present to 2050 |
| Reducing Human Vulnerability | Basic Human Sustenance | Daily Per Capita Calories Supply as a Percentage of Total Requirements |
| | | Percept of population with access to clean water |
| | Environmental Health | Child Death Rate from Respiratory Diseases |
| | | Death Rate from Intestinal Infectious Diseases |
| | | Under-5 Mortality Rate |

| | | |
|---|---|---|
| Social and Institutional Capacity | Science/ Technology | Research & Development Scientists and Engineers per Million Population |
| | | Expenditure for Research & Development as a Percentage of GNP |
| | | Scientific and technical articles per million population |
| | | IUCN Members |
| | | Civil and Political Liberties |
| | | Environmental Regulatory Stringency |
| | | Environmental Regulatory Innovation |
| | | Percent of Land Area Under Protected Status |
| | | Number of Sectoral EIA Guidelines |
| | | Number of ISO 14001 Certified Companies per GDP |
| | | Dow Jones Sustainability Group Index: Percent of eligible companies in index |
| | | Average Innovest Eco Value rating of firms |
| | | Number of World Business Council on Sustainable Development members, per GDP |
| | | Environmental Competitiveness (WEF Survey) |
| | | Availability of Sustainable Development Information at the National Level |
| | | Environmental Strategies and Action Plans |
| | | Percent of ESI variables missing from public global data sets |
| | | Energy Efficiency (total energy consumption per unit GDP) |
| | | Renewable Energy Production as a Percentage of Total Energy Consumption |
| | | Price of Premium Gasoline (USD per gallon) |
| | | Subsidies for Energy or Materials Usage (WEF Survey) |
| | | Corruption measure (World Bank) |
| | | Number of Memberships in Environmental Intergovernmental Organizations |
| | | Percent of CITES Reporting Requirements Met |
| | | Levels of Ratification under the Vienna Convention for the Protection of the Ozone Layer |
| | | Compliance with Environmental Agreements (WEF Survey) |
| | | Montreal Protocol Multilateral Fund participation |
| | | Global Environmental Facility Participation |
| | | FSC Accredited Forests as Percent of Total Forest Area |
| | | Ecological Footprint 'Deficit' |
| | | CO2 Emissions (total times per capita) |
| | | CFC Consumption |
| | | S02 Exports |
| | | Historic, Cumulative CO2 emissions |

ESI Scores of the Countries All Over the World

The ESI scores can be obtained by averaging the values of the 22 indicators and calculating a standard normal percentile for each country. In 2001, the ESI score of 122 countries, ranging from 80.5 (Finland) to 24.7 (Haiti), were derived, representing the percentage of countries expected to have a lower level of environmental sustainability than that particular country, assuming the environmental sustainability scores are normally distributed. The five highest ranking countries (corresponding ESI score) are Finland (80.5), Norway (78.2), Canada (78.1), Sweden (77.1), and Switzerland (74.6); whereas the five lowest are Haiti (24.7), Saudi Arabia (29.8), Burundi (30.1), Ethiopia (31.2), and Libya (31.3). In Asia, Japan got the highest ESI score of 60.6 and which was ranked the 22nd in the world.

**Table 2** The ESI Scores of Selected Asian Countries in 2001

| Country | ESI Score | Rank | Country | ESI Score | Rank |
|---|---|---|---|---|---|
| Japan | 60.6 | 22 | India | 40.9 | 94 |
| Taiwan (ROC) | 60.4 | 23 | South Korea | 40.3 | 96 |
| Malaysia | 49.7 | 53 | China (PRC) | 37.6 | 109 |
| Singapore | 46.8 | 66 | Philippines | 35.7 | 113 |
| Nepal | 46.7 | 67 | Vietnam | 34.2 | 115 |
| Thailand | 45.2 | 75 | Kuwait | 31.9 | 117 |
| Pakistan | 43.6 | 86 | Saudi Arabia | 29.8 | 122 |
| Indonesia | 42.6 | 87 | | | |

Unfortunately, Taiwan was out of the list because the ESI working group did not hold Taiwan's data acceptable in quantity and quality. However, Taiwan has been included in the list and among the height ranking countries of Current Competitiveness Index also conducted by the WEF. Since cross-national comparisons of environmental sustainability is not less important than those of economic competitiveness, this has led to our effort in trying to develop the ESI score of Taiwan based on the framework and details published by the ESI working group [9].

The ESI Score of Taiwan

The basic criterion for an acceptable ESI is that at least one half number of the 67 variable values can be obtained. Through extensive data collection and analysis, the research team of this study concluded that data supporting totally 47 out of the 67 variables could be dig out. That is, the ESI score of Taiwan can be derived under the current situations for data availability.

The ESI score of Taiwan attained was 60.4 with a Z-scale of 0.266, which was ranked the 23rd by comparing with those of other 122 countries. This score is just a little smaller than that of Japan (60.6) whose score is the highest in Asia. Table 2 listed the ESI scores of several major Asian countries for illustrating the relative levels of environmental sustainability in this area.

The information related to ESI is presented in Figure 1. In the upper right of the figure is a snapshot of Taiwan's performance along the five components of environmental sustainability. The score for each component was marked on each axis, and then the points were connected to form a closed area and the size of this area is then

the measure of Taiwan's overall performance. In the lower right of the figure is a report of the average Index score for Taiwan in its peer group as defined by GDP per capita (Purchasing Power Parity) in 2000. Peer groups were assigned by dividing all countries into five equal groups, sorted by GDP per capita.

Taiwan is in Group 2, associated with a GDP per capita between $6,190 and $14,375 as the GDP per capita for Taiwan in 2000 was $14,200, almost reaching the upper limit of the interval of this peer group. It can be observed that Taiwan was still weak in water quality, reduction population pressure, environmental health, and capacity for debate; whereas it embraces strengths in reducing water and consumption, terrestrial system, reducing pollution, and environmental information.

Based on the ESI scores and other economic indicators, analysis has been performed by the WEF and it was concluded that the ESI has relatively high correlation with the GDP per capita ( r = 0.76) and the WEF Current Competitiveness Index ( r = 0.65) while having low correlation with the GDP growth rate ( r = 0.03). According to the Global Competitiveness Report 2000 publish by the WEF [11], Taiwan was ranked the 21st in 59 countries with available economic data required to generate the WEF Current Competitiveness Index.

It should be noted that these 59 countries are probably the highest ranking countries in terms of economic performance because the remaining countries in the world tend to be worse as they did not even have enough economic data. The relationship between the ESI score derived by our research group and the WEF Current Competitiveness Index score is consistent with the analysis carried out by the WEF. We can further conclude that Taiwan embraces good performances both in economic competitiveness and environmental sustainability.

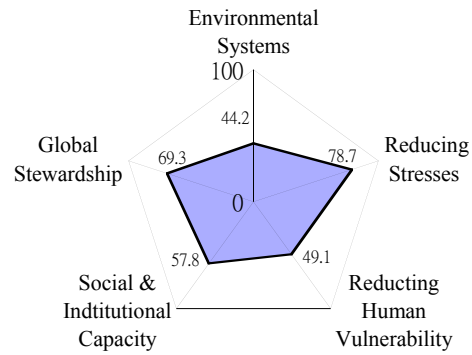
Assuming that the total number of countries in both lists is 123, Taiwan can stand within the highest 20%. However, Taiwan should not feel satisfactory with regard to these performances as the global economy is becoming more and more competitive and the environmental stress is still not unloosen.

