1. Application of JEPIX to Nikkei 225 Japanese Companies

Creation of Environmental Indicator for Investors

Prof. Dr. Nobuyuki Miyazaki

Dr. Kentaro Azuma

With special thanks to Tomoki Sakuma and Ren Makino for their dedication

Preface

At the early stage of the environmental reporting and accounting – around the year of 2000 in Japan, it was something special that companies conduct environmental reporting and accounting. Companies could easily demonstrate their consideration to the environment by just conducting environmental reporting and accounting, and enhance their reputation in the market and society.

Current situation in Japan, however, looks drastically different. Environmental reporting and accounting have been widely accepted and practiced by Japanese companies. According to the research conducted by Ministry of Environment Japan, 1,011 companies publish environmental reports and 629 companies carry out environmental accounting in 2009, following their guidelines (MoE 2009). For the Japanese companies, environmental reporting and accounting is becoming more and more a part of their usual business.

Taking the current situation into consideration, it is not any more of interest if a company conducts environmental reporting and accounting or not. It would be more important to find out through their environmental reporting and accounting how much environmental impact has been actually caused and reduced by the company. Making use of the fact that there are so many environmental reports and quantitative data in those reports available in Japan, authors have decided to carry out a quantitative and comparative research on environmental impacts, basing on inventory data disclosed through the reports.

The results shown in this paper are rather provisional and authors plan to develop this research in the long term to the creation of environmental indicator for investors. There are many kinds of financial indicators available for investors such as ROE (return on equity), PER (price-earnings ratio), liquidity ratio and so on and so on. Investors consider these indicators when they make decisions and these indicators thereby influence the price of stocks.

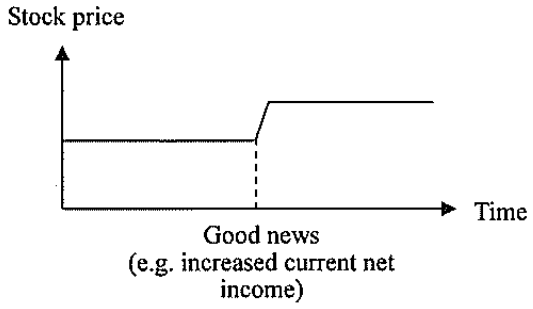
But if it comes to environment, there is actually no generally accepted and useful indicator available for investors. One of the reasons for this may be that there had been not much information on environment disclosed and this had been hindering the empirical studies. Now the situation is changing at least in Japan. This research describes what can be and what cannot be done with current situation of environmental reporting and accounting in Japan.

Chapter 1
Purpose and structure of this paper

Investors place top priority on reaping economic benefits in stock market. They focus on maximizing their economic profits to be gained from investment activities by analyzing and interpreting a wide variety of financial & non-financial indicators. All of the investment activities reflect the desire of investors to the economic benefits.

Good news which informs investors of prospect of getting return from a company set off a buying order and pulls the stock price of the company. On the other hand, investors punch in a sell order when the company announces bad news which indicates that they could suffer an economic loss. For example, the announcement that a company has increased current net income is good news for investors since it possibly increase investors' gain, and thereby the stock price of this company regularly goes up ceteris paribus.

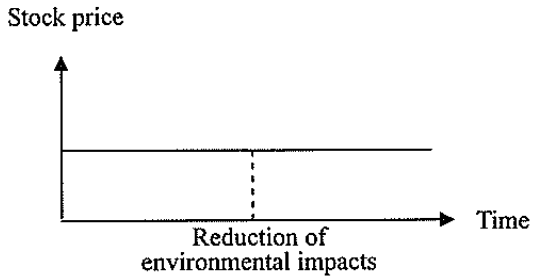
Fig.1.1 Stock price movement by good news



How could the news about environmental impacts of companies affect the stock price then? Present corporate activities, which consume a large amount of energy and put out a lot of pollutants, thereby could not maintain economic growth in the future, let alone achieve the sustainable economic progress. From this standpoint, the reduction of environmental impacts generated from corporate activities should be good news for the investors if they hold a long term perspective.

It is still the case that investors do not regard corporate environmental data as useful information for the investment decision making though many companies disclose quantitative information on environmental impacts in their environmental or CSR reports.

Fig.1.2 Stock price movement by the reduction of corporate environmental impacts



We observe that such information currently does not affect stock price and this is the departure point of this paper. Stock price is a quite important indicator for the main stakeholder such as creditors and investors as it reflects corporate value. The companies' motivation for reducing environmental impacts may depend on whether the effort has a positive impact on the stock price. Furthermore, the situation that only financially excellent companies gain higher stock price, should not be acceptable. Hence mechanism should be established which translates the changes in environmental impacts into the stock price, with the aim of encouraging companies to reduce environmental impacts.

One of the reasons why changes in environmental impacts currently does not affect stock price is because there is no environmental indicators which are considered by investors on their decision makings. Environmental costs, eco efficiency and other environmental indicators which grasp environmental aspects of companies, have been developed and have become widely used by Japanese companies. However, these indicators are not originally developed for decision making outside the company, especially by investors. There can be a new eco indicator created for investors´ decision makings. Creation of such an index could encourage companies to reduce their environmental impacts through stock price.

The purpose of this paper is to explore the possibility for a creation of new environmental indicator which could be used for investment decision making, combined with other existing financial indicators such as ROE (return on equity), PER (price-earnings ratio), R&D (research and development) cost and so on. For that purpose, an extensive research on environmental impacts infomation disclosed by Japanese companies through their environmental reports was conducted. Basing on the findings obtained through the analysis, this paper discusses obstacles standing before the creation of such environmental indicator for investors.

Chapter 2 outlines procedure followed to analyze quantitative data in environmental reports. To carry out impact assessment on the inventory data JEPIX (Japan Environmental Policy Index) was applied (2.1). 225 companies listed in Nikkei 225 Index has become the target of this research in

order to collect various industrial sectors and their data on environmental impacts (2.2)[1]. Corporate inventory data were extracted exclusively from environmental reports and there was no individual interview carried out for collection of the data (2.3). The result of the analysis is given as a Tab. 2.1 (2.4).

The results given in the chapter 2 contains still difficulty in terms of comparability between companies. Among obstacles to overcome, chapter 3 deals with boundary issues. Inventory data disclosed in environmental reports differ in their boundaries. This issue becomes complex as boundary issues can be discussed from 4 different perspectives; organizational boundary (3.1), value chain boundary (3.2), business portfolio boundary (3.3) and material boundary (3.4). Lastly, concluding remarks (chapter 4) and bibliography will be provided.

[1] Among 225 companies within the Nikkei 225, 30 companies have not disclosed quantitative data of environmental impacts which is necessary for analyzing it with JEPIX and indeed the other 185 companies have provided the data in this paper.

Chapter 2
Procedure and results of environmental impact calculation

This chapter deals with the procedure followed in this research to calculate corporate environmental impact. Firstly, a tool for impact assessment used in this research, JEPIX, will be introduced. Secondly, target companies of this research, Nikkei 225, will be specified. Thirdly, method to collect environmental impact data will be confirmed. Lastly, the results and interpretation for them will be given.

2.1 Japan Environmental Policy Index (JEPIX)

Companies get involved in air pollutant emissions, water pollutant emissions and other categories of environmental impact as well as greenhouse gas emissions. Even though company advocate the reduction of greenhouse gases as the single most important task at present situation for their environmental measures, they should not neglect other environmental impacts. From this standpoint, this paper employs impact assessment tool which enables weighting of different environmental categories.

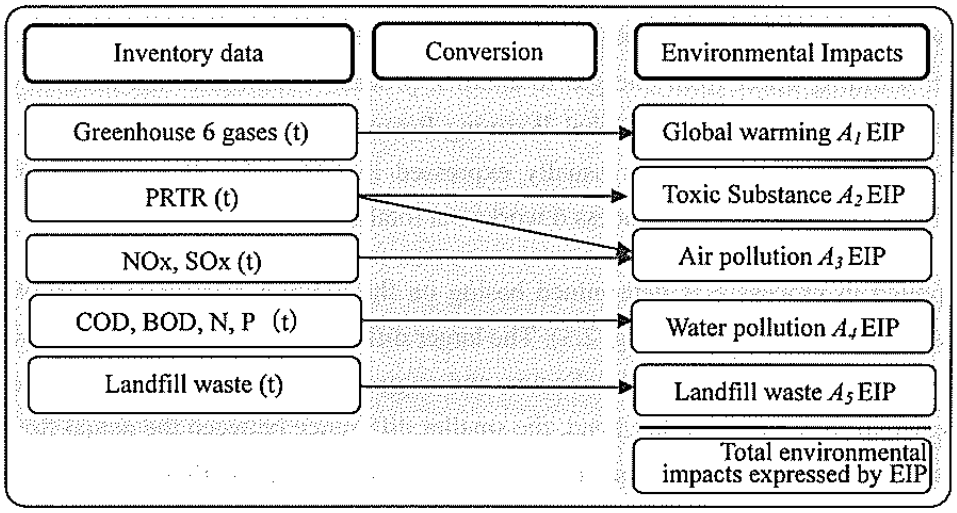
JEPIX (Japan Environmental Policy Index) is an impact assessment tool developed for Japanese companies.[2] JEPIX targets greenhouse gases (6types of gases), PRTR, NOx, SOx, COD, BOD, N, P, and landfill waste as the environmental pollutants causing environmental impacts. These emissions indicated by physical units (e.g. ton) causing inventory data. Since the amount of environmental impacts per ton differ from one environmental pollutant to another, the inventory data are not comparable each other in terms of environmental impact.

JEPIX converts these inventory data into EIP (Environmental Impact Point) by adding weights to each inventory data in accordance with the distance to target. As a result, inventory data for different environmental categories can be compared and combined into total EIP. The inventory data are categorized into global warming, chemical pollution, air pollution, water pollution and landfill waste through the conversion process (See Fig. 2.1).

