Dr Chika Saka, School of Business Administration, Kwansei Gakuin University, Japan and Visiting Fellow at The Australian National University and Dr Roger L. Burritt, School of Business and Information Management, The Australian National University.

1. Introduction

In Japan, more than 90% of companies which disclose environmental accounting information use the Ministry of Environment (MOE) Environmental Accounting Guideline (MOE, 2002; Nashioka, p.184).

In the MOE Guideline, environmental accounting consists of the following structural elements and has the purpose of attaining two types of benefits derived from costs incurred from environmental conservation activities during the regular course of business (See Figure 1).

Environmental cost consists of investments and expenses, which relate to the prevention, reduction and/or avoidance of environmental impacts, removal of such impacts, restoration following the occurrence of a disaster and other activities, measured in monetary terms. Environmental benefit is the benefit obtained from environmental conservation activities and is measured in physical units. Economic benefit is the company’s income resulting from environmental conservation activities and is measured in monetary terms.

In Japan, more than 90% of companies which disclose environmental accounting information use the Ministry of Environment (MOE) Environmental Accounting Guideline (MOE, 2002; Nashioka, p.184).

The following section presents an analysis of environmental accounting information based on 5 years of data (the 1999 to 2003 financial years) from two Japanese companies, Canon and Ricoh. Both of these companies are in electronics manufacturing and are well known for their excellent environmental management.¹

---

¹ The 2004, “Environmental Management Ranking” by Nikkei Research ranked Ricoh as the top and Canon as the seventh most excellent environmental management companies in the top 100 companies in Japan see [http://www.nikkei-r.co.jp/kankyo/2004/seizo/s_ranking.htm](http://www.nikkei-r.co.jp/kankyo/2004/seizo/s_ranking.htm)
Environmental/sustainability reports provide the main source of environmental accounting information in Japan. All data in the following tables except for the data shown in italics are derived from the environmental accounting sections in Canon’s and Ricoh’s environmental/sustainability reports. Figures in italics are extracted from other sections in the environmental/sustainability reports, or from their financial reports. As the basis for analysis of the environmental accounting information the indicators proposed in the Japanese Institute of CPA research report No.22 (2004) “Issues and Future Developments of Environmental Accounting in Japan” are used.

This paper examines what kind of analysis is possible using environmental accounting information disclosed in selected corporate environmental reports in the electronics industry in Japan and the limitations of such analysis. The following are addressed in turn in this short paper: analysis of environmental costs, analysis of environmental benefits and impacts (physical units), analysis of economic benefits (monetary value), analysis of environmental impact (monetary value), social costs and concluding comments.

2. Analysis of Environmental Costs

The MOE guideline recommends that environmental costs should be disclosed for each category of environmental investments and environmental expenses. Environmental investment information is related to the environmental activities associated with capital investments that generate long-term benefits.

When comparing environmental costs of different companies it is not enough to rely on the nominal amounts, instead, it is also necessary to consider business size and industry. To eliminate the effect of business size when analysing environmental costs, the following sales revenue indicator can be used:

\[ \text{Environmental cost to sales ratio} (%) = \frac{\text{Environmental costs (yen)}}{\text{Sales (yen)}} \]

“Profit of the current period” or “total assets” can also be used as deflators.

Even when using a time-series comparison of data for a single company, the change in business size is reflected in sales revenues. For example, business expansion as a result of merger or business contraction as a result of factory closedown will affect revenues. Division by sales revenue compensates for the change of the business size and makes it possible for to compare environmental costs between companies as well as over time for a specific company.

Information about environmental cost also indicates how much of its management resource the company invests in environmental activities. When analyzing the importance the company gives to environmental activities in its business, the following indicators can be used:

\[ \text{Environmental expense ratio} (%) = \frac{\text{Environmental expenses (yen)}}{\text{Gross operating expenses (yen)}} \]

\[ \text{Environmental investment ratio} (%) = \frac{\text{Environmental investments (yen)}}{\text{Gross capital investments (yen)}} \]

\[ \text{Environmental Research and Development (R&D) cost ratio} (%) = \frac{\text{Environmental R&D costs (yen)}}{\text{Gross R&D costs (yen)}} \]
When these indicators are used, it is necessary to confirm the scope of the environmental costs or expenses. As environmental accounting does not have a specific accounting standard, such as those developed for financial accounting, variation exists between companies in relation to the items that are included in environmental expenses or investment categories.