## MEASUREMENT OF ECO-EFFICIENCY

### Basics about Eco-efficiency

Eco-efficiency is a management concept, or philosophy which encourages business to attain environmental improvement while creating economic values. As more and more enterprises around the world feel interested in becoming more environmental responsible, eco-efficiency has offered them good opportunities. In short, eco-efficiency is concerned with "creating more value with less impact". Unlike other conceptual frameworks regarding environmental performance of private or public sectors developed in the last decade, eco-efficiency has been much more welcomed as economic profit is emphasized and this enables innovation and hence growth and competitiveness for business.

ESI: 60.4
Ranking: 23
GDP/Capita: $14,200
Peer group ESI: 52.2
Variable coverage: 46
Missing variables imputed: 21




| | |
|---|---|
| Air Quality | -0.68 / 0.18 |
| Water Quantity | -0.33 / 0.04 |
| Water Quality | -1.67 / 0.25 |
| Biodiversity | -0.12 / 0.04 |
| Terrestrial Systems | -0.13 / 1.91 |
| Reducing Pollution | -0.28 / 1.33 |
| Reducing Water Stress | -0.06 / 0.45 |
| Reducing Ecosystem Stress | -0.15 / 0.12 |
| Reducing Water & Consumption | -0.10 / 3.21 |
| Reduction Population Pressure | -0.86 / 0.51 |
| Basic Human Sustenance | 0.58 / 0.57 |
| Environmental Health | -0.62 / 0.60 |
| Science/technology | 0.08 / 0.80 |
| Capacity for Debate | -0.71 / 0.03 |
| Regulation and Management | -0.25 / 0.86 |
| Private Sector Responsiveness | 0.00 / 0.10 |
| Environmental information | 0.13 / 1.00 |
| Eco-Efficiency | -0.39 / -0.33 |
| Reducing Public Choice Distortions | -0.02 / -0.34 |
| International Commitment | -0.02 / 0.72 |
| Global-Scale funding/Participation | 0.26 / 0.00 |
| Protecting International Commons | -0.21 / 0.28 |

□: Indicator value, ■: Reference (average value)

**Figure 1** The Environmental Sustainability Index of Taiwan and Analysis Report

Since the term "eco-efficiency" was first used in 1990 by the Basel based researchers Schaltegger and Sturm and officially addressed in "Changing Course" presented to the 1992 Earth Summit in Rio de Janeiro, its concept has been further shaped and developed by the World Business Council for Sustainable Development (WBCSD). Eco-efficient companies were defined in "Changing Course" as those creating ever more useful products and services [10].

That is, eco-efficiency is adding more values while continuously reducing consumption of resources and pollution. The working definition currently used by the general public is that agreed by the participants at the first multi-stakeholder workshop on eco-efficiency held by the WBCSD in 1993:

*"Eco-efficiency is achieved by the delivery of competitively-priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resources intensities throughout the life cycle to a level at least in line with the earth's estimated carrying capacity."*

In a few words, eco-efficiency can be expressed as "creating more value with less impact" or "doing more with less", which are preferred by many business leaders. In the academia, eco-efficiency has been termed as "economic and environmental efficiency in parallel". The OECD (Organization for Economic Co-operation and Development) has called eco-efficiency "the efficiency with which ecological resources are used to meet human needs".

The organization further defined it as a ratio of an "output" (the value of products and services produced by a firm, sector, or economy as a whole) divided by the "input" (the sum of environmental pressure generated by the firm, the sector, or the economy). On the macro-level, eco-efficiency was defined concisely by the European Environment Agency (EEA) as "more welfare from less nature" and it can be achieved by decoupling resource use and pollutant release from economic development.

Eco-efficiency embraces common visions as those of other environmental concepts and management systems. For example, eco-efficiency and "Cleaner Production" have much in common as they both help companies in their quest for continuous improvement in minimizing their consumption of resources, reducing environmental burdens and limiting associated risks and liabilities [12].

However, eco-efficiency goes beyond mere resource use and pollution reduction. It emphasizes value creation and links environmental to business excellence. Also, eco-efficiency relate to the concept of "Design for Environment" and "Eco-innovation" because it includes product design among the technological opinions for reducing material and energy intensity in production processes. Moreover, an Environmental Management System (EMS) creates the framework in which the opportunities of eco-efficiency can be realized. In the later sections of this paper, we will see how particular management systems of ISO 14000 can be employed in measuring and reporting eco-efficiency.

Although eco-efficiency should not be confined in the business arena, it is basically a business concept since it was proposed and applied using business languages. The WBCSD has identified seven elements that business can use to improve their eco-efficiency [13]:

1. Reduce material intensity
2. Reduce energy intensity
3. Reduce dispersion of toxic substance

4. Enhance recyclability
5. Maximize use of renewables
6. Extend product durability
7. Increase service intensity

These seven elements can be thought of as being concerned with three broad objectives [9]:

1. Reducing the consumption of resources: including mining the use of energy, materials, water and land, enhancing recyclability and product durability, and closing material loops.
2. Reducing the impact on nature: including minimizing emissions, water discharges, waste disposal and the dispersion of toxic substances, and fostering the sustainable use of renewable resources.
3. Increasing product or service value: providing more benefits to customers through product functionality, flexibility and modularity; providing additional services and focusing on selling the functional needs that customers actually want.

Actually, in terms of eco-efficiency, the third objective is more important than others because making profit is its major goal. The first and the second "objectives" can be treated as two "constraints" in the economic profit maximization problem. Thus, the business rationale for eco-efficiency is straightforward: it makes good business sense.

Eco-efficiency Indicators

Mathematically, with a generalized formulation, eco-efficiency can be expressed as follows:

$$\text{Eco-efficiency} = \frac{\text{product or service value}}{\text{environmental influence}}$$

This is basically the "framework" of eco-efficiency and it is flexible enough to be widely used and easily interpreted across the business spectrum. The effective measurement of eco-efficiency can be accomplished by a common set of definitions, principles and indicators. All indicators to be used in measuring eco-efficiency can be classified into two types: "generally applicable indicators" and "business specific indicators". Generally applicable indicators are a small number of indicators having been identified as being valid for virtually all business. On the other hand, business specific indicators should be recognized, designed, and used by individual companies to fit their particular circumstances. They are more likely to be individually defined from one business to another. The judgment depends on the nature of the business. Thus, the first step to measure eco-efficiency is to construct the set of these indicators. For all types of indicators, an "eco-efficiency indicator" should [15]:

1. be relevant and meaningful with respect to protecting the environment and human health and/or improving the quality of life,
2. inform decision making to improve the performance of the organization,
3. recognize the inherent diversity of business,
4. support benchmarking and monitoring over time,
5. be clearly defined, measurable, transparent and verifiable,
6. be understandable and meaningful to identified stakeholders,

7. be based on an overall evaluation of a company's operations, products and services, especially focusing on all those areas that are of direct management control, and
8. also recognize relevant and meaningful issues related to upstream (e.g. suppliers) and downstream (e.g. use) aspects of a company's activities.