---

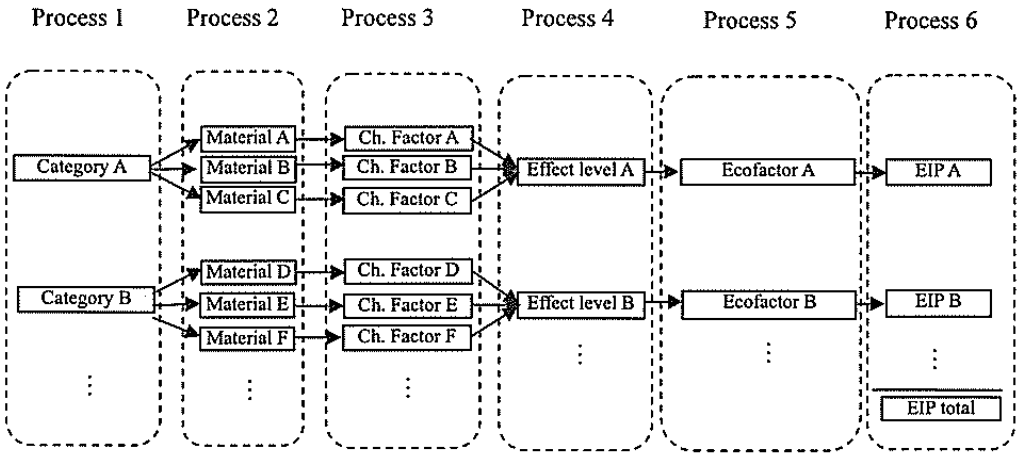
[2] For detailed information on JEPIX see Miyazaki et al. (2003). There is also JEPIX spreadsheet available for free of charge on the following websites cavailable only in Japanese.
http://www.jepix.org (JEPIX Website)
http://subsite.icu.ac.jp/coe/ (International Christian University Website)
http://www.kpmg.or.jp/profile/azsus/ (KPMG AZSA Sustainability Co., Ltd. Website)

Fig. 2.1 Technical character of JEPIX



The conversion of JEPIX has 6 processes (See Fig. 2.2) as follows. Process 1 determines 5 categories of the environmental impacts which are global warming, chemical pollution, air pollution, water pollution and landfill waste. Process 2 recognizes the environmental pollutants as inventory data in each category. Process 3 multiplies the inventory data by characterization factors that give effect levels (process 4). Process 5 multiplies effect level by EcoFactors and finally process 6 works out EIP.

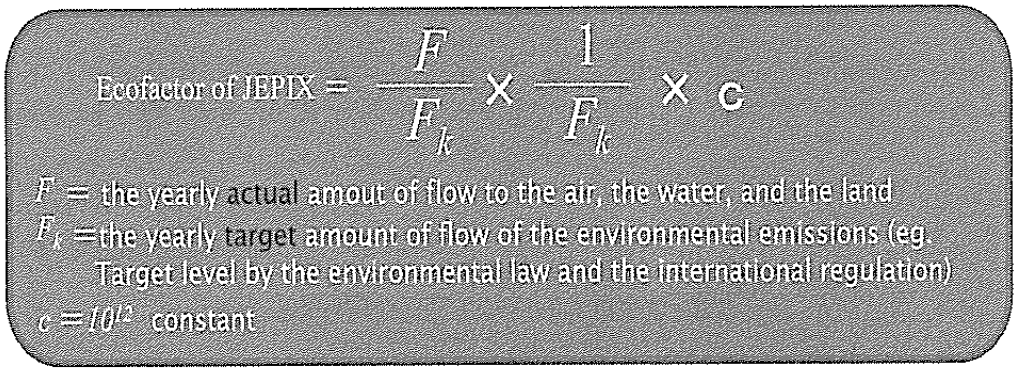
Fig. 2.2 computation method of JEPIX



To take global warming as an example, process 1 sets up the category of global warming and process 2 collects the inventory data measured in quantitative unit (e.g. ton, kg) of 6 gases including CO_2 that have potential to cause global warming. Since the effect of greenhouse gases per unit against global warming differ from one gas to another, process 4 multiplies the inventory data by characterization factor that is GWP (Global Warming Potential) in this case, and calculates effect level to the global warming which is usually expressed in CO_2-t. Finally process 5 multiplies amount of effect by EcoFactors and process 6 works out total EIP.

EcoFactor applied in process 5 is determined basing on the method developed by BUWAL, and calculated by the following formula (Fig. 2.3). The larger difference between the actual flow (F) and the target flow (Fk) gives the higher EcoFactor, and suggests the more urgency that we have to downsize the actual flow. On the other hand, the smaller difference between the actual flow and the target flow shows the lower EcoFactor and it indicates that the actual flow is less urgent to be reduced.

Fig. 2.3 Calculating method of EcoFactor



Incidentally, JEPIX has been developed of its theorization and practice by working with a number of companies who are the members of JEPIX forum. (Fig. 2.4.)

Fig. 2.4 Participant companies of JEPIX Forum

Canon	Kao	Noritz
Sekisui Chemical	Suntory	Daikin Industries
Bosch Japan	Komatsu	Ajinomoto
Alps Electric	Yamatake	Taiheiyo Cement
Mitsubishi Estate	Tokyo Gas	All Nippon Airways
Railway Technical Research Institute	Asahikasei	Toshiba
Fujifilm	Terumo	Sumitomo Chemical
J-POWER(Electric Power Development)	Kubota	Dai Nippon Printing
The Tokyo Electric Power	Fujitsu	Nippon Oil

2.2 Nikkei 225 as the target companie

We have targeted 225 companies listed in Nikkei 225 Index (See Fig 2.5) to figure out corporate environmental impacts for two reasons as follows. First, because this research is the first empirical survey for environmental indicator, it is preferable to cover as various industrial sectors as possible. In addition, given the feasibility of the work to collect and analyze corporate environmental impacts, we had to choose the portfolio from limited number of companies. The companies included in Nikkei 225 are given as Fig. 2.5.

Fig. 2.5 Nikkei 225 Index as of December 2007

Communications (7companies)
Sky Perfect JSAT Holdings
NTT Data
Nippon Telegraph and Telephone
NTT DoCoMo
KDDI
Yahoo Japan
Softbank

Shipbuilding (2 companies)
Mitsui Engineering & Shipbuilding
Kawasaki Heavy Industries

Steel Products (4 companies)
Nippon Steel
Sumitomo Metal Industries
Kobe Steel
JFE Holdings

Textiles&Apparel (6companies)
Toyobo
Unitika
Nisshinbo Industries
Teijin
Toray Industries
Mitsubishi Rayon

Nonferrous Metals (12 companies)
SUMCO
Furukawa
Mitsui Mining & Smelting
Toho Zinc
Mitsubishi Materials
Sumitomo Metal Mining
Dowa Holdings
Nippon Light Metal
The Furukawa Electric
Sumitomo Electric Industries
Fujikura
Toyo Seikan

Pulp&Paper(4 companies)
Oji Paper
Mitsubishi Paper Mills
Hokuetsu Paper Mills
Nippon Paper Group

Rubber Products (2 companies)
The Yokohama Rubber
Bridgestone

Gas (2 companies)
Tokyo Gas
Osaka Gas

Machinery (14 companies)
Okuma Holdings
Komatsu
Sumitomo Heavy Industries
Ebara Corp.
Chiyoda Corp.
Daikin Industries
NSK
NTN
JTEKT Corp.
Kubota Corp.
The Japan Steel Works
Hitachi Zōsen Corporation
Mitsubishi Heavy Industries
IHI

Construction (9 companies)
Comsys Holdings Corp.
Taisei Corp.
Obayashi Corp.
Shimizu Corp.
Kajima Corp.
Daiwa House Industry
JGC
Kumagai Gumi
Sekisui House

Automotive (9companies)
Mitsubishi Motors
Nissan Motor
Isuzu Motors
Toyota Motor
Hino Motors
Mazda Motor
Honda Motor
Suzuki Motor
Fuji Heavy Industries

Mining (1 company)
Inpex Corp.

Retail (5 companies)
Mitsui Fudosan
Mitsubishi Estate
Heiwa Real Estate
Tokyo Land
Sumitomo Realty & Development

Pharmaceuticals (8 companies)
Takeda Pharmaceutical
Astellas Pharma
Dainippon Sumitomo Pharma
Shionogi & Co.
Chugai Pharmaceutical
Eisai
Kyowa Hakko Kirin
Daiichi Sankyo

Trading Companies (7 companies)
Itochu Corp.
Marubeni Corp.
Toyota Tsusho
Mitsui & Co.
Sumitomo Corp.
Mitsubishi Corp.
Sojitz Corp.

Air Transport (2 companies)
All Nippon Airways
Japan Airlines

Other Land Transport (2 companies)
Nippon Express
Yamato Holdings

Marine Transport (3 companies)
Nippon Yusen K.K.
Mitsui O.S.K. Lines
Kawasaki Kisen Kaisha

Fishery(1 company)
Nippon Suisan Kaisha

Retail (7companies)
Fast Retailing
Aeon
Isetan
Seven & I Holdings
Takashimaya
Mitsukoshi
Marui Group

Warehousing (1 company)
Mitsubishi Logistics Corp.

Precision instruments (6 companies)
Nikon
Olympus
Terumo
Konica Minolta HD
Ricoh
Citizen Holdings

Oil&Coal Products (3companies)
Nippon Mining Holdings
Nippon Oil
Showa Shell Sekiyu

Chemicals (16companies)
Mitsubishi Chemical Holdings
Showa Denko
Sumitomo Chemical
Nissan Chemical Industries
Nippon Soda
Tosoh
Toagosei
Denki Kagaku Kogyo
Shin-Etsu Chemical
Mitsui Chemicals
Ube Industries
Nippon Kayaku Co
Kao
Asahi Kasei
Fujifilm Holdings
Shiseido

Railway/Bus (7 companies)
Tobu Railway
Tokyu
Odakyu Electric Railway
Keio
Keisei Electric Railway
East Japan Railway Company
West Japan Railway Company

Insurance (4 companies)
Mitsui Sumitomo Insurance
Sompo Japan Insurance
Millea Holdings
T&D Holdings

Banking (11 companies)
Sumitomo Mitsui Financial Group
Mizuho Financial Group
Shinsei Bank
The Chiba Bank
The Bank of Yokohama
The Shizuoka Bank
Mizuho Trust & Banking
The Sumitomo Trust and Banking
Mitsubishi UFJ Financial Group
Resona Holdings
Chuo Mitsui Trust Holdings

Glass & Ceramics (8 companies)
Asahi Glass
Nippon Sheet Glass
Sumitomo Osaka Cement
Taiheiyo Cement
Tokai Carbon
Toto
NGK Insulators
Nitto Boseki

Other Manufacturing (3 companies)
Toppan Printing
Dai Nippon Printing
Yamaha

Services (7 companies)
Toho
Tokyo Dome
Secom
CSK Holdings
Dentsu
Trend Micro
Konami

Securities (4 companies)
Daiwa Securities Group
Nomura Holdings
Shinko Securities
Nikko Cordial

Other Financial Services (2 companies)
Credit Saison
Mitsubishi UFJ NICOS

Shipbuilding (2 companies)
Mitsui Engineering & Shipbuilding
Kawasaki Heavy Industries

Electric Machinery (29 companies)
Advantest
GS Yuasa
Canon
Minebea
Casio Computer
Hitachi
Toshiba
Mitsubishi Electric
Fuji Electric Holdings
Meidensha
NEC
Fujitsu
Oki Electric Industry
Panasonic Electric Works
Tokyo Electron
Sharp
Sony
TDK
Sanyo Electric
Mitsumi Electric
Alps Electric
Pioneer
Clarion
Yokogawa Electric
Denso
Panasonic
Taiyo Yuden
Kyocera
Fanuc

Foods (12 companies)
Nisshin Seifun Group
Meiji Seika Kaisha
Meiji Diaries.
Nippon Meat Packers
Sapporo Holdings
Asahi Breweries
Kirin Brewery
Takara Holdings
Kikkoman.
Ajinomoto
Nichirei
Japan Tobacco

2.3 How to collect corporate inventory data

Corporate inventory data were collected exclusively through publicly disclosed environmental reports. These reports also include reports disclosed under names such as CSR Report, Sustainability Report and so on. There was no individual interview conducted for data collection.