On the other hand, the contents of environmental costs (activities for which environmental costs are reported) changes depending on the extent of environmental consciousness in society and the level of corporate environmental activity, so that a rigid definition of environmental costs could cause problems. Hence, when analyzing environmental costs it is desirable to take the contents of corporate environmental activities into consideration. It should be noted that larger environmental costs do not necessarily mean better environmental performance. Environmental benefits related to environmental expenditures need to be checked at the same time. Environmental benefit is mentioned in the following section.

Environmental costs and related ratios for Canon and Ricoh are shown in Table 1 (see p.13). All the figures in Table 1 are consolidated figures which include domestic business and those related to activities outside Japan. The consolidated coverage slightly differs between the environmental accounts and that used for consolidated financial statements, however this should not materially affect the comments made below. For example, some non-manufacturing companies/sales subsidiaries are not included in the environmental reports and their relative environmental impacts could be considered to be quite small. Financial accounting figures shown in italics are extracted from the consolidated financial statements.

Table 1 reveals that in both companies environmental costs have increased, but more so in Ricoh, which has almost doubled its expenditure in the past five years. While Canon's "Environmental costs to sales ratio" and "Environmental expense ratio" are almost unchanged over the period, these ratios for Ricoh have increased in past five years, which indicates that Ricoh's environmental costs have increased more than the expansion of its operations.

As for environmental investment, in general both the "Environmental investment" and "Environmental investment ratio" for Canon are at higher levels than for Ricoh. However, one of the reasons is that Ricoh narrowly defines environmental investment as that related to investment in fixed assets as defined for financial accounting, but Canon adds contamination remediation costs etc. to its environmental investment figures based on its in-house environmental investment criteria.

In the case of environmental R&D costs, Ricoh's "Environmental R&D costs" and "Environmental R&D cost ratios" are higher than Canon's.

3. Analysis of Environmental Benefits and Impacts (Physical Units)

(1) Environmental Benefits

In the MOE Guideline, environmental benefit consists of "Environmental benefit (physical units)" and "Economic benefit (monetary value)" (See Figure 1). This section examines environmental benefit (physical unit), while economic benefit
Environmental benefit is calculated as the difference between the total volume of environmental impacts in the previous and current years. Environmental benefit is the reduced volume of environmental impact, so that a larger environmental benefit means that the company contributed more to environmental conservation. However, as the amount of environmental benefit is affected by the size of the company, the following indicators, based on sales revenue as a deflator, can be used to eliminate the effect of the business size. In addition to "sales", the "profit of the current period" or "total assets" can also be used.

Environmental benefit to sales ratio (t/yen)
= Reduction volume of environmental impact (t) / Sales (yen)

As environmental benefit is the benefit from incurring environmental costs, the following indicator can be used to show the level of cost effectiveness:

Environmental benefit to environmental cost ratio (t/yen)
= Reduction of environmental impact (t) / Environmental costs (yen)

This indicator shows how much environmental impact has been reduced by spending 1 yen as an environmental cost. However, this indicator is only useful when the contents and scope of environmental costs and benefits correspond with each other. As the level of the environmental activity increases, cost effectiveness (environmental benefit to environmental cost ratio) usually decreases, so that the absolute level of total environmental impact, reflecting the status of progress, should also be considered.

(2) Environmental Impacts

Environmental impact (in physical units) of activities is essential information for the proper evaluation of environmental costs and benefits. Environmental impact is represented by physical information about the company's absolute environmental burden. The current level of environmental impact reflects the company's environmental achievements in reducing its impact. As environmental impact figures are influenced by business size, the following indicators based on sales can be used to eliminate the effect of business size. "Total assets" or "the number of employees" may also be used.

Environmental impact to sales ratio (t/yen)
= Environmental impact (t) / Sales (yen)

This indicator shows the volume of environmental impact per 1 yen of sales. The smaller the "environmental impact to sales ratio" the better; however the ratio is affected by industry, and so an inter-industry comparison is not appropriate. Moreover, even if this relative indicator declines, the increase of total environmental impact because of expanding sales is undesirable.

From another perspective, the following indicator shows the percentage of the environmental impact that the company has reduced in the current period:

Environmental benefit to total environmental impact ratio (%)
= Reduction volume of environmental impact (t) / Total environmental impact (t)
Reduction in the volume of environmental impact is reflected by the company’s past activities. At the first stage of environmental activity there is more room for reduction of environmental impact, but when the activity is at a higher level, the room for reduction will usually be lower. For instance, in the case where the company has already attained zero-emission production, there is little room for environmental benefit to be achieved through further reduction via continuous improvement. Therefore, to evaluate the reduction in volume of impact, or the reduction ratio, a simple comparison is not appropriate. Instead, it is necessary to consider the company’s past activities. As the achievement levels from past activities are reflected in the level of total environmental impact of the current period, data about total environmental impact should also be considered.