WBCSD proposed a framework containing three levels of organization for eco-efficiency information: categories, aspects, and indicators. This is consistent with the terminology used in the ISO 14000 series, and in the Global Reporting Initiative (GRI). By definition, categories are broad areas of environmental influence or business value. Each category has several aspects, which are generally types of information related to the specific category, aiming at describing what is to be measured. Indicators are then the specific measure of an individual aspect that can be used to track and demonstrate performance. There may be several indicators for a given aspect. A full list of categories, aspects, and indicators was presented in Table 3.

As mentioned in the preceding, all of the indicators can be classified as a "generally applicable" or "business specific" one. For generally applicable indicators, the WBCSD has proposed three general principles to be followed. That is [14],

1. The indicator is related to a global environmental concern or business.
2. It is relevant and meaningful to virtually all business.
3. The methods for measurement are established and definitions accepted globally.

There are limited referential generally applicable indicators proposed by the WBCSD, though theoretically more indicators should exist. These belong to two categories, i.e., the first two categories in Table 3 except the third, because all indicators for the environmental influence of product/service use are business specific. The following are typical generally applicable indicators [14]:

1. Product/service value
   - Quantity of goods/services produced or provided to customers
   - Net sales
2. Environmental influence in product/service creation
   - Energy consumption
   - Material consumption
   - Water consumption
   - Greenhouse gas (GHG) emissions
   - Ozone depleting substance (ODS) emissions

In addition, there are several indicators putting up with the potential of becoming generally applicable provided current efforts to develop global agreement on measurement methods are successful. They are:

- Additional financial value indicators
- Acidification emissions to air
- Total waste

On the other hand, each company must evaluate its own business to determine what the applicable business specific indictors should be, through taking into account the needs of management and stakeholders. WBCSD recommended that ISO 14031,

concerned with "Environmental Performance Evaluation" (EPE), can be employed as guidance for selecting pertinent business specific indicators.

The most relevant type of indicator for the purpose of eco-efficiency according to the ISO classification is the Operational Performance Indicator (OPI). These indicators can be identified in the following areas:

- Indicators on emissions of individual or group of gases and metals to air or water (e.g., VOC, SO2, NOx, priority heavy metals)
- Environmental burden/effect indicators (e.g., eutrophication, photosmog, human toxicity)
- Summary parameters for water effluents (e.g., COD and others)
- Indicators on particular fraction of waste or non-product output (e.g., waste to landfill)
- Product use indicators (e.g., product packaging, energy consumption during product use)
- Indicators on aspects of upstream impacts emerging at operation of suppliers

**Table 3** List of Categories, Aspects, and Examples of Indicators

| CATEGORY | ASPECT | EXAMPLE INDICATOR |
|---|---|---|
| **Product/Service Value** | **Volume** | Units sold |
| | | Statistical unit |
| | | Employees |
| | | Space |
| | *Mass* | Quantity sold |
| | | Quantity produced |
| | *Monetary* | Net sales/turnover |
| | | Gross Margin |
| | | Value added |
| | | Liabilities |
| | | Reserves/provisions |
| | | Investments and write-offs |
| | | costs |
| | *Function* | Product performance |
| | | Service delivered |
| | | Product durability |
| | | Transport capacity |
| | | Agricultural yield |
| | *Other potentially relevant information* | Product price |
| | | Market share |
| | | Margins |
| | | Market matrix |
| **Product/Service Creation Environmental Influence** | *Energy consumption* | Gigajoules consumed |
| | | Fossil fuel type |
| | | Source |
| | | Emission |
| | *Material consumption* | Tons consumed |
| | | Type |
| | | Source |

| | | |
|---|---|---|
| | | Characteristics |
| | *Natural source consumption* | Tons consumed |
| | | Source |
| | | Land use |
| | | Non-process water |
| | *Non-product output* | Before treatment |
| | | Techniques of treatment |
| | | Releases to land and water after treatment |
| | | Air emissions |
| | | Priority heavy metal releases |
| | | Persistent, bio-accumulative and toxic releases |
| | *Unintended Events* | Accidental releases |
| **Production/Service Use Environmental Influence** | *Product/service* | Characteristics (e.g., recyclability, reusability, bio-degrability, durability, safety/risk) |
| | *Packaging waste* | Tons sold |
| | | Source |
| | *Energy consumption* | Gigajoules consumed |
| | | Fossil fuel type |
| | | Source |
| | | Emission |
| | *Emission during use and disposal* | Releases to land, water and air from use and disposal |

Source: Verfaillie, Hendrik A and Robin Bidwell, "Measuring Eco-efficiency: A Guide to Reporting Company Performance", WBCSD Press, 2001 [14].

Also, some example indicators classified into the categories of "value indicators" and "environmental influence indicators" include the following:

- Value indicators
- EBIT (profit before interest expense and income tax)
- Gross margin
- Value added
- Environmental influence indicators (in both creation and use of goods/services)
- Priority heavy metal (PHM) emissions to surface water
- Waste to landfill
- Waste to incineration
- Photochemical oxidant creation
- Eutrophication emission to surface water
- Chemical oxygen demand (COD) to surface water
- Packaging
- GHG emissions from purchased electricity

Preparing and Reporting Information

Gathering and preparing eco-efficiency is not straightforward because no well-established methodologies are available. Flexibility in the framework of measuring and reporting eco-efficiency also brings about fuzziness and vagueness. Environmental performance includes diversified parameters corresponding to different impacts and which are still not broadly accepted. Through a pilot program on the subject of reporting eco-efficiency incorporating over twenty member companies in many countries, the WBCSD identified and proposed the following key issues to be taken care in preparing an eco-efficiency profile of a company or operation:

- Selection of Boundaries
- Data Availability
- Sensitivity and Error
- Transformation and Conversion
- Aggregation
- Interpretation and Benchmarking

Briefly speaking, boundaries of data to be selected and compiled need to be identified at first. Sensitivity and error accompanied with the data imprecision or inadequacy should be taken into account. It is also important to offer some perspective on issues such as the scope and limitations of the indicators so that the readers can fully understand the essence of the report. Besides, details are usually aggregated into smaller amount of items, yet the aggregation should not obscure important information about an enterprise's eco-efficiency performance. As for the issue of benchmarking, external users of eco-efficiency information intend to make comparisons between companies and over time. However, the diversity of business and the specific circumstance of individual companies should be addressed and hence only comparisons among companies providing the same product/service are acceptable.

Actually, there are no official rules for reporting eco-efficiency information of a company. However, some elements of a company's eco-efficiency profile were summarized by WBCSD. They are [14]:

- Organization profile
- Value profile
- Environmental file
- Eco-efficiency ratios
- Methodological information

The content and these elements is presented in Table 4. Also, the trends of eco-efficiency over time are important and should be reported, preferably using figures. In addition, a verification statement might be included if a third party review were undergone.