Some of the companies has disclosed their reports only on the websites, and have not provided paper-based reports. In that case, either paper or web-based reports were used in this research.

In inventory data collection, issue of boundary rises. The current situation in terms of boundary is that each company discloses its inventory data according to the boundary which was set basically

by their own choice. That means for example that some company includes their emissions in foreign countries in their boundary and the others do not. This fact hinders comparison of data between the companies, and will be discussed more precisely in the next chapter. Here only the procedure followed to collect inventory data will be described. Inventory data were collected on the boundary set in environmental reports and there is basically no adjustment conducted. Only one adjustment conducted exceptionally was that we excluded emissions of logistics from their boundaries.

2.4 Results and interpretation

Tab. 2.1 is a ranking of the corporate environmental impacts with Nikkei 225 companies. It arranges the companies according to their total EIP in descending order.

The table shows global warming, chemical pollution, air pollution, water pollution and landfill waste as categories of environmental impacts. The environmental impact painted thickly in Tab. 2.1 accounts for the higher percentage relative to other categories of the company. For example, the percentage of environmental impacts of shipping company is led by air pollution followed by global warming and landfill waste.

The important issue of the boundary is that the total amount of environmental impacts would be larger when company conscientiously discloses their wide variety of environmental impacts. Therefore, more conscientious companies tend to come to the higher ranking in Tab. 2.1. The 40 companies who take 186th place may have generated environmental impacts though they have not disclosed quantitative environmental data so that JEPIX could not figure out their environmental impacts.

Table 2.1 Ranking of environmental impact

Unit: Million EIP

Industry Sector	Company Name	RANK	Total EIP	Global Warming	%	Toxical Substance	%	Air Pollution	%	Water Pollution	%	Landfill Waste	%
Marine Transport	Mitsui O.S.K. Lines, Ltd.	1	424,339	18,244	4.3%	0	0.0%	406,053	95.7%	0	0.0%	41	0.0%
Marine Transport	Kawasaki Kisen Kaisha, Ltd.	2	319,018	13,040	4.1%	0	0.0%	305,978	95.9%	0	0.0%	0	0.0%
Marine Transport	Nippon Yusen K.K.	3	311,048	15,705	5.0%	0	0.0%	295,341	95.0%	0	0.0%	2	0.0%
Pulp&Paper	Oji Paper Co., Ltd.	4	115,879	3,180	2.7%	0	0.0%	10,963	9.5%	98,707	85.2%	3,030	2.6%
Electric Power	The Tokyo Electric Power Co., Inc.	5	113,618	96,135	84.6%	0	0.0%	17,454	15.4%	0	0.0%	29	0.0%
Steel Products	JFE Holdings, Inc.	6	100,558	58,114	57.8%	13,395	13.3%	21,588	21.5%	3,941	3.9%	3,520	3.5%
Steel Products	Nippon Steel Corp.	7	78,035	65,994	84.6%	7,372	9.4%	611	0.8%	0	0.0%	4,057	5.2%
Electric Power	Chubu Electric Power Co., Inc.	8	73,538	62,823	85.4%	78	0.1%	7,235	9.8%	0	0.0%	3,403	4.6%
Electric Power	The Kansai Electric Power Co., Inc.	9	54,114	49,121	90.8%	106	0.2%	3,757	6.9%	0	0.0%	1,130	2.1%
Steel Products	Sumitomo Metal Industries, Ltd.	10	53,698	26,161	48.7%	6,882	12.8%	19,755	36.8%	0	0.0%	900	1.7%
Chemicals	Sumitomo Chemical Co., Ltd.	11	44,424	4,772	10.7%	2,390	5.4%	5,090	11.5%	32,167	72.4%	4	0.0%
Glass & Ceramics	Taiheiyo Cement Corp.	12	42,767	16,258	38.0%	0	0.0%	26,484	61.9%	0	0.0%	24	0.1%
Electric Machinery	NEC Corp.	13	37,715	2,206	5.9%	34,442	91.3%	1,050	2.8%	3	0.0%	13	0.0%
Chemicals	Ube Industries, Ltd.	14	37,593	3,290	8.8%	5,252	14.0%	15,920	42.3%	12,141	32.3%	990	2.6%
Chemicals	Nissan Chemical Industries, Ltd.	15	31,830	487	1.5%	0	0.0%	297	0.9%	30,917	97.1%	129	0.4%
Textiles & Apparel	Toray Industries, Inc.	16	29,172	4,275	14.7%	9,689	33.2%	2,537	8.7%	12,631	43.3%	40	0.1%
Pulp&Paper	Mitsubishi Paper Mills Ltd.	17	28,299	1,079	3.8%	0	0.0%	857	3.0%	25,248	89.2%	1,115	3.9%
Chemicals	Mitsui Chemicals, Inc.	18	27,626	5,457	19.8%	0	0.0%	3,321	12.0%	17,414	63.0%	1,434	5.2%
Chemicals	Tosoh Corp.	19	26,420	6,501	24.6%	1,994	7.5%	8,982	34.0%	8,878	33.6%	65	0.2%
Oil&Coal Products	Nippon Oil Corp.	20	22,846	13,002	56.9%	0	0.0%	8,156	35.7%	1,646	7.2%	43	0.2%
Nonferrous Metals	Mitsubishi Materials Corp.	21	22,619	9,016	39.9%	0	0.0%	9,933	43.9%	3,489	15.4%	181	0.8%
Electric Machinery	Toshiba Corp.	22	22,013	3,359	15.3%	13,112	59.6%	1,471	6.7%	3,462	15.7%	608	2.8%
Construction	Kajima Corp.	23	18,890	331	1.8%	0	0.0%	0	0.0%	0	0.0%	18,559	98.2%
Construction	Shimizu Corp.	24	18,447	259	1.4%	0	0.0%	0	0.0%	0	0.0%	18,187	98.6%
Nonferrous Metals	Mitsui Mining & Smelting Co., Ltd.	25	18,104	1,576	8.7%	15,242	84.2%	202	1.1%	0	0.0%	1,084	6.0%
Chemicals	Showa Denko K.K.	26	18,058	2,850	15.8%	3,883	21.6%	2,445	13.5%	8,742	48.4%	129	0.7%
Pulp&Paper	Nippon Paper Group, Inc.	27	17,798	8,697	48.9%	0	0.0%	7,928	44.5%	0	0.0%	1,173	6.6%
Steel Products	Kobe Steel, Ltd.	28	17,552	15,486	88.2%	0	0.0%	8	0.0%	0	0.0%	2,057	11.7%
Chemicals	Asahi Kasei Corp.	29	16,489	5,841	35.4%	0	0.0%	5,439	33.0%	4,440	26.9%	769	4.7%
Electric Machinery	Panasonic Corp.	30	14,551	2,029	13.9%	597	4.1%	1,881	12.9%	9,985	68.6%	59	0.4%
Glass & Ceramics	Asahi Glass Co., Ltd.	31	14,457	3,100	21.4%	0	0.0%	3,104	21.5%	6,962	48.2%	1,291	8.9%
Nonferrous Metals	Sumitomo Metal Mining Co., Ltd.	32	13,987	1,419	10.1%	4,138	29.6%	577	4.1%	226	1.6%	7,627	54.5%
Glass & Ceramics	Sumitomo Osaka Cement Co., Ltd.	33	13,829	2,811	20.3%	0	0.0%	11,018	79.7%	0	0.0%	0	0.0%
Textiles & Apparel	Teijin Ltd.	34	13,490	1,297	9.6%	664	4.9%	2,591	19.2%	8,932	66.2%	6	0.0%
Construction	Obayashi Corp.	35	11,724	260	2.2%	0	0.0%	259	2.2%	0	0.0%	11,206	95.6%
Railway/Bus	East Japan Railway Company	36	11,551	2,768	24.0%	1	0.0%	55	0.5%	0	0.0%	8,727	75.6%
Pharmaceuticals	Kyowa Hakko Kirin Co., Ltd.	37	9,519	699	7.3%	1,713	18.0%	541	5.7%	6,561	68.9%	5	0.1%
Chemicals	Mitsubishi Chemical Holdings Corp.	38	9,273	9,259	99.8%	0	0.0%	0	0.0%	0	0.0%	14	0.2%