Table 2 (see p.14) shows the environmental benefits and related ratios of Canon and Ricoh. CO2 and Waste reduction are considered as benefits here because they represent important environmental burdens.

Before analysing the figures in Table 2, it is necessary to acknowledge that the concept of “reduction” differs between the two companies. Ricoh reports the amount of reduction in the emission of substances for the current year in comparison with those in the previous year (emissions in the previous year less emissions in current year), which line up with the calculation outlined in the MOE Guideline. In contrast, Canon has calculated the “CO2 reduction” as the estimated extent to which energy saving for one year stem from energy saving investments/activities conducted in the current period. Therefore, as Canon’s figure does not reveal the increase or decrease in total CO2 emissions, in order to find Canon’s total CO2 emissions it is necessary to refer to other sections than the environmental accounting section in Canon’s sustainability report (shown in italics in Table 2).

In relation to the waste emission data, Ricoh’s data relate to final disposal volume; on the other hand Canon’s data reflect the total volume of gross emissions. From the indicators, Canon’s waste emission volume seems more than Ricoh’s even though both are declining. However as outlined above, a simple data comparison is not appropriate.

As the meanings associated with the impact reductions differ between two companies, strictly speaking, the meanings of the ratio of “CO2 reduction (t) / Sales (million yen)” also differ. Hence, it is inappropriate to use these figures for inter-company comparisons, but they are useful for time series comparison for the performance of a single company. For example, Table 2 shows the trend in volumes for Canon’s “CO2 reduction” and “Waste reduction”. It also shows that Canon’s “total CO2 emission” appears to have increased for each of the past five years, although one of the reasons for this is that Canon has expanded the scope of its data gathering aggregation exercise over the period examined. In contrast, Table 2 also shows that Ricoh’s volume of “CO2/Waste reduction” and “CO2 / waste reduction to sales ratio” have decreased.

Both Canon and Ricoh commenced their environmental conservation activities at an early stage and are known as leading environmental companies in Japan. Both companies have substantially accomplished a high level of CO2/waste reduction and most of their plants have reached zero-emissions. Therefore, it is difficult for both
companies to gain further environmental benefits.

To calculate the “Environmental benefit to environmental cost ratio” (Reduction of environmental impact / Environmental costs), various environmental benefits (reduction of CO₂, waste, NOₓ, SOₓ, etc.) have to be aggregated in the numerator, environmental impact reduction; however, different substances are not directly additive.

Ricoh uses weights to address this issue. These weights identify environmental impact by totaling and weighting various types of environmental impacts expressed in different units (CO₂=1), and by calculating the converted quantity of emission reduction, by multiplying the environmental impact reduction by the conversion coefficients. In other words, this figure refers the degree of importance of environmental impact reduction converted into tonnes of CO₂ reduction equivalents.

These values of coefficients are based on the Swedish Environmental Priority Strategies method (CEAPMS, 1999). Ricoh discloses these figures in their environmental accounts (see Table 2 “Converted quantity of reduction/ Environmental costs”). This figure shows that environmental cost efficiency has fallen as environmental activity has increased. This conversion coefficient is useful for comparison and assessment of the company’s overall performance in relation to environmental activity. However, in order to obtain comparable figures between different companies, standardization of the conversion coefficient process is needed.

Information about Physical Environmental impacts (Total CO₂/ waste emission) are also shown in Table 2. For comparison, “Environmental impact (t) / Sales (yen)”, which eliminates the effect of business size on results, is also shown in Table 2. The Table shows that CO₂ emissions per 1 billion yen for both companies are almost stable, but waste emission per 1 billion yen has improved dramatically over the past five years.

With the “Environmental benefit to total environmental impact ratio ” (Reduction in volume of environmental impact / Total environmental impact), it was impossible to calculate the rate in a meaningful way because both of the companies have repeatedly expanded their data aggregation scope and reexamined their conversion factors in last five years. In Japan, 1999 is known as “the first year of environmental accounting”; since then companies have improved their environmental accounting data quality and scope.

For the evaluation of sustainable corporate environmental management, it is necessary to consider environmental impact information in combination with environmental cost and benefit information in a comprehensive way.