**Table 4** The Elements of a Company's Eco-efficiency Profile

| |
|---|
| Organization profile |
| Company name |
| Business segments |
| Report for |
| System boundaries |
| Number of employees |
| Internet |
| Contact for additional information |
| Value profile |
| GAI |
| Mass of product sold |
| Net sales |
| BSI |
| Value added |
| Gross margin |
| EBIT |
| Environmental profile |
| GAI |
| Energy consumed |
| Material consumed |
| Water consumed |
| GHG emissions |
| ODS emissions |
| BSI |
| Electricity consumed |
| GHG from upstream electricity generation |
| Natural gas consumed |
| Eco-efficiency ratios |
| Mass of product sold per |
| Energy consumption |
| Material consumption |
| GHG emissions |
| Net sales per |
| Energy consumption |
| Material consumption |
| GHG emissions |
| Methodological information |
| ISO 14,031 was used to identify relevant aspects of our business activity and to select respective meaningful indicators. |

1. GAI means generally applicable indicators; BSI means business specific indicators.
2. The BSI's listed in this table are just examples

Examples of Eco-efficiency Reports

In the preceding, the information concerning the framework, the indicators together with their classifications, and the critical issues have been introduced and discussed. In this section, case studies were presented to demonstrate the practices of reporting eco-efficiency.

Example Profile Format

The key elements discussed in the preceding were presented in Figure 2 using the format suggested by WBCSD. This format was designed to incorporate all necessary information in a single sheet of paper, which is eco-efficient.

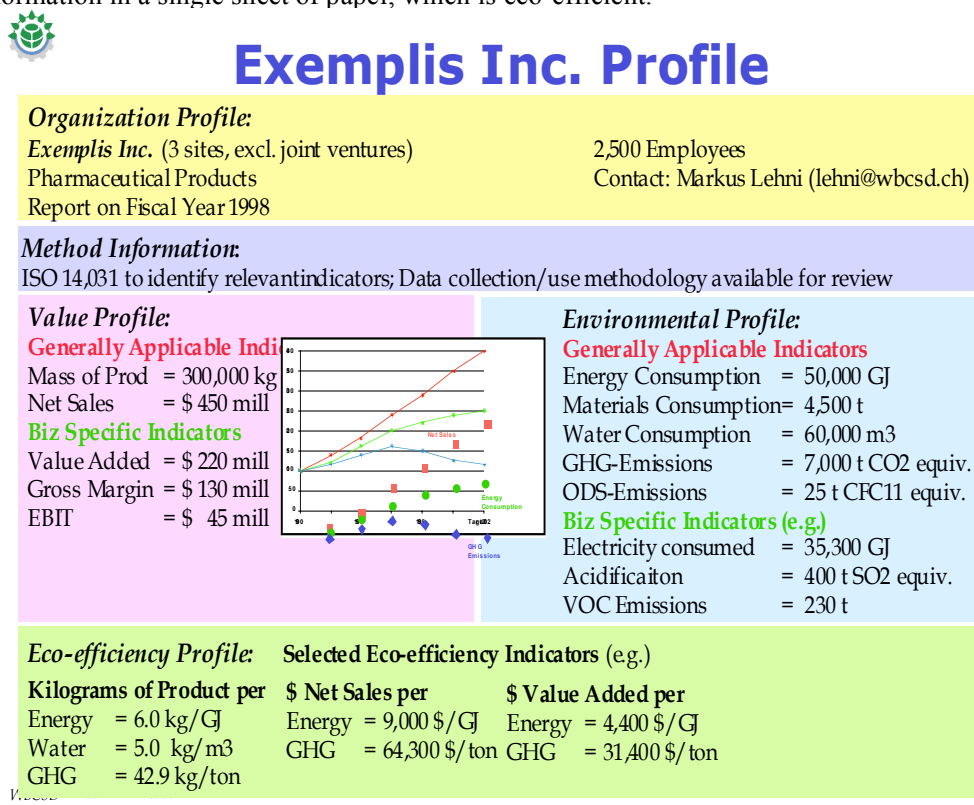



**Figure 2** The Example Format for Reporting a Company's Eco-efficiency Using a Single Sheet (from Lehni, Markus, "Eco-efficiency Indicators Concept Reporting Format", WBCSD [16])

An Eco-efficiency Report of Several Taiwanese Semi-conductor Manufacturers [17]

- Introduction
- Background Information
- Framework for Eco-efficiency Indicators

| **Environmental GAI** | |
|---|---|
| aspect | Indicator |
| Energy consumption | Electricity consumption |
| | Fuel oil consumption |
| | Natural gas consumption |
| Material consumption | Acid consumption |
| | Organic material consumption |
| | Developer |
| | light resistor |
| Net water consumption | Potable water consumption |
| | Water bought from other sources |
| GHG emissions | PFCs emissions ($CO_2$ equivalents of CF4, NF3, C2F6, SF3, C3F8) |

| **Environmental BSI** | |
|---|---|
| Acidification emissions | HF |
| | HCl |
| | $H_2SO_4$ |
| | $SO_3$ |
| VOC emissions | Total organic carbon |
| Sludge | $CaF_2$ |
| Economic GAI | |
| Number of product | Chips |
| Economic BSI | |
| Unit value per employee | $/employee |

- Example Eco-efficiency Analysis

Two Eco-efficiency ratios, "NT$ sold/KWH electricity" and "Million NT$/tonne water", were computed and demonstrated in Figure 3.