Unit: Million EIP

Industry Sector	Company Name	RANK	Total EIP	Global Warming	%	Toxical Substance	%	Air Pollution	%	Water Pollution	%	Landfill Waste	%
Oil&Coal Products	Nippon Mining Holdings, Inc.	39	8,835	5119	57.9%	0	0.0%	3,650	41.3%	0	0.0%	66	0.7%
Construction	Taisei Corp.	40	8,701	3,122	35.9%	0	0.0%	1,178	13.5%	0	0.0%	4400	50.6%
Oil&Coal Products	Showa Shell Sekiyu K.K.	41	8,645	5437	62.9%	0	0.0%	2,990	34.6%	0	0.0%	219	2.5%
Pharmaceuticals	Takeda Pharmaceutical Company, L	42	8,564	453	5.3%	592	6.9%	446	5.2%	7003	81.8%	70	0.8%
Automotive	Nissan Motor Co., Ltd.	43	8,472	2,561	30.2%	3000	35.4%	2,911	34.4%	0	0.0%	0	0.0%
Air Transport	All Nippon Airways Co., Ltd.	44	8,041	7722	96.0%	0	0.0%	0	0.0%	0	0.0%	318	4.0%
Machinery	Komatsu Ltd.	45	7,965	282	3.5%	1,647	20.7%	2,455	30.8%	120	1.5%	3461	43.5%
Chemicals	Denki Kagaku Kogyo K.K.	46	7,513	168	2.2%	2,278	30.3%	4855	64.6%	0	0.0%	211	2.8%
Shipbuilding	Kawasaki Heavy Industries, Ltd.	47	6,667	309	4.6%	2,850	42.8%	3,069	46.0%	413	6.2%	26	0.4%
Nonferrous Metals	Dowa Holdings Co., Ltd.	48	6,223	1,205	19.4%	0	0.0%	0	0.0%	0	0.0%	5018	80.6%
Automotive	Honda Motor Co., Ltd.	49	6,056	457	7.5%	2,119	35.0%	3457	57.1%	0	0.0%	23	0.4%
Chemicals	Fujifilm Holdings Corp.	50	6,050	1,520	25.1%	0	0.0%	776	12.8%	3023	50.0%	731	12.1%
Textiles & Apparel	Kuraray Co., Ltd.	51	5,920	1,291	21.8%	308	5.2%	1,801	30.4%	2444	41.3%	75	1.3%
Textiles & Apparel	Mitsubishi Rayon Co., Ltd.	52	5,747	1,518	26.4%	0	0.0%	1,402	24.4%	2669	46.4%	158	2.8%
Nonferrous Metals	Nippon Light Metal Co., Ltd	53	5,597	1,197	21.4%	2655	47.4%	954	17.1%	409	7.3%	381	6.8%
Electric Machinery	Hitachi, Ltd.	54	5,460	2940	53.9%	0	0.0%	714	13.1%	866	15.9%	939	17.2%
Chemicals	Shin-Etsu Chemical Co., Ltd.	55	5,337	1,192	22.3%	0	0.0%	703	13.2%	3108	58.2%	334	6.3%
Automotive	Suzuki Motor Corp.	56	5,201	297	5.7%	1,976	38.0%	2928	56.3%	0	0.0%	0	0.0%
Automotive	Mazda Motor Corp.	57	4,261	432	10.1%	1971	46.3%	1,844	43.3%	0	0.0%	14	0.3%
Nonferrous Metals	SUMCO Corp.	58	4,252	575	13.5%	3493	82.2%	37	0.9%	0	0.0%	147	3.4%
Rubber Products	Bridgestone Corp.	59	3,988	848	21.3%	0	0.0%	2494	62.5%	0	0.0%	646	16.2%
Communications	Nippon Telegraph and Telephone Cr	60	3,721	3719	99.9%	0	0.0%	0	0.0%	0	0.0%	2	0.1%
Automotive	Fuji Heavy Industries Ltd.	61	3,711	223	6.0%	1,251	33.7%	1575	42.4%	662	17.9%	0	0.0%
Other Manufacturing	Dai Nippon Printing Co., Ltd.	62	3,643	1,106	30.4%	38	1.0%	2073	56.9%	315	8.6%	111	3.1%
Construction	Kumagai Gumi Co.,Ltd.	63	3,287	86	2.6%	0	0.0%	61	1.8%	0	0.0%	3140	95.5%
Electric Machinery	Sharp Corp.	64	3,267	1,435	43.9%	1504	46.0%	95	2.9%	223	6.8%	9	0.3%
Electric Machinery	Fujitsu Ltd.	65	3,210	1,132	35.3%	0	0.0%	1938	60.4%	0	0.0%	140	4.4%
Machinery	Kubota Corp.	66	3,058	544	17.8%	1,082	35.4%	1174	38.4%	166	5.4%	92	3.0%
Electric Machinery	Mitsubishi Electric Corp.	67	3,025	903	29.9%	945	31.3%	693	22.9%	1293	42.7%	64	2.1%
Textiles & Apparel	Toyobo Co., Ltd.	67	3,025	1220	40.3%	0	0.0%	1,218	40.3%	0	0.0%	587	19.4%
Electric Machinery	Sony Corp.	69	2,847	1,014	35.6%	1788	62.8%	45	1.6%	0	0.0%	0	0.0%
Other Manufacturing	Toppan Printing Co., Ltd.	70	2,832	756	26.7%	53	1.9%	1118	39.5%	792	28.0%	117	4.1%
Electric Machinery	Denso Corp.	71	2,693	894	33.2%	113	4.2%	480	17.8%	1181	43.9%	25	0.9%
Glass & Ceramics	Nippon Sheet Glass Co., Ltd.	72	2,599	721	27.7%	100	3.9%	1567	60.3%	46	1.8%	164	6.3%
Pulp&Paper	Hokuetsu Paper Mills, Ltd.	73	2,582	724	28.0%	0	0.0%	1418	54.9%	147	5.7%	293	11.3%
Other Land Transport	Nippon Express Co., Ltd.	74	2,517	1,157	46.0%	0	0.0%	0	0.0%	0	0.0%	1360	54.0%
Nonferrous Metals	Sumitomo Electric Industries, Ltd.	75	2,493	893	35.8%	247	9.9%	871	35.0%	0	0.0%	482	19.3%
Automotive	Toyota Motor Corp.	76	2,428	1576	64.9%	0	0.0%	0	0.0%	852	35.1%	0	0.0%

Unit: Million EIP

Industry Sector	Company Name	RANK	Total EIP	Global Warming	%	Toxical Substance	%	Air Pollution	%	Water Pollution	%	Landfill Waste	%
Automotive	Hino Motors, Ltd.	77	2,406	335	13.9%	626	26.0%	932	38.7%	0	0.0%	514	21.4%
Nonferrous Metals	The Furukawa Electric Co., Ltd.	78	2,392	2,246	93.9%	0	0.0%	135	5.7%	0	0.0%	10	0.4%
Textiles & Apparel	Unitika, Ltd.	79	2,207	400	18.1%	0	0.0%	644	29.2%	766	34.7%	397	18.0%
Mining	Inpex Corp.	80	2,180	246	11.3%	1,627	74.6%	29	1.3%	0	0.0%	278	12.7%
Retail	Aeon Co., Ltd.	81	2,100	1,293	61.6%	0	0.0%	0	0.0%	0	0.0%	807	38.4%
Precision instruments	Konica Minolta Holdings, Inc.	82	1,918	259	13.5%	275	14.4%	1,113	58.0%	263	13.7%	8	0.4%
Machinery	Daikin Industries, Ltd.	83	1,883	1,655	87.9%	79	4.2%	92	4.9%	56	3.0%	2	0.1%
Chemicals	Nippon Kayaku Co., Ltd.	84	1,842	108	5.8%	5	0.3%	115	6.2%	1436	78.0%	178	9.7%
Railway/Bus	Tobu Railway Co., Ltd.	85	1,733	384	22.2%	0	0.0%	0	0.0%	0	0.0%	1,349	77.8%
Railway/Bus	West Japan Railway Company	86	1,658	1,395	84.2%	0	0.0%	0	0.0%	0	0.0%	263	15.8%
Machinery	Mitsubishi Heavy Industries, Ltd.	87	1,623	535	33.0%	0	0.0%	132	8.1%	617	38.0%	339	20.9%
Glass & Ceramics	Tokai Carbon Co., Ltd.	88	1,586	680	42.9%	0	0.0%	698	43.4%	82	5.2%	136	8.6%
Foods	Nippon Meat Packers, Inc.	89	1,558	461	29.6%	0	0.0%	272	17.5%	0	0.0%	825	52.9%
Machinery	NSK Ltd.	90	1,436	430	30.0%	490	34.1%	508	35.4%	1	0.0%	7	0.5%
Railway/Bus	Odakyu Electric Railway Co., Ltd.	91	1,392	849	61.0%	0	0.0%	0	0.0%	0	0.0%	543	39.0%
Electric Machinery	TDK Corp.	92	1,368	359	26.2%	85	6.2%	924	67.6%	0	0.0%	0	0.0%
Electric Machinery	Sanyo Electric Co., Ltd.	93	1,361	760	55.9%	59	4.4%	225	16.5%	301	22.1%	15	1.1%
Chemicals	Tosgosei Co., Ltd.	94	1,197	80	6.7%	0	0.0%	318	26.6%	788	65.8%	11	0.9%
Communications	NTT DoCoMo, Inc.	95	1,171	1,094	93.5%	0	0.0%	0	0.0%	0	0.0%	76	6.5%
Electric Machinery	Canon Inc.	96	1,160	971	83.7%	58	5.0%	74	6.4%	0	0.0%	56	4.9%
Other Manufacturing	Yamaha Corp.	97	1,150	154	13.4%	668	58.1%	255	22.1%	1	0.1%	72	6.3%
Electric Machinery	Kyocera Corp.	98	1,120	415	37.1%	361	32.2%	253	22.6%	89	7.9%	2	0.2%
Foods	Nisshin Seifun Group Inc.	99	1,092	191	17.5%	0	0.0%	340	31.1%	22	2.0%	540	49.4%
Foods	Ajinomoto Co., Inc.	100	1,092	501	45.9%	6	0.6%	130	11.9%	0	0.0%	456	41.7%
Chemicals	Kao Corp.	101	1,063	460	43.3%	34	3.2%	342	32.2%	209	19.7%	18	1.7%
Communications	KDDI Corp.	102	990	932	94.1%	0	0.0%	0	0.0%	0	0.0%	58	5.9%
Precision instruments	Ricoh Co., Ltd.	103	982	927	94.4%	0	0.0%	51	5.2%	3	0.3%	1	0.1%
Nonferrous Metals	Toyo Seikan Kaisha, Ltd.	104	963	639	66.4%	81	8.4%	243	25.2%	0	0.0%	0	0.0%
Automotive	Isuzu Motors Ltd.	105	831	183	22.0%	251	30.2%	315	37.8%	82	9.8%	1	0.1%
Other Land Transport	Yamato Holdings Co., Ltd.	106	715	452	63.2%	0	0.0%	0	0.0%	0	0.0%	263	36.8%
Pharmaceuticals	Eisai Co., Ltd.	107	696	84	12.1%	487	69.9%	29	4.1%	89	12.7%	8	1.2%
Precision instruments	Citizen Holdings Co., Ltd.	108	688	111	16.1%	388	56.4%	117	16.9%	54	7.9%	19	2.7%
Real Estate	Mitsui Fudosan Co.,Ltd	109	655	395	60.3%	0	0.0%	0	0.0%	0	0.0%	260	39.7%
Electric Machinery	Fuji Electric Holdings Co., Ltd.	110	651	190	29.2%	0	0.0%	6	0.8%	447	68.7%	9	1.3%
Foods	Kirin Brewery Co., Ltd.	111	621	450	72.5%	0	0.0%	170	27.4%	0	0.0%	0	0.0%
Glass & Ceramics	Toto Ltd.	112	614	151	24.5%	0	0.0%	0	0.0%	0	0.0%	463	75.5%
Machinery	JTEKT Corp.	113	611	275	45.1%	117	19.2%	121	19.8%	97	15.9%	0	0.0%
Foods	Japan Tobacco Inc.	114	584	393	67.3%	0	0.0%	135	23.1%	29	5.0%	27	4.6%