4. Analysis of Economic Benefit (Monetary Value)

Economic benefit, as represented in Table 3 (see p.14), is the benefit to company’s profits, measured in monetary terms, as a result of carrying out environmental conservation activities. This economic benefit is divided into substantial benefits and estimated benefits, depending on whether the data is confirmed. Substantial benefits are economic benefits calculated based on confirmed or verified data. Estimated benefits are expected economic
benefits calculated based on a number of assumptions.

Substantial benefits have an impact on corporate cash flow and consist of "revenues" and "expense savings". "Revenue" results from environmental conservation activities which are actually shown on the company’s financial statements as revenue for the current period, such as income derived from the recycling of used products or waste generated by key business operations. "Expense saving" is the avoidance or prevention of expenses by conducting environmental conservation activities relative to those of previous years, such as expense savings through lower resource input, environmental impact/waste emissions reductions and environmental remediation activities.

In addition, environmental activities contribute to corporate profit in various ways which cannot be measured as substantial benefits. To illustrate, some companies, including Ricoh, calculate and disclose the estimated benefits "avoidance of risk" and "contribution to value-added production". The benefit from "avoidance of risk", for example in Ricoh, is calculated by multiplying the expected amount of damage by an occurrence coefficient and impact coefficient. The benefit of "contribution to value-added production" is the amount of contribution to company profits that expenditure on environmental conservation activities is estimated to have. For example, Ricoh calculated the "Environmental friendly product gross margin" multiplied by "Gross margin contribution rate calculated using environmentally aware points" as an estimated benefit.

When taking estimated benefits into consideration, the figures reveal that environmental conservation activities pay.

However, the estimated benefit contains elements of speculation and is less certain than the calculation of substantial benefit, and the estimation methods differ between companies. Hence, when analyzing estimated benefits, the company’s concept of estimated benefit and the way in which it is described in the environmental accounting section need to be considered. At this point, the estimated benefit remains useful only for time-series analysis of one company. It provides important data for internal management decision making purposes.

To analyze the efficiency of environmental activity, the following indicator can be used:

\[ \text{Economic benefit to environmental costs ratio (¥) } = \frac{\text{Economic benefit (yen)}}{\text{Environmental costs (yen)}} \]

Table 3 shows environmental (substantial and estimated) benefits data and related indicators for both companies.

In Ricoh’s case, the "Economic benefit to environmental costs ratio" has been above one throughout the last five years. It means that the environmental activity has also contributed to Ricoh's economic performance, if both substantial and estimated environmental benefits are considered. Moreover, as Ricoh’s "economic benefit to environmental costs ratio" have an upward trend, the cost effectiveness of Ricoh’s environmental activity has improved.

Social benefit is a benefit that is generated by expenditure on environmental
conservation activities for society rather than for the company. Canon calculates the "Economic benefit for the customer" (lower electric energy expense from reduced product energy consumption) as a social benefit. Ricoh calculates "Economic benefit for the customer" (reduction in user's electricity expenses thanks to an improved energy saving function and product performance) and "Economic benefit to society" (Reduction in society's waste disposal cost), as a social benefit.

As both Canon and Ricoh belong to the same industry, the concept behind social benefits is similar, however the practice of social benefit calculation differs between companies and between industries. Therefore, by looking at the kind of benefits the company recognizes, the objectives and focus of the company's environmental activity can be revealed.

5. Analysis of Environmental Impact (Monetary Value) - Social Cost

If environmental benefit and environmental impact can be converted from physical measures to monetary values, they can provide a new perspective for the analysis of corporate environmental activity. There are two ways permitted in the MOE Guideline for converting environmental impact information into monetary value: (a) damage cost; and (b) avoidance cost. Interpretation of the data will depend on the method of conversion adopted.

Firstly, the figure for environmental impact converted using the damage cost method represents the cost of the company's activities to society. If two companies earn the same amount of profit and one incurs a greater amount of social costs than the other, the company is considered less desirable from the environmental standpoint. The following indicator can be used to show the company's "Social net profit":

\[
\text{Social net profit (yen)} = \frac{\text{Net profit}}{\text{Social costs}} *
\]

*Converted environmental impacts using the damage cost method

This indicator shows the so-called "true profit" of the company gained by off setting social costs against net profit. The type of environmental impact included in pre-converted environmental impact data is to be noted and conversion unit values standardized to allow use of this data for inter-company comparison. However, opinion differs about which unit value is appropriate. In practice, different unit values are used. Hence, for comparative purposes, the converted amount and the conversion method both need to be disclosed.