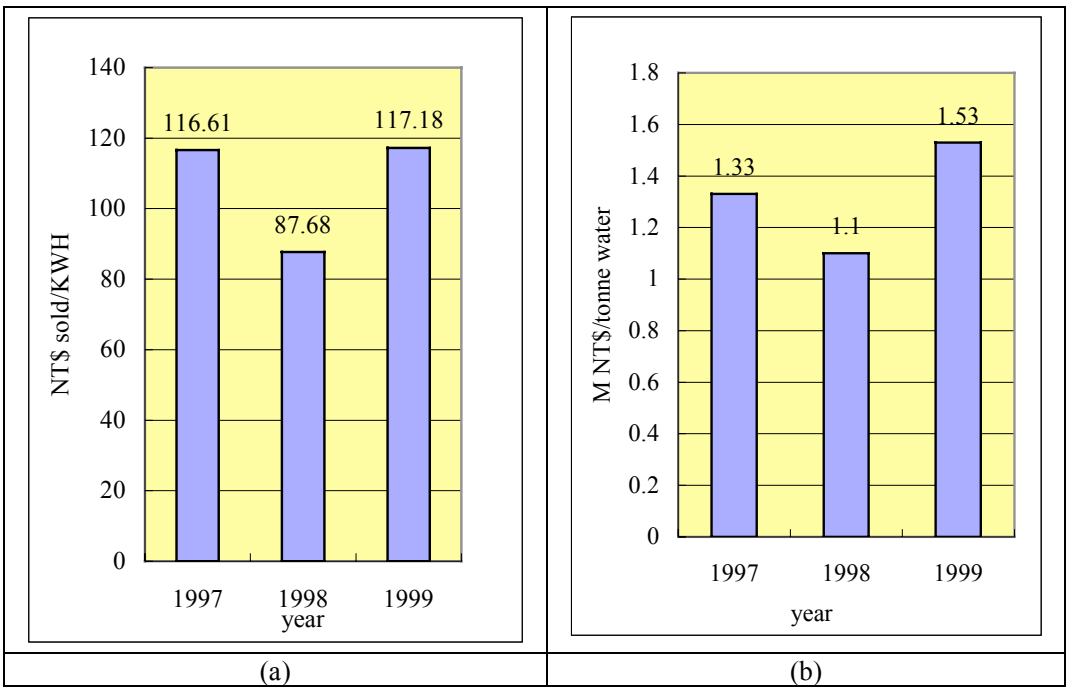



**Figure 3** Two Eco-efficiency Ratios of Several Semi-conductor Manufacturers in Taiwan from 1997 to 1999.

## CONCLUSION

The environmental sustainability index (ESI) developed by the World Economic Forum (WEF) was examined and the ESI score of Taiwan in the year of 2000 was derived in this study. Taiwan's ESI score of 60.4 would be ranked the 23rd in 123 countries all over the world if Taiwan were in the list. High correlations between Taiwan's ESI score and the WEF Current Competitiveness Index score were also found, which is the same as the analysis performed for other countries.

Eco-efficiency was selected as one of the indicators contributing to the component of "social and institutional capacity" in the framework of ESI. The measurement framework of eco-efficiency was discussed in this paper. The sound principles and practical concepts were stressed to help readers understand the fundamentals and executive approaches with relatively limited time. Generally applicable and business specific indicators, together with the guidance on selecting the

later were also examined. The basic important practical implications for preparing an eco-efficiency profile of a company or operation were also introduced. The elements of a company's eco-efficiency profile were outlined and two local case studies were presented as examples for illustrating the powerfulness of eco-efficiency in helping local business attain both the economic and the environmental goals.

A significant amount of materials presented in this paper was integrated from many documents prepared by WBCSD, the BCSD of Taiwan, ROC, as well as the local member companies. Their efforts in developing, applying, and promoting eco-efficiency have contributed much to promising improvement in sustainability of the business as well as the society.

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# PART IV

# APPENDICES

**APPENDIX 1**

## WELCOME ADDRESS

**Mr. Nien-Hsiung Kuo**
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**Republic of China**

Mr. Yuji Yamada, Special Advisor to the Secretary General, Asian Productivity Organization
Mr. David K.P. Liu, Director General, NGO Affairs Committee, Ministry of Foreign Affairs of ROC
Mr. Bao-Cheng Chang, General Manager, China Productivity Center
Distinguished Guests, Ladies and Gentlemen

Good Morning.

I am greatly honored to have an opportunity of meeting all of you this morning gathered at the opening of APO's Forum on B2B Cooperation on Electronic-Eco-Commerce.

On behalf of Dr. Yen-Shiang Shih, Director General of IDB, I wish to welcome you all to this forum. Prior to my departure from my office this morning, Dr. Shih asked me to convey his apology to you for not being able to come due to a schedule conflict. Dr. Shih has also asked me to express our sincere appreciation to APO, represented by Mr. Yamada for bringing this important program to Taipei.

Many of you traveled for thousands of miles from overseas. I would like to extend my warmest personal welcome to you to the beautiful island of Taiwan.

Ladies and gentlemen, we gather here today at the time when we just entered the 21st Century. The Asia-Pacific Region, like the rest of the world is experiencing the multiple problems of environmental pollution and natural resources deficiency. Our precious natural resources and environmental assets are being depleted faster than they can be restored. If we continued on the same pattern of economical development without paying proper attention to environmental conservation, the natural resources that we enjoy today would no longer be available for the future generations.

Like many countries in the region, Taiwan experienced serious environmental degradation due mainly to fast industrial development and lack of proper environmental management in 1980s. In recent years, however, we have witnessed a substantial progress in the environmental performance of our industries. Thanks to improved regulatory enforcement and proper incentives and assistance provided by government agencies, we have seen a substantial improvement in both the altitude and performance of environmental management by our industries.

Over the past forty years, the industrial sectors in this country have undergone a tremendous transition. We moved from a focus of consumer commodity industries and light industries in 1950s and 1960s, to capital and technology intensive industries in 1970s, and to high-technology industries in 1980s and 1990s. The industry is now being upgraded to raise the level of technology and to speed up the development of high-technology sectors. I am proud to say that IDB has played a pivotal role to make such transition a reality.

The rapid industrialization in Taiwan not only brings us with added wealth, but also the problems of environmental damages and resource depletion. To avert the negative trends on the environment, IDB has worked very hard to assist our industry to improve their environmental performances. We have assisted our industry over the past two decades by providing technical assistance and financial incentive programs on numerous topics such as industrial waste minimization, ISO 14000, corporate synergy system, and occupational health and safety. All these elements are important parts of GP currently being promoted by APO.

The environmental management in our industrial sector is now being implemented with an emphasis on Green Productivity measures. That means, instead of end-of-pipe treatment, we encourage our industries to adopt GP concept by preventing waste generation at source and by practicing water and energy conservation. We have many successful cases to prove that adopting GP can greatly reduce pollution control costs, and at the same time increase profits and efficiencies.

The Green Productivity (GP) concept currently being promoted by APO is indeed very closely related to our job at IDB. We are one of the key agencies in the country responsible for development and implementation of strategies to upgrade our industrial sectors. The essence of our strategy these days is to improve production efficiency through quality improvement, cost reduction and environmental enhancement. All these are very much in line with the GP concept adopted by APO.

To meet the needs of our industry, we constantly adjusted the focus of our environmental programs. I wish to point out to you that we are now in the process of developing the policy and strategy to develop eco-material industry and to promote green purchasing by both public and private sectors. The electronic-eco-commerce, the main theme of the forum this week in Taipei, will certainly be one of the key topics of our agenda in the near future.

Ladies and gentlemen, Taiwan formally enters WTO only nine days ago on November 11 following a lengthy application process lasting for 12 years. As we now become a partner of global trade, it is our responsibility to make sure that our products and services are produced in accordance with the international practices. It is under this spirit that this forum is being organized this week.

Ladies and gentlemen, over the last twenty years, in the process of developing capabilities in industrial technologies and environmental protection, we are very grateful to have many opportunities to work with APO in many projects designed to promote the GP concept. These include GP demonstration projects, the GP promotion workshops, for example. Additionally, many of our experts have been invited by APO to serve as resource person for GP promotion in the region.

The cooperation between APO and IDB is being brought to a new dimension recently by the creation of International Green Productivity Association, IGPA here in Taipei. With a support from IDB, IGPA has begun to operate in Taipei since late 1999. The organization is still at an early stage of development, mainly in defining its roles and seeking for participation. When it is fully developed, I am certain the association will closely work together with its members and APO and NPOs (National Productivity Organizations) to bring the GP promotion to a new height.

Ladies and gentlemen, IDB strongly endorses APO's program in promotion of the GP concept. My agency pledges to continue to work together with APO on GP promotion in the region. Additionally, we also pledge to continue support the programs of IGPA.