Unit: Million EIP

Industry Sector	Company Name	RANK	Total EIP	Global Warming	%	Toxical Substance	%	Air Pollution	%	Water Pollution	%	Landfill Waste	%
Machinery	The Japan Steel Works, Ltd.	115	548	261	47.6%	0	0.0%	42	7.6%	165	30.0%	81	14.7%
Pharmaceuticals	Astellas Pharma Inc.	116	547	148	27.0%	338	61.7%	37	6.7%	6	1.1%	19	3.5%
Electric Machinery	Mitsumi Electric Co., Ltd.	117	541	206	38.1%	333	61.6%	1	0.3%	0	0.0%	0	0.1%
Rubber Products	The Yokohama Rubber Co., Ltd.	118	521	329	63.1%	0	0.0%	139	26.7%	48	9.2%	5	1.0%
Electric Machinery	Oki Electric Industry Co., Ltd.	119	512	235	45.9%	183	35.7%	29	5.6%	0	0.0%	65	12.8%
Electric Machinery	Taiyo Yuden Co., Ltd.	120	495	300	60.5%	0	0.0%	25	5.1%	0	0.0%	170	34.4%
Electric Machinery	Casio Computer Co., Ltd.	121	488	72	14.7%	321	65.8%	92	18.8%	4	0.7%	0	0.0%
Pharmaceuticals	Daiichi Sankyo Co., Ltd.	122	487	151	31.1%	3	0.6%	170	34.9%	124	25.4%	39	7.9%
Real Estate	Mitsubishi Estate Co., Ltd.	123	463	349	75.3%	0	0.0%	0	0.0%	0	0.0%	114	24.7%
Nonferrous Metals	Furukawa Co., Ltd.	124	459	25	5.4%	143	31.2%	214	46.7%	0	0.0%	77	16.8%
Automotive	Mitsubishi Motors Corp.	125	402	329	81.9%	0	0.0%	70	17.5%	0	0.0%	3	0.7%
Glass & Ceramics	Nitto Boseki Co., Ltd.	126	394	180	45.7%	0	0.0%	0	0.0%	0	0.0%	214	54.3%
Pharmaceuticals	Shionogi & Co., Ltd.	127	383	106	28.1%	9	2.5%	156	40.8%	41	10.8%	68	17.9%
Chemicals	Nippon Soda Co., Ltd.	128	382	199	52.1%	1	0.3%	129	33.8%	0	0.0%	52	13.7%
Railway/Bus	Tokyu Corp.	129	370	279	75.5%	0	0.0%	0	0.0%	0	0.0%	91	24.5%
Foods	Meiji Dairies Corp.	130	367	210	57.2%	0	0.0%	127	34.6%	0	0.0%	30	8.2%
Foods	Asahi Breweries, Ltd.	131	338	268	79.3%	0	0.0%	70	20.7%	0	0.0%	0	0.0%
Retail	Takashimaya Co., Ltd.	132	287	155	54.1%	0	0.0%	0	0.0%	0	0.0%	132	45.9%
Chemicals	Shiseido Co., Ltd.	133	285	36	12.6%	0	0.0%	7	2.4%	242	84.8%	0	0.0%
Communications	NTT Data Corp.	134	280	215	76.6%	0	0.0%	0	0.0%	0	0.0%	65	23.4%
Machinery	NTN Corp.	135	278	266	95.6%	0	0.0%	0	0.0%	0	0.0%	12	4.4%
Precision Instruments	Olympus Corp.	136	269	110	40.7%	0	0.0%	119	44.2%	1	0.3%	40	14.9%
Glass & Ceramics	NGK Insulators, Ltd.	137	269	228	84.7%	0	0.0%	0	0.0%	0	0.0%	41	15.3%
Foods	Meiji Seika Kaisha, Ltd.	138	262	156	59.6%	0	0.0%	71	27.1%	20	7.6%	15	5.7%
Foods	Nichirei Corp.	139	259	194	75.2%	0	0.0%	27	10.4%	27	10.6%	10	3.8%
Electric Machinery	Panasonic Electric Works Co., Ltd.	140	240	240	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Electric Machinery	Pioneer Corporation	141	236	201	85.0%	0	0.0%	35	15.0%	0	0.0%	0	0.1%
Retail	Mitsukoshi, Ltd.	142	235	145	61.6%	0	0.0%	0	0.0%	0	0.0%	90	38.4%
Gas	Tokyo Gas Co., Ltd.	143	230	136	59.1%	6	2.5%	13	5.8%	4	1.8%	71	30.7%
Pharmaceuticals	Dainippon Sumitomo Pharma Co., L	144	228	71	31.3%	6	2.8%	13	5.8%	130	57.1%	7	3.0%
Air Transport	Japan Airlines Corp.	145	220	83	37.7%	28	12.8%	41	18.6%	0	0.0%	68	31.0%
Electric Machinery	GS Yuasa Corp.	146	200	118	59.2%	4	2.2%	0	0.0%	0	0.0%	77	38.6%
Foods	Sapporo Holdings Ltd.	147	196	107	54.3%	0	0.0%	46	23.5%	44	22.2%	0	0.0%
Railway/Bus	Keio Corp.	148	195	124	63.6%	0	0.0%	0	0.0%	0	0.0%	71	36.4%
Electric Machinery	Alps Electric Co., Ltd.	149	194	96	49.2%	1	0.6%	95	48.8%	0	0.0%	3	1.3%
Foods	Kikkoman Corp.	150	181	90	49.6%	0	0.0%	91	50.4%	0	0.0%	0	0.0%
Precision Instruments	Terumo Corp.	151	175	115	65.7%	0	0.0%	56	32.1%	2	1.4%	2	0.9%
Machinery	Ebara Corp.	152	169	59	35.2%	26	15.2%	30	18.0%	26	15.5%	27	16.1%

Unit: Million EIP

Industry Sector	Company Name	RANK	Total EIP	Global Warming	%	Toxical Substance	%	Air Pollution	%	Water Pollution	%	Landfill Waste	%
Foods	Takara Holdings Inc.	153	148	93	62.8%	0	0.0%	0	0.0%	0	0.0%	55	37.2%
Construction	JGC Corp.	154	142	13	9.0%	0	0.0%	0	0.0%	0	0.0%	129	91.0%
Electric Machinery	Tokyo Electron Ltd.	155	141	108	76.5%	0	0.0%	9	6.2%	0	0.0%	24	17.3%
Banking	Mitsubishi UFJ Financial Group, Inc.	156	137	124	90.2%	0	0.0%	0	0.0%	0	0.0%	13	9.8%
Fishery	Nippon Suisan Kaisha, Ltd.	157	136	45	33.2%	0	0.0%	0	0.0%	0	0.0%	91	66.8%
Insurance	Millea Holdings, Inc.	158	135	42	31.1%	0	0.0%	0	0.0%	0	0.0%	93	68.9%
Insurance	Mitsui Sumitomo Insurance Co., Ltc	159	132	51	38.7%	0	0.0%	0	0.0%	0	0.0%	81	61.3%
Precision Instruments	Nikon Corp.	160	131	125	95.1%	2	1.3%	3	2.4%	0	0.0%	2	1.2%
Machinery	Hitachi Zosen Corporation	161	128	37	29.0%	0	0.0%	26	20.1%	0	0.0%	65	51.0%
Retail	Isetan Co., Ltd.	162	126	95	75.2%	0	0.0%	0	0.0%	0	0.0%	31	24.8%
Machinery	Sumitomo Heavy Industries, Ltd.	163	125	95	76.3%	0	0.0%	0	0.0%	0	0.0%	30	23.7%
Shipbuilding	Mitsui Engineering & Shipbuilding Co	164	121	82	67.7%	0	0.0%	0	0.0%	0	0.0%	39	32.3%
Insurance	Sompo Japan Insurance Inc.	165	107	44	40.6%	0	0.0%	0	0.0%	0	0.0%	64	59.4%
Gas	Osaka Gas Co., Ltd.	166	107	95	88.7%	0	0.0%	5	4.8%	7	6.1%	0	0.3%
Pharmaceuticals	Chugai Pharmaceutical Co., Ltd.	167	97	83	85.3%	0	0.0%	13	13.1%	1	0.9%	1	0.7%
Machinery	Chiyoda Corp.	168	77	10	13.3%	0	0.0%	0	0.0%	0	0.0%	66	86.7%
Nonferrous Metals	Fujikura Ltd.	169	75	61	81.5%	0	0.1%	4	5.1%	0	0.0%	10	13.3%
Electric Machinery	Yokogawa Electric Corp.	170	68	12	17.5%	11	15.5%	28	41.0%	0	0.0%	18	26.0%
Electric Machinery	Meidensha Corp.	171	50	30	60.0%	0	0.0%	0	0.0%	1	1.9%	19	38.0%
Electric Machinery	Fanuc Ltd.	172	49	40	82.4%	0	0.0%	0	1.0%	0	0.0%	8	16.6%
Construction	Sekisui House, Ltd.	173	46	46	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Securities	Nikko Cordial Corp.	174	45	24	53.9%	0	0.0%	0	0.0%	0	0.0%	21	46.1%
Construction	Daiwa House Industry Co., Ltd.	175	39	38	96.2%	0	0.0%	0	0.0%	0	0.0%	1	3.8%
Electric Machinery	Advantest Corp.	176	37	27	72.1%	0	0.0%	5	13.6%	3	8.0%	2	6.2%
Electric Machinery	Minebea Co., Ltd.	177	29	22	74.2%	0	0.0%	0	0.0%	0	0.0%	8	25.8%
Insurance	T&D Holdings, Inc.	178	23	18	75.8%	0	0.0%	0	0.0%	0	0.0%	6	24.2%
Trading Companies	Mitsui & Co., Ltd.	179	23	14	58.4%	0	0.0%	0	0.0%	0	0.0%	10	41.6%
Securities	Nomura Holdings, Inc.	180	21	21	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Banking	Mizuho Financial Group, Inc.	181	7	3	40.8%	0	0.0%	0	2.7%	0	0.0%	4	58.5%
Electric Machinery	Clarion Co., Ltd.	182	6	5	94.8%	0	0.0%	0	0.0%	0	0.0%	0	5.2%
Securities	Daiwa Securities Group Inc.	183	5	0	0.0%	0	0.0%	0	0.0%	0	0.0%	5	100.0%
Banking	Shinsei Bank, Ltd.	184	5	2	46.8%	0	0.0%	0	0.0%	0	0.0%	3	53.2%
Banking	The Shizuoka Bank, Ltd.	185	1	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Unit: Million EIP