Finally, I wish to express our gratitude to Ministry of Foreign Affairs of ROC, represented here by Mr. David K.P. Liu, Director General, NGO Affairs Committee, for the opportunities of working together with you on this program. I wish to thank CPC, represented here by Mr. B. C. Chang, General Manager, and Taiwan Environmental Management Association, for implementing this forum.

I wish also to say thank you to all resource persons from overseas and domestic organizations for providing timely and important information through lectures, and staff of CPC and IGPA to carry out the tasks of organizing this forum, and to Ford Lio Ho Company for allowing the participants to visit its facilities during the course of this event.

To the course participants from overseas and from domestic firms, I wish all of you a wonderful time in the next few days acquiring new skills and knowledge and making new friends. To the participants from overseas it is also my hope that you will enjoy your time while in Taiwan and share with us your experience from your countries. It is my sincere hope that we could do more to learn from each other to find better approaches to protect our environment and to achieve sustainable development in the region.

I thank you again for the opportunity of meeting with you. I wish the forum a great success and the best of luck to you all.

**APPENDIX 2**

## WELCOME ADDRESS

**Dr. Pao-Cheng Chang**
**President, China Productivity Centre**

There has been much discussion on the beneficial effects of new technology, particularly in terms of improved speed and productivity. There has been much less focus on the potential for improvement in other areas, such as green procurement and production. Our forum is designed to move towards addressing that imbalance. In this sense, our primary concern is the need for the latest technological advancements to enable substantial economical development i.e. the factors to consider with regard to environment protection and related matters.

Improved communication makes possible a greater level of improvement and reaction at the different points of the production process, which would previously have been impossible. In other words, more consumers are now becoming aware of environmental concerns and producers are recognizing the increased importance of eco-design, material reuse, and recycling. This is also the case with the manufacture of product parts that are increasingly reusable and biodegradable. The difficulty of green production in the past, such as that relating to the green supply chain, prohibited such developments. These obstacles have been overcome with the development of information technologies that bring firms closer together in strategic alliance for mutual benefit.

The APO has long been a promoter of Green Productivity and has organized a number of projects in member countries in Taiwan. For example, Ford Lio Ho company has participated in the GPDP demonstration plant that makes wide use of green materials. Green production will increase its considerable new outputs and pose new challenges but also greater benefit to the world we live in. As such, it should be embraced wholeheartedly and built upon.

Through the various paper presentations, panel discussions and group activities, this forum is designed to allow the sharing of difference experiences in the promotion of Green Productivity. Many of these ideas and approaches have proved successful at different stages of national economic development for many APO members.

Participants shall discuss the different papers and seek to identify the approach that is most suited to the needs of their own countries. Active participation and sharing are of crucial importance. A successful program is one where people take part and learn something that they can take home with them and usefully apply in their work. We thank the APO for providing resource persons and all those local contributors to the forum.

**APPENDIX 3**

## OPENING ADDRESS

**Mr. Yuji Yamada**
**Special Adviser to the Secretary-General**
**Asian Productivity Organization**

Mr. Nein-Hsiung Kuo, Deputy Director General of Industrial Development Bureau of the Ministry of Economic Affairs, the Government to the Republic of China
Dr. Pao-Cheng Chang, President of China Productivity Center
Dr. Shen-yann Chiu, Executive Secretary of Taiwan Environment Management Association
Mr. Frank J. S. Pai, APO Liaison Officer for the Republic of China
The Resource Persons for this Forum
And all the delegates from the APO Member Countries;

A very good morning to you all.

At the outset, on behalf of the APO Secretariat, I would like to extend my very warm welcome to all of you for attending the Forum on B2B Cooperation on "E2Commerce". I would also like to extend my grateful appreciation to the China Productivity Center (CPC) and the Taiwan Environmental Management Association (TEMA) for making such excellent arrangements for this important event.

As an inter-governmental regional organization devoted to productivity improvement, the APO, for the past forty years, has been endeavoring to service its 18 member nations in the Asia-Pacific Region for promoting sustainable socio-economic development, mainly through human resources development in the agriculture, industry and service sectors.

Today, we all know that the efforts to increase productivity would come to naught, unless it is accompanied with simultaneous improvement of the environment. Therefore, the APO since its inception in 1961 has been paying due attention not only to productivity improvements but also to environmental preservation. This effort of the APO was further strengthened in the wake of the Rio Earth Summit in 1992 by instituting the Green Productivity (GP) program in 1994 with the belief and conviction that the key challenges to implementing the Agenda 21 is to promote the organic integration of environmental protection with productivity enhancement.

We are all aware that we have been placed in a situation to more squarely tackle the increasing trend towards economic globalization, as exemplified by ever-intensifying inter-dependence, faster technology advancement, and the resultant keener, and sometimes, even cut-throat competitions. All these phenomena have compelled us to more proactively employ practical ways and means for environmentally sustainable development on one hand, while being productively competitive in the global market, on the other hand.

Today, we are not only faced with the pressing demand from the market for integrating environmental concerns with productivity endeavor, but also we are confronted with the challenges for pushing forward business with speed in this age of changes. There are a growing number of companies world-wide who have made their

firm commitment for betterment of the environment, that have led to establishment of pragmatic and effective environmental management systems. All such initiatives on the part of private sector corporations are backed up by their firm conviction that the pre-requisite for sound corporate management is not only to improve their financial and environmental performance, but, also more importantly to contribute to promoting social fairness through business competition based on the practice of fair trade. This is the very essence of the concept of Green Productivity that the APO has been advocating.

To set this idea into motion in concrete terms, the APO together with the CPC planned and organized the "Top Forum on GP - as Management Strategies for Enhancing International Competitiveness by Greening the Supply Chain" in Taipei, Republic of China in the year 2000, in this same venue. The forum concluded that the greening of the supply chain is one of the very important management strategies to adopt, as it is directly related to the productivity and the overall business competitiveness with an ultimate aim of achieving environmental sustainability.

To green or to "greenize" the supply chain, the first and foremost importance is to produce green product and services. Then only, we can meet the expectation of the market for greenizing the supply chain. For this end, the APO has been putting in all our efforts through its GP programs. If the business partners lack in their capacity and capability to satisfy the market demand for such green products and service, the efforts to achieve our GP goal would end in vain. The current situation that we observe, however, gives us an encouraging and promising sign. With the incessant and untiring efforts being made by private sector corporations, a hoard of green products and services are now coming up in the market. How to more efficiently and effectively market them domestically as well as globally is the issue that we have now to address.

Fully appreciating the fast advancing Information Communication Technology (ICT), especially, in the area of INTERNET at a global level, it is only natural that we should take the maximum advantage for this technology in greening the supply chain. Hence, this Forum.

We see today that business corporations in this region are using Information Communication Technology, and the related tools and strategies such as B2B and E-commerce to more vigorously meet the needs of consumers.

With the renewed interest in e-commerce and the recognition that the environment is an important element that needs to be taken into account while doing business, the APO believes that it is an appropriate time to promote B2B together with the issues of IT and the environment. Thus, the word “Electronic-Eco-commerce” or “E2-commerce” was coined to reflect this new interest. This is a new idea and we do hope many member countries will endeavor to implement E2 commerce. We believe that this forum would be a good avenue for discussing and deliberating on the new ideas relating to E2 and for formulating a mechanism or infrastructure for getting it operationalized in the area of greening the supply chain. Many larger companies together with SMEs could work out synergy for putting GP practices in place by employing electronic and eco-commerce for the benefits of all member countries. We must not overlook also the growing interest amongst the industries as well as the

governments to promote the use of electronic networking to boost international trade and E-commerce under the WTO framework.

B2B co-operation within the APO member countries is the cornerstone of the E2Commerce. Specifically, large companies from Japan, the Republic of China, India, the Republic of Korea, Singapore, etc could help their suppliers who are mainly SMEs in other APO member countries in meeting the challenges of the new millennium. Also, by adding the dimension of B2B cooperation, GP promotion could be further enhanced through the applications of Green Supply Chain by means of E2Commerce to achieve a win-win situation for both the large industries and SMEs in the region. As I mentioned earlier, I would like to stress here that crucial importance in the E2Commerce is first for us to be equipped with capability to produce green products and services and then consider how best to utilize ICT technology, but not the other way around.

I hope this Forum would provide you with the opportunities to interact and collaborate with one another on the emerging issues of GP and explore the possibilities and mechanisms for B2B cooperation for mutual benefits.

Before I conclude, let me once again extend my very warm welcome to all the participants for this Forum and look forward to a very stimulating discussion during the next few days. In particular, let me express my heartfelt gratitude to all the resource persons assemble here despite their busy schedule for sharing their experiences and wisdom. In earnest, I hope this Form will become a real form that will be sustained and continued on through ICT networking with each other for the cause of Green Productivity, ever after this meeting here. I would also like to thank once again CPC/TEMA for making all the arrangements. Last but not least, to all of you participating in this forum, I would wish you a very productive and enjoyable, pleasant stay in Taipei.

Thank you very much for your attention.

**APPENDIX 4**

# HIGHLIGHTS OF PANEL DISCUSSION I

***Issues and opportunities for B2B and E2Commerce***

Chairperson: Takashi Kiuchi
Panelist: Kenny Lee, B.G. Srinivas, Tak Hur, Dinesh Jain

*Issue 1: The challenge of making all the stakeholders realise that E2Commerce is a win-win situation*

E2Commerce has to be a win-win situation to all the stakeholders in the supply chain; customers, vendors, governments; environmental organizations must be able to use E2Commerce to achieve their objectives.

*Issue 2: Compatibility of business processes, systems and different cultures*

A standard or common platform has to be developed to make the diverse way of doing things compatible.

*Issue 3: Low level of understanding of the second 'e' in e2commerce*

The environmental issues are not so prevalent or dominant compared to the first 'e'. The stakeholders need to be educated that the other 'e' is equally important, if not more than, the electronic part of the 'e'.

*Issue 4: Mindset change amongst participants of E2Commerce*

The mindset change has to be the way the business is conducted. There has to be more of collaboration, more of trust than withholding the information.

*Issue 5: Security*

One of the utmost issue in the minds of organizations which are deliberating e-commerce.

*Issue 6: Cost barriers for small and medium scale enterprises*

The inherit capital which is required is a barrier by itself. There is another issue of technology obsolescence by itself.

**APPENDIX 5**

# HIGHLIGHTS OF PANEL DISCUSSION II

***How to achieve a win-win situation for financial and environmental performance for the SMEs through E2Commerce***

Chairperson: Ryoichi Yamamoto
Panellists: Tim Wu, Leong Choong Cheng, Takashi Kiuchi, B.G. Sriniivas,

The issues facing SMEs in implementing 2ECommerce:

*Issue 1: Financial constraints*
In general, most SMEs have limited financial resources to invest in new software and hardware involved in E2commerce.

*Issue 2: Limited technical knowledge*
Most SMEs lack the technical know-how outside of their core activities.

*Issue 3: Prevalence of day-to-day operations focus*
SMEs have their resources prioritized for day-to-day operation and troubleshooting rather than planning on more strategic issues. They have limited time to focus on strategic areas such as gaining competitive advantage from green products or E2Commerce.

*Issue 4: Security*
SMEs may be wary that their proprietary information will be compromised on e-commerce.

Four incentives that would make E2Commerce attractive to SMEs:

*Incentive 1: Compliance to customer demand*
Most SMEs are part of the stakeholders in the supply chain of a multinational. Multinationals can play as a catalyst E2commerce by insisting on environmental management standards and also to provide technical and operations assistance so that SMEs to comply with their requirements.

*Incentive 2: Compliance to legal requirement*
The government implement awareness campaign on the environmental protection. Carrot and stick method can be utilised where infringement will be punished while rewarding those SMEs that exceed the legal environmental requirements. The government can also provide financial and technical assistance to SMEs to comply with environmental demands.

*Incentive 3: Improvement in productivity and efficiency*
To help SMEs realise that adopting the e-commerce will improve their productivity and efficiency.

*Incentive 4: Achieve competitive advantage*
Achieving and maintaining environmental management standards and labels will enhance the image of the companies, and makes them more attractive to the increasing number of customers that demand green credentials.

**APPENDIX 6**

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**APPENDIX 7**

## PROGRAM AND SCHEDULE

**Forum on B2B Cooperation on "E2Commerce" (*Electronic-Eco-Commerce*)**

| **20 November 2001** | **Tuesday** |
|---|---|
| | Moderator**:** IGPA/CPC |
| 08:00 - 09:00 | Registration |
| 09:00 - 10:00 | Opening Ceremony<br>1. Welcome Address: Mr. Nein-Hsiung Kuo, Deputy Director General, IDB<br>2. Welcome Address: Dr. Pao-Cheng Chang, President, CPC<br>3. Opening Address: Mr. Yuji Yamada, Special Adviser to the Secretary-General |
| 10:00 - 10:30 | Group Photo and Tea Break |
| 10:30 - 11:00 | APO's GP Activities in the Region<br>Mr. Augustine Koh, Director, Environment Department |
| | Chairperson: Mr. Yuji Yamada |
| 11:00 - 12:30 | Green Productivity, B2B and E2 commerce: concepts and approaches<br>Speaker 1: Mr. Takashi Kiuchi, Chairman, E-Square, Japan<br>Speaker 2: Mr. B.G. Srinivas, Associate Vice President and Head - Enterprise Solutions, Infosys Technologies Limited, India |
| 12:30 - 13:30 | Lunch |
| | Moderator: Mr. Augustine Koh |
| 13:30 - 14:20 | Challenges in E2 Commerce<br>Mr. Leong Choong Cheng, Co-Founder, Vice President, Business Development, ECNET Limited, Singapore |
| 14:20 – 15:10 | Infrastructure Requirements of E2 Commerce<br>Mr. Dinesh Jain, Director-Asia Pacific, iS3C Consultancy Services Ltd, USA |
| 15:10 - 15:25 | Tea Break |
| 15:25 - 17:00 | Panel Discussion<br>Chairperson : Mr. Takashi Kiuchi<br>"Issues and Opportunities for B2B and E2 Commerce – Linking with other Initiatives"<br>Speaker 1: Mr. Kenny Lee, Senior Manager, Advanced e-Commerce Technology Laboratory, Institute for Information Industry, Taiwan<br>Speaker 2: Mr. B.G. Srinivas, India<br>Speaker 3: Professor Tak Hur, Dept. of Materials Chemistry & Engineering, School of Chemical and Biological Engineering, Konkuk University, Republic of |