Industry Sector	Company Name	RANK	Total EIP	Global Warming	%	Toxical Substance	%	Air Pollution	%	Water Pollution	%	Landfill Waste	%
Banking	Resona Holdings, Inc.	186		0	-	0	-	0	-	0	-	0	-
Banking	Chuo Mitsui Trust Holdings, Inc.	186		0	-	0	-	0	-	0	-	0	-
Banking	Sumitomo Mitsui Financial Group, Ir	186		0	-	0	-	0	-	0	-	0	-
Banking	The Chiba Bank, Ltd.	186		0	-	0	-	0	-	0	-	0	-
Banking	The Bank of Yokohama, Ltd.	186		0	-	0	-	0	-	0	-	0	-
Banking	The Sumitomo Trust and Banking C	186		0	-	0	-	0	-	0	-	0	-
Banking	Mizuho Trust & Banking Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Communications	Yahoo Japan Corp.	186		0	-	0	-	0	-	0	-	0	-
Communications	Sky Perfect JSAT Holdings Inc.	186		0	-	0	-	0	-	0	-	0	-
Communications	Softbank Corp.	186		0	-	0	-	0	-	0	-	0	-
Construction	Comsys Holdings Corp.	186		0	-	0	-	0	-	0	-	0	-
Machinery	Okuma Holdings, Inc.	186		0	-	0	-	0	-	0	-	0	-
Machinery	IHI Corp.	186		0	-	0	-	0	-	0	-	0	-
Nonferrous Metals	Toho Zinc Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Other Financial Services	Credit Saison Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Other Financial Services	Mitsubishi UFJ NICOS Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Railway/Bus	Keisei Electric Railway Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Real Estate	Heiwa Real Estate Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Real Estate	Tokyu Land Corp.	186		0	-	0	-	0	-	0	-	0	-
Real Estate	Sumitomo Realty & Development C	186		0	-	0	-	0	-	0	-	0	-
Retail	Seven & I Holdings Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Retail	Marui Group Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Retail	Fast Retailing Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Securities	Shinko Securities Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Services	Dentsu Inc.	186		0	-	0	-	0	-	0	-	0	-
Services	Trend Micro Inc.	186		0	-	0	-	0	-	0	-	0	-
Services	Toho Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Services	Tokyo Dome Corp.	186		0	-	0	-	0	-	0	-	0	-
Services	Secom Co., Ltd.	186		0	-	0	-	0	-	0	-	0	-
Services	CSK Holdings Corp.	186		0	-	0	-	0	-	0	-	0	-
Services	Konami Corp.	186		0	-	0	-	0	-	0	-	0	-
Textiles & Apparel	Nisshinbo Industries, Inc.	186		0	-	0	-	0	-	0	-	0	-
Trading Companies	Sojitz Corp.	186		0	-	0	-	0	-	0	-	0	-
Trading Companies	Itochu Corp.	186		0	-	0	-	0	-	0	-	0	-
Trading Companies	Marubeni Corp.	186		0	-	0	-	0	-	0	-	0	-
Trading Companies	Toyota Tsusho Corp.	186		0	-	0	-	0	-	0	-	0	-
Trading Companies	Sumitomo Corp.	186		0	-	0	-	0	-	0	-	0	-
Trading Companies	Mitsubishi Corp.	186		0	-	0	-	0	-	0	-	0	-
Transport Equipment	Topy Industries, Ltd.	186		0	-	0	-	0	-	0	-	0	-
Warehousing	Mitsubishi Logistics Corp.	186		0	-	0	-	0	-	0	-	0	-

There is another issue than the boundaries in Tab. 2.1. It comes from the attributes that each industrial sector has. For instance, among 225 companies all the 3 shipping companies make the top 3 and all the 3 electric power companies ranked respectively 5th, 8th, and 9th. On the other hand, several industrial sectors such as banking, insurance, and brokerage business ranked lower.

These results denote that the amount of environmental impacts from companies depends on not merely the level of commitment for environmental measures, but the attributes that each industrial sector has. It should be noted that the companies who belong to shipping industry, electric power industry, steel industry and paper and pulp industry are not exactly environmentally backward companies even though they inevitably generate larger amount of environmental impacts than the other companies who belong to the other industrial sectors.

Chapter 3
Obstacles to overcome

The procedure for assessing corporate environmental impacts began with the collection of the environmental report from 225 companies listed in the Nikkei 225 Index. It subsequently included picking up the inventory data from these reports, inputting these data into JEPIX, and assessment of the environmental impacts with the factors of JEPIX (See Fig. 3.1). As a result, JEPIX superficially improves comparability of corporate environmental impacts in 225 companies though the non-comparable elements still remain as obstacles to overcome.

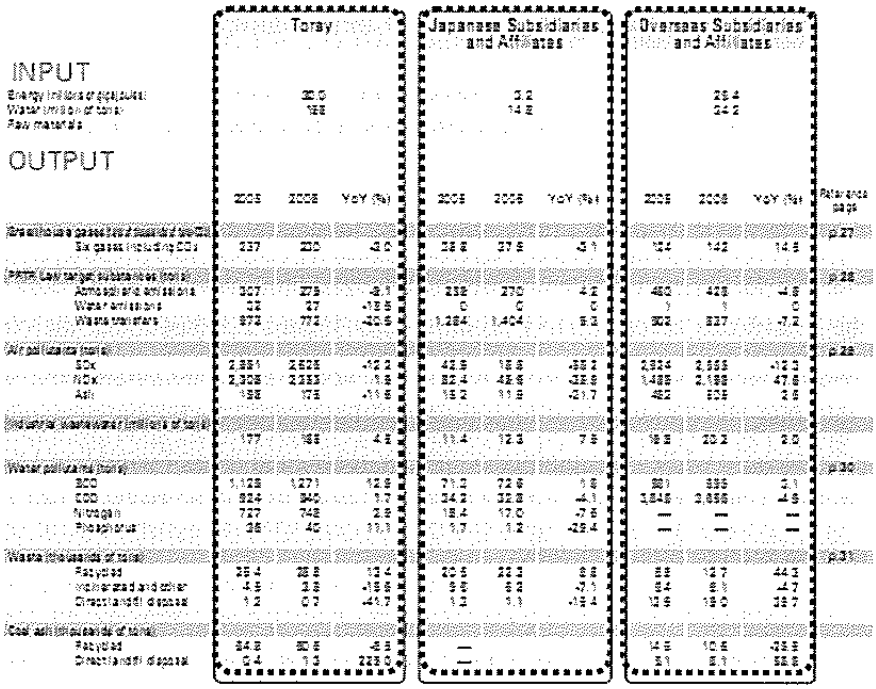
One of the major obstacles to be overcome is an issue of boundaries.[3] The boundaries among companies vary widely and it is technically difficult to bring them onto a common basis for comparison. The issue of boundaries contains complex difficulties because boundaries can be discussed from 4 different perspectives; organizational boundary, value chain boundary, business domain boundary, and material boundary. These perspectives are to be described below.

3.1 Organizational Boundary

Organizational boundary is the perspective whether companies only include parent company or include domestic and foreign subsidiary and affiliated companies when they disclose inventory data. For example, Toray Industries, Inc. (Figure 3.1) and Toyobo Co., Ltd. (Figure 3.2) who belong to the fabric industry in Japan disclose their inventory data along the perspective of organizational boundary.

[3] Choice of emission factors may be another element which hinders the comparability of environmental impacts.

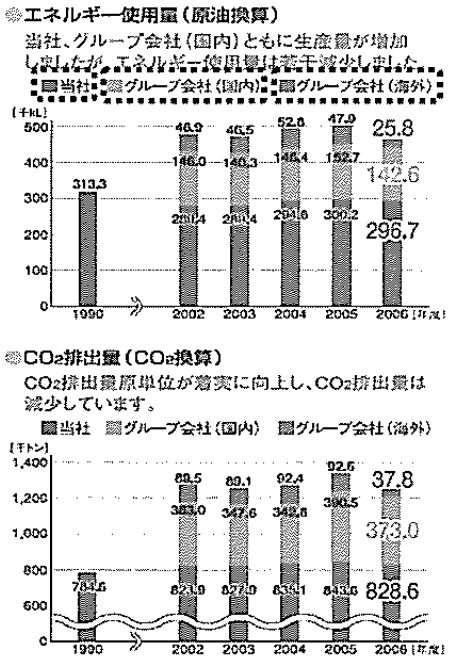
Fig. 3.1 Inventory data of Toray Industries, Inc.



	Toray			Japanese Subsidiaries and Affiliates			Overseas Subsidiaries and Affiliates			Reference page
	2005	2006	YoY (%)	2005	2006	YoY (%)	2005	2006	YoY (%)	
Greenhouse gases (10,000 tons-CO2)										p.27
Six gases including CO2	237	230	-3.0	28.8	27.8	-3.1	124	142	14.8	
PRTR Law target substances (tons)										p.28
Atmospheric emissions	307	279	-9.1	232	270	4.2	460	428	-4.8	
Water emissions	32	27	-15.5	0	0	0	1	1	0	
Waste transfers	873	772	-20.5	1,284	1,404	9.3	362	327	-7.2	
Air pollutants (tons)										p.29
SOx	2,881	2,525	-12.2	42.5	18.8	-55.2	2,924	2,555	-12.1	
NOx	2,326	2,283	-1.8	82.4	48.6	-38.8	1,488	2,188	47.6	
Ash	198	175	-11.6	18.2	11.8	-21.7	462	505	2.6	
Industrial wastewater (million m3/year)										
	177	185	4.2	13.4	12.5	7.5	18.8	20.2	2.2	
Water pollutants (tons)										p.30
BOD	1,125	1,271	12.9	71.2	72.6	1.9	881	886	2.1	
COD	824	845	1.7	34.2	32.8	-4.1	3,845	3,656	-4.9	
Nitrogen	737	748	2.9	18.4	17.0	-7.5	—	—	—	
Phosphorus	38	40	11.1	1.7	1.2	-29.4	—	—	—	
Waste (thousand tons)										p.31
Recycled	28.4	28.8	12.4	20.5	20.3	8.8	8.8	12.7	44.3	
Incinerated and other	4.8	3.8	-15.5	6.8	6.2	-7.1	6.4	6.1	-4.7	
Direct landfill disposal	1.2	0.7	-41.7	1.2	1.1	-13.4	13.9	19.0	36.7	
Coal ash (thousand tons)										
Recycled	84.8	80.6	-5.0	—	—		14.6	10.6	-28.8	
Direct landfill disposal	0.4	1.3	225.0				3.1	5.1	66.8	

Toray Industries Inc., CSR Annual Report, 2007: 58 (dotted frame by author)

Fig. 3.2 Inventory data of Toyobo Co., Ltd.

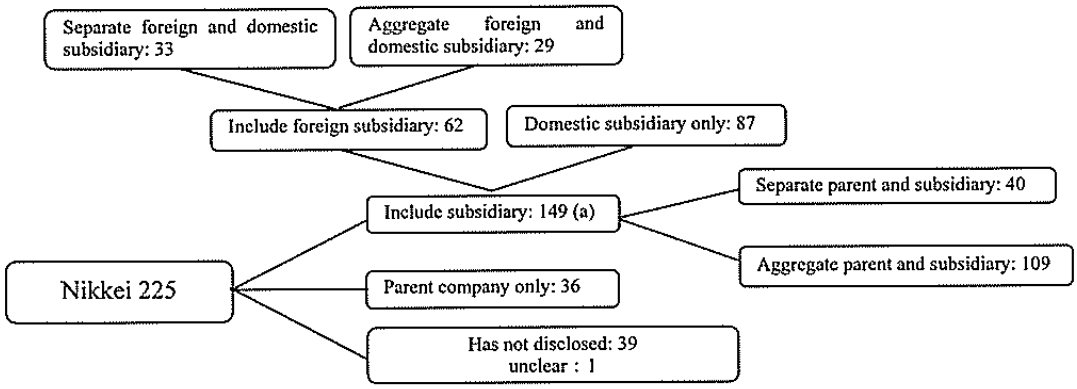


Toyobo, CSR Report, 2007:33 (dotted frame by author, Japanese only)

Both Toray Industries, Inc. and Toyobo Co., Ltd. classify their environmental disclosure into parent companies, domestic subsidiaries and foreign subsidiaries. Fabric industry in Japan has a tendency to disclose their inventory data along with the organizational boundary.