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| | Korea<br>Speaker 4: Mr. Dinesh Jain, Director-Asia Pacific, iS3C Consultancy Services Ltd |
| 18:30 | Welcome Dinner |

| **21 November 2001** | **Wednesday** |
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| | Moderator: Mr. Leong Choong Cheng, Singapore |
| 09:00 - 09:45 | "The current status of e-Industry in Taiwan", Dr. Li-Chuan Chu, Deputy Executive Secretary, Science and Technology Advisory Group, Executive Yuan of ROC |
| 09:45 - 10:15 | "EMS: Issues, Opportunities in B2B Cooperation", by Mr. Raymond Leung, Taiwan Environmental Management Association, Taiwan |
| 10:15 -10:30 | Tea break |
| 10:30 - 11.00 | Corporate Synergy Systems (CSS) and "Experience of Using CSS to Promote GP", Dr. Shen yann Chiu, Taiwan Environmental Management Association |
| 11:00 - 11:45 | LCA and B2B, E2Commerce, Concept and Linkages: Prof. Tak Hur, ROK |
| 11:45 - 12:30 | "Eco-label & E2 Commerce" by Dr. Yu Ning, President, Environment and Development Foundation, Taiwan |
| 12:30 - 13:30 | Lunch |
| | Chairperson: IGPA |
| 13:30 - 17:00 | Site visit to Ford Lio Ho, Chung Li |

| **22 November 2001** | **Thursday** |
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| | Moderator: Mr. Frank Pai, CPC |
| 09:00 – 09:30 | GP as a Comprehensive Approach to Socio-Economic Productivity – linking GP with B2B and E2 commerce for eco-efficiency Services<br>By Dr. Ryoichi Yamamoto, Professor, Center for Collaboration Research and Institute of Industrial Science, University of Tokyo, Japan |
| 09:30 - 10:30 | Chairperson: Prof. Yamamoto, Japan<br>Panel Discussion: "How to Achieve a Win-Win Situation for Financial and Environmental Performance for the SMEs through E2 Commerce"<br>Panelist 1: Mr. Tim Wu, Director of Information and Technology, Ford Lio Ho Motor Company, Taiwan<br>Panelist 2: Mr. Leong Choong Cheng, Co-Founder, Vice President, Business Development, ECNET Limited<br>Panelist 3: Mr. Takashi Kiuchi, Japan<br>Panelist 4: Mr. B.G. Srinivas, India |
| 10:30 - 10:45 | Tea break |
| | Chairperson: Ms. Setsuko Miyakawa |

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| 10:45 - 11:20 | Case 1: Green Procurement:<br>"Green Product Development and Green Procurement of Matsushita Electric Group" by Mr. Nobuhisa Itoh, Director, Corporate Environmental Affairs Division, Matsushita Electric Industrial Co., Ltd., Japan |
| 11:20 - 12:10 | Case 2: Greening the Market through Eco-Manufacturing<br>"Even a Small Marketing Company can Lead in Greening the Market - an Effort by Fuji Xerox Office Supply (FOXS) by Mr. Hiroaki Koshibu, Corporate Statutory Auditor, Fuji Xerox Office Supply Co., Ltd., Japan |
| 12:10 - 13:10 | Lunch |
| | Chairperson: Mr. Augustine Koh |
| 13:10 -15:00 | Group discussion: "Green Supply and Procurement and its linkage to B2B and E2 commerce" |
| 15:00 - 15:15 | Tea break |
| 15:15 – 17.00 | Group Presentations |
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| **23 November 2001** | **Friday** |
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| | Chairperson: Mr. Mukesh Bhattarai |
| 09:00 - 09:45 | Case 3: E2 Commerce in Practice and its Future Implications to Businesses<br>"Industrial Ecology and Business Ethics", Mr. Takashi Kiuchi, Chairman E-square, Japan |
| 09:45-10:30 | Case 4: Toshiba's activities on ECP and Green Procurement by Mr. Seizo Doi, Chief Specialist, Environmental Protection Planning Division, Toshiba Corporation, Japan |
| 10:30 - 10:45 | Tea break |
| 10:45 - 11:30 | Case 5: Concept and Practices in Zero Emission, Eco-design and Eco Manufacturing by Mr. Hiroaki Koshibu, Japan |
| 11:30 - 12:30 | Case 6: EMS Success Stories<br>"Canon's Activities on the Environment" by Mr. Yasufumi Sato, GM of Environment Administration Div, Environment Engineering Center, Canon INC., Japan |
| 12:30 – 14:00 | Lunch |
| | Chairperson: Prof Tak Hur |
| 14:00 – 15:00 | Case 7: Eco-City 21: Concept, Principles and Practices<br>Mr. Takashi Kiuchi, Chairman, E-square |
| 15:00 – 15:15 | Tea break |
| 15:15 – 17.00 | Group Discussion: Eco-design and Eco-Manufacturing and E2: Implications for Business and Green Productivity |

| **24 November 2001** | **Saturday** |
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| | Chairperson: Mr. Dinesh Jain, India |
| 09:00 – 09:50 | Case 8: Eco-Design<br>"NEC's Eco Products Development" by Mr. Koji Yamaguchi, Vice President, Environmental Affairs, NEC Corporation, Japan |
| 09:50 – 10.40 | Case 9: Measurement for Sustainability<br>"Environmental Activities, concentrating on Green Purchasing at Overseas Affiliates" by Mr. Nobuo Hashizume, Director, Global Environmental Policy Office, Seiko Epson Corporation, Japan |
| 10:40 – 11:00 | Tea break |
| 11:00 – 12:00 | Case 10: Measurement of Sustainability and Eco-efficiency by Prof. Shin-Cheng Yeh, National Kaohsiung Normal University, Taiwan |
| 12:00 - 13:00 | Lunch |
| 13:00 - 15:00 | Chairperson: Prof. R. Yamamoto<br>Group Discussion: The Way Forward<br>"How to Benefit from B2B and E2commerce - Immediate and long term plans" |
| 15:00 - 15:15 | Tea break |
| 15:15 –16:15 | Chairperson: Prof. R. Yamamoto<br>Group Presentations followed by a panel discussion |
| 16:15 – 16:45 | Panel Discussion:<br>Chairperson: Prof. R. Yamamoto<br>All speakers - about 5 minutes each<br>Mr. Nobuo Hashizume, Japan<br>Mr. Koji Yamaguchi, Japan<br>Mr. Mr. Dinesh Jain, India |
| 16:45 - 17:15 | Closing (CPC/APO) |
| 18:30 | Farewell Dinner (hosted by IDB) |