Figure 3.3 classifies the companies listed in Nikkei 225 Index into each organizational boundary they adopt for their environmental reporting. Meanwhile, JEPIX targets greenhouse gases (6types of gases), PRTR, NOx, SOx, COD, BOD, N, P and landfill waste as the inventory data to be figured out. Since companies in many cases vary the boundaries according to the inventory data, the result of Figure 3.3 has been based on the boundaries according to CO_2 emissions. Figure 3.3 shows that the companies within Nikkei 225 Index tend to disclose their environmental impacts of both parent and subsidiary companies. Having said that, the dimension of organizational boundaries each company individually adopts are not the same because while one aggregates the environmental data of parent and subsidiary company, another discloses the data separately. Likewise, one aggregates foreign and domestic subsidiary, another divides foreign from domestic.

Fig. 3.3 The organizational boundaries of CO_2 emission with Nikkei 225 companies



In addition, the definition of "subsidiary" within the environmental reports differs from that within the financial reports. Among 149 companies (a) which have disclosed their inventory data including the subsidiaries, 105 companies specify the number of subsidiaries included in their environmental reports.[9] Figure 3.4 compares the number of subsidiaries included in the environmental and the financial reports, and shows that the number of subsidiaries within the environmental reports is substantially lower than that within the financial reports.

[9] Other 44 companies have not specified their boundaries in their environmental reports.

Fig. 3.4 How many subsidiaries are included in both environmental reporting and financial reporting?

The number of subsidiaries in environmental reports = 4,060

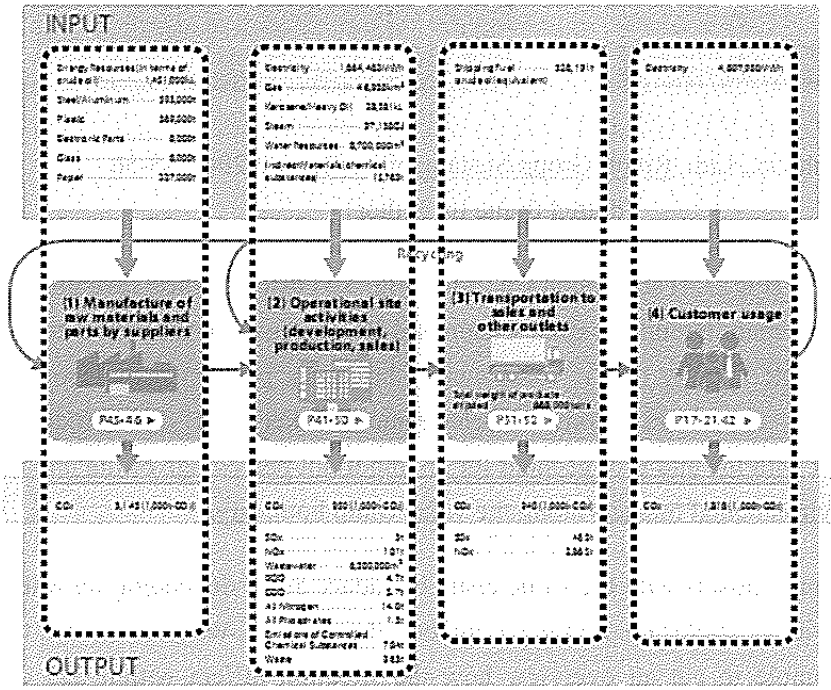
The number of subsidiaries in financial reports = 13,029

Among 105 companies in Nikkei 225 who disclose environmental impact on consolidated basis

3.2 Value chain boundary

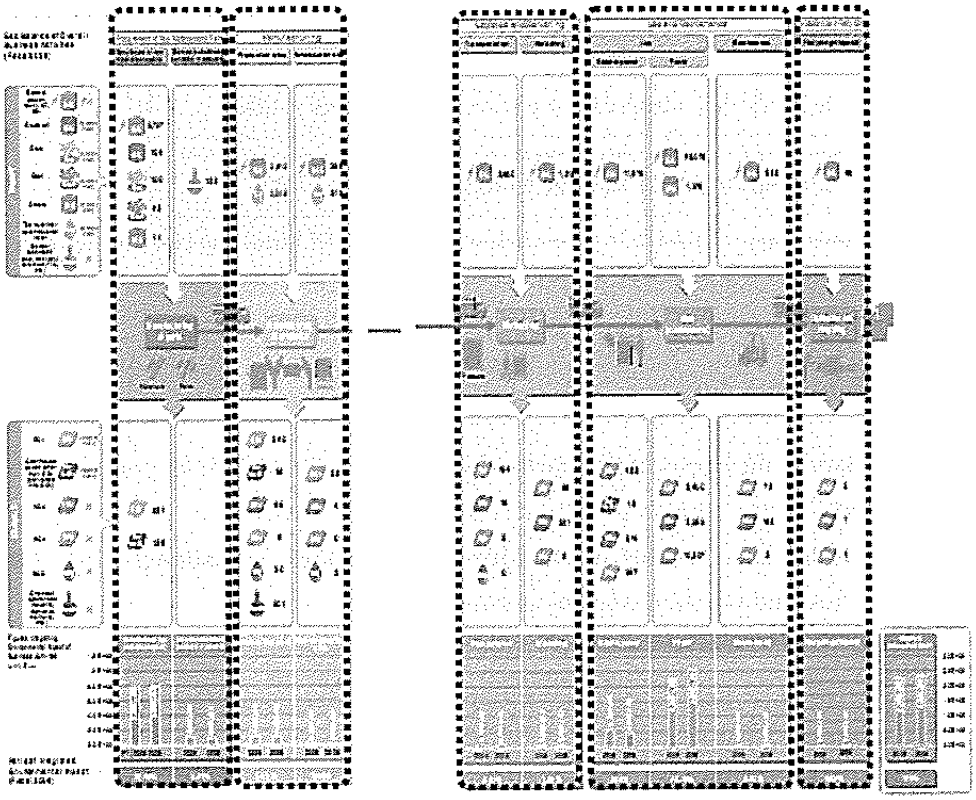
Value chain boundary is the perspective whether companies only include the process of production manufacture or include the process of logistics and end-user when they disclose inventory data. Manufacturing industry has a choice of the following processes: component fabrication, product manufacture, logistics, and product usage by customers.

Fig. 3.4 Inventory data of Canon Inc



Canon Inc., Sustainability Report, 2007:16 (dotted frame by author)

Fig. 3.5 Environmental impacts of Ricoh Co. Ltd.



Ricoh Co., Ltd., Ricoh Group Sustainability Report, 2007:55-56
(dotted frame by author)

For example, Canon Inc. (Fig. 3.4) and Ricoh Co., Ltd. (Fig. 3.5) disclose their inventory data along the perspective of value chain boundary. Both Canon and Ricoh organize their inventory data with the processes of corporate activity that is component fabrication, product manufacture, logistics, and product usage by customers. Consumer-electronics maker and other industry whose environmental impacts with the end user account for an important percentage of the impacts tend to disclose corporate environmental impacts along the value chain boundary.

Corporate environmental impacts with the value chain boundary differ depending on which process the company includes in its disclosure. Among a number of processes, we have chosen the process of logistics as an example to get an overview how the situation differs within 225 companies. Airlines, land transportation companies, shipping firm, railroad and bus companies have been counted separately from other industries as the logistics process is the main business for these transportation companies (Fig 3.6).

Fig. 3.6 CO_2 emissions of logistics process with Nikkei 225 companies

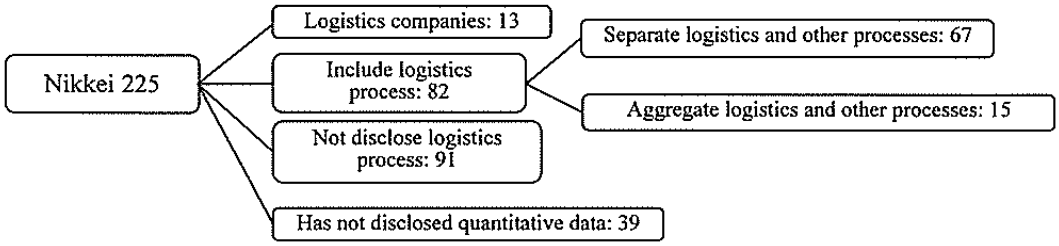
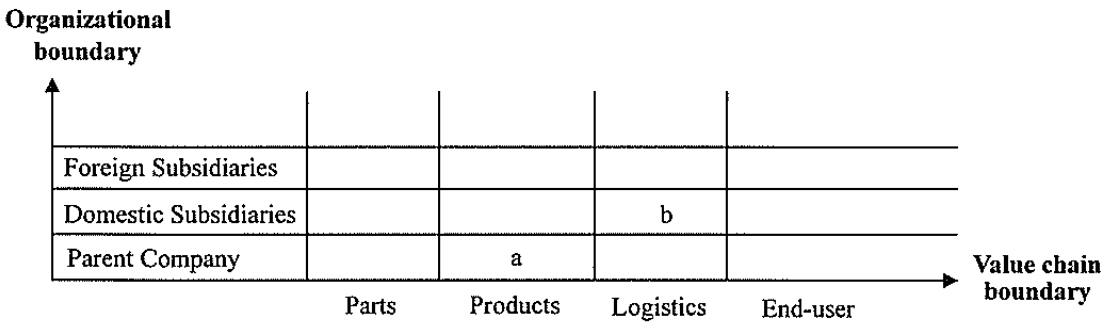


Fig. 3.6 shows that 82 companies out of Nikkei 225 Index have disclosed CO_2 emission with logistics while 91 companies have not. Among those 82 companies, 67 companies have separately disclosed CO_2 emission with logistics from other processes and 15 companies have lumped logistics together with other processes. From the perspective of value chain boundary with an example of logistics, Nikkei 225 companies disclose their inventory data in very different manner. Given the perspective of organizational boundary and value chain boundary, a matrix as indicated by Fig. 3.7 can be depicted.

Fig. 3.7 Matrix of organizational boundary and value chain boundary



For example, cell a. denotes the environmental impacts with the assembly line in parent company while cell b. denotes the environmental impacts with logistics in domestic subsidiary.

3.3 Business segment boundary

Business segment boundary is the perspective how much business portfolio should be covered in disclosing inventory data, especially when the company runs a number of different businesses. Taiheiyo Cement Corp. discloses their corporate inventory along the perspective of business segment boundary (Fig.3.8).

Fig. 3.8 Corporate inventory of Taiheiyo Cement

大気への排出：CO_2排出量

06年度		排出量(t)				
		セメント事業	資源事業	環境事業	発電事業	総計
エ業プロセス起源	セメント用石灰石脱炭酸	9,439,254				9,439,254
	生石灰製造		38,505	2,619		41,124
	小計	9,439,254	38,505	2,619		9,480,378
化石燃料起源	石炭	4,798,518	7,922	2,475	244,383	5,053,298
	石油コークス	1,516,335	103,038	177	17,986	1,637,537
	重油	160,158	6,663	497	491	167,809
	軽油	33,253	34,367	959	0	68,579
	灯油	2,516	546	281	125	3,469
	ガソリン	55,522	113	8	0	55,640
	小計	6,566,302	152,650	4,395	262,985	6,986,332
購入電力由来(間接排出)		239,220	21,665	2,798	0	263,683
合計		16,244,776	212,820	9,813	262,985	16,730,394

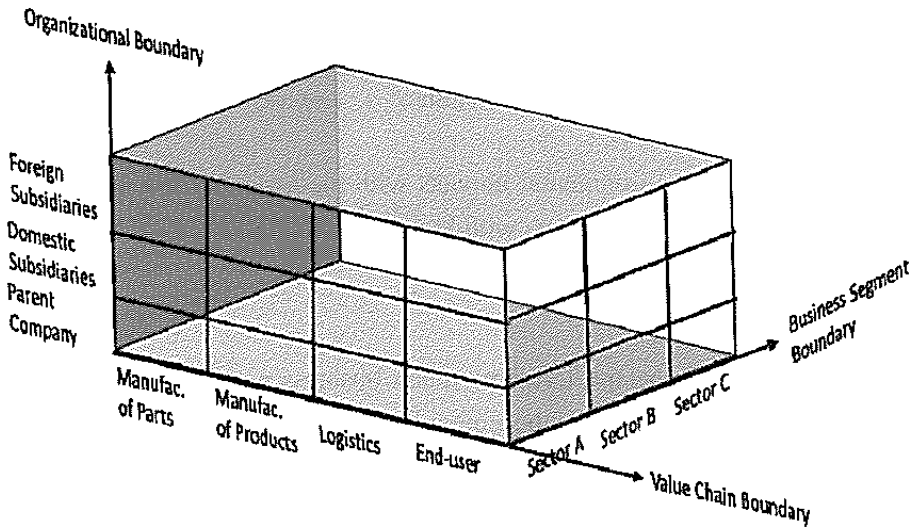
大気への排出：SOx・NOx・ばいじん

06年度	排出量(t)				
	セメント事業	資源事業	環境事業	発電事業	総計
SOx	4,253	79	16	102	4,449
NOx	30,640	146	46	266	31,098
ばいじん	583	14	2	25	624

Taiheiyo Cement, CSR Report information packet, 2007, Japanese only

Taiheiyo Cement Corp. discloses their corporate inventory of the cement business, the mineral resources business, the environmental business and the power generation business. Providing that company runs normally different businesses parallel to each other, and makes business portfolio, the coverage of business portfolio is an additional consideration. Fig. 3.9 is three dimensional matrix which is composed of Fig. 3.7 (corporate and process boundaries) and business segment boundary.

Fig. 3.9 Three dimensional figure of boundaries

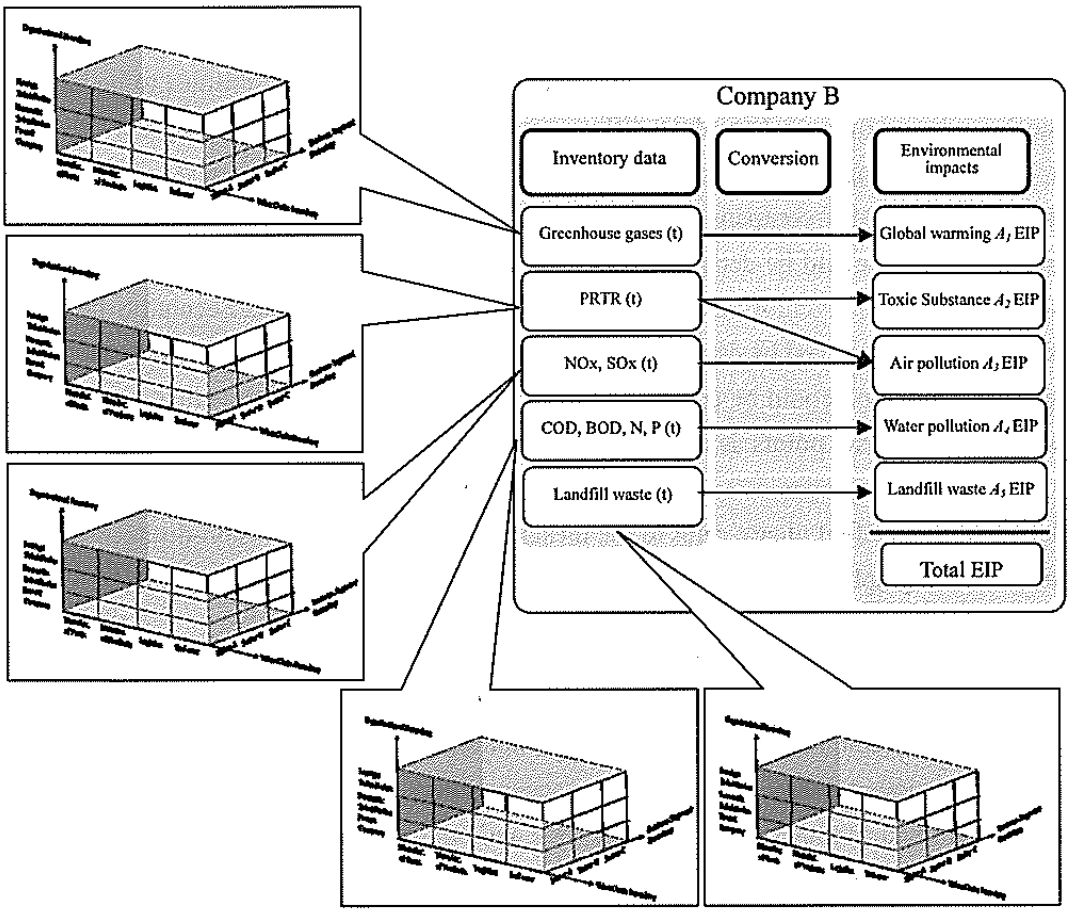


3.4 Material boundary

Material boundary is the perspective which materials company discloses in the environmental report. Having targeted greenhouse gases (6types of gases), PRTR, NOx, SOx, COD, BOD, N, P, and landfill waste as the inventory data to be figured out in JEPIX, the corporate environmental impacts of each company vary according to which inventory data they disclose. For example, even though two different companies have disclosed the same inventory data of 6 greenhouse gases, one may disclose only 3 gases and another may disclose all 6 gases.

The coverage of material boundary often relates to other boundaries. For example, PRTR has generally only domestic inventory data because the disclosure of PRTR is ruled by domestic law in Japan. On the other hand, greenhouse gases obviously require both domestic and foreign subsidiaries' disclosure while NOx, SOx, COD, BOD, N, P require only domestic disclosure because they are the cause of regional environmental issues. Fig. 3.10 shows the relation between each inventory data and the three dimensional matrix of 3 boundaries.

Fig. 3.10 Relationship between the three dimensional figure and materials



Chapter 4
Concluding remarks

In Japan, environmental reporting and accounting emerged around the year of 2000, and have been well accepted by Japanese companies. So much corporate environmental data become currently available and it may be now the time to explore how these data can be actually utilized. Our aim, creation of environmental indicator for investors, would be one of the possibilities. There exist still obstacles to utilization of the data and variance of boundaries may be the major one to be solved. The perspectives of organizational boundary, value chain boundary, business segment boundary and material boundary are available to discuss this issue. The important point in boundary issue is that the total amount of environmental impacts would increase when a company conscientiously discloses its environmental impacts with wider boundary. In other words, honesty does not pay as long as each company has a choice in the bounds of environmental disclosure. This problem makes the comparison of environmental impacts between companies difficult and it will also disturb the calculation of environmental indicator. From this point of view, there needs to be comprehensive standards set in the long term for the boundaries of corporate inventory data disclosed through environmental reporting.[4]

As for calculation of environmental indicators, there are currently two possibilities to be explored. Firstly, the boundaries of inventory data differs among companies, but normally stay the same within a company along with years. This enables us to conduct historical comparison of environmental impacts of a company without having to deal with boundary issues as much and environmental indicator could be determined basing on the historical comparison. To carry out this comparison, accumulated inventory data along with years are to be collected. Secondly, the issue of boundaries can be partly solved by estimating the environmental impacts which are not disclosed by companies. The estimation could be conducted in accordance with the principle that companies get extra environmental impact points as a penalty if inventory data is not disclosed. This method may generate incentives for companies to more precise and comprehensive environmental disclosure. For the details of the method please refer to the thesis by Prof. Kumagai on "non-disclosure penalty factors" in this monograph.

For the development of environmental indicators, comprehensive databese for corporate environmental impact will be indispensable. On the contrary to financial data which already have various databeses available to be implemented for empirical studies, it is still in developing phase for corporate environmental data in terms of data accumulation. For the making of such a database for environmental impacts may require not only time and budget, also contribution from authorized organizations in the long term.

---

[4] In GHG accounting there exist already comprehensive standards for boundaries (WBCSD & WRI, 2004).

Bibliography

Azuma, Kentaro, Ökobilanzierung und Periodisierung, Berlin, 2007

Braunschweig, Arthur und Ruedi Müller-Wenk, Ökobilanzen für Unternehmungen, Eine Wegleitung für die Praxis, Bern, 1993

BUWAL, Bewertung in Ökobilanzen mit der Methode der ökologischen Knappheit Ökofaktoren 1998, BUWAL Schriftenreihe Umwelt, Bern, 1998

CDSB, CDSB Reporting Framework, 2009

Eichhorn, Peter, Umweltschutz aus der Sicht der Unternehmenspolitik, in: Zeitschrift für betriebswirtschaftliche Forschung, 24. Jg., 1972, S. 633-649

JEPIX Forum, Practical Application of JEPIX, Method for Ecological Accounting and Life Cycle Impact Assessment for Japan based on the EcoScarsity Principle, Tokyo, 2004

Ministry of Environment, Research for Environmentally Friendly Corporations Activities, 2009 (in Japanese)

Miyazaki, Nobuyuki, et al., JEPIX, Method for Eco Rating and Environmental Accounting based on the Eco Scarcity Principle, Technical Report Calculation of Eco Factors for Japan, Social Science Research Institute Monograph Series Nr. 7, Tokyo, 2003

Müller-Wenk, Ruedi, Die ökologische Buchhaltung, Informations- und Steuerungsinstrument für umweltkonforme Unternehmenspolitik, Frankfurt, 1978

Schaltegger, Stefan und Roger Burritt, Contemporary Environmental Accounting, Issues, concepts and practice, Greenleaf, 2000

Siegenthaler, Claude Patrick, Ökobilanz, 30 Jahre Forschung an der Schnittstelle zwischen Natur- und Wirtschaftswissenschaften, St. Gallen, 2005

WBCSD & WRI, The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, REVISED EDITION, 2004