Secondly, the figure for environmental impact converted using the avoidance cost method represents the measurement of the company's social responsibility to be avoided. However, it is impractical to consider the presence of any business activity without there being some environmental impact, as a zero avoidance cost would mean shutdown of the business.

Moreover, calculation of the avoidance cost of environmental impact is dependent upon technical capabilities and increases as the environmental impact decreases. So the figures calculated using avoidance cost present many problems for the comparison of business performance, but they are useful for internal management decision making.

Ricoh disclosed the converted amounts of damage costs caused by environmental
impacts (social costs) since 2001. The data are shown in Table 4 (see p.14).

This converted value for environmental impact is obtained by multiplying total environmental impact by the damage cost coefficients. For example, Ricoh uses the factor of 108 Euro/t-CO2 of EPS Ver.2000 for its calculation (CEAPMS, 1999). The reason that Ricoh uses this method, as explained in the report, is that the amount "108 Euro/t-CO2" is almost the same as the marginal reduction cost calculated by Ricoh's actual investment in CO2 reduction.

The environmental impact (social cost - monetary value) is useful for comparisons over time. "Social net profit" in Table 4 shows that Ricoh has reduced social costs and at the same time increased corporate net profit. This means that Ricoh has steadily improved its sustainability environmental management.

5. Conclusion

This paper examines several sustainable environmental management indicators and analyses their uses. To evaluate sustainable environmental management it is necessary to assess all of these indicators in a comprehensive manner. As indicated, specific indicators present problems of interpretation, as does a narrow focus on the comparison of environmental costs and benefits.

In addition, the analysis reveals a number of problems if the purpose is to compare corporate environmental accounting data. Three are summarised below:

- Differences in boundary definitions and in the methods for calculating environmental costs/benefits.

In Japan, most companies disclose their environmental accounting information based on the Environmental Accounting Guideline of the MOE (MOE, 2002), on the face of it making comparison easy. However, as the MOE Guideline does not provide rigid details of the cost-benefit analysis, aggregation scope or method of calculation, this means that the definition and method of calculation for environmental costs/benefits differs between companies. Moreover, as most companies have introduced environmental accounting over a number of years, they have expanded the scope of aggregation and added new items. Therefore, care has to be taken when trying to compare the performance of different companies, and when comparing past and current data and associated trends.

- Limitations of information about environmental benefits and environmental burden.

Most environmental benefits and environmental burden information provided are related to the production process. However, from a product life-cycle perspective, greater environmental burden tends to occur at the time of product usage and disposal. As environmental burden at the time of usage and disposal are locked-in at the time the product is designed, companies producing the products should be responsible for these environmental burdens. In practice, most environmental R&D costs are incurred to reduce environmental burdens imposed at the time of usage and disposal. However, it is difficult to capture these environmental burdens in the data because they depend on the way products are used and the duration of usage, thereby making it difficult to calculate environmental benefits attributable to environmental R&D activities.
Lack of information about stocks.

The MOE Guideline provides for information about annual costs, burdens and benefits from environmental conservation activities, through flow information. Accumulations of environmental burdens (stock information) and resulting environmental liabilities (e.g. remediation liabilities from soil contamination) do not form part of the MOE framework.

Environmental accounting is a new and developing field and, as indicated above, there are many issues to be solved if the quality of data is improved. The demand for environmental accounting information is growing, for example, from the growing environmental ratings and eco-fund (environmental-friendly investment trusts) markets. Environmental accounting provides a rich information source providing stakeholders with relevant data that are not captured through conventional accounting, but until data quality is improved external parties seeking to use the information need to be well wary.

References


### Table 1: Environmental costs and related ratios

<table>
<thead>
<tr>
<th>Figures and ratios</th>
<th>Company/Year</th>
<th>Canon</th>
<th>Ricoh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental investments (billion yen)</td>
<td></td>
<td>3.57</td>
<td>3.57</td>
</tr>
<tr>
<td>Environmental expenses (billion yen)</td>
<td></td>
<td>9.00</td>
<td>9.51</td>
</tr>
<tr>
<td>Total Environmental costs (billion yen)</td>
<td></td>
<td>12.57</td>
<td>13.08</td>
</tr>
<tr>
<td>Environmental R&amp;D costs (billion yen)</td>
<td></td>
<td>0.49</td>
<td>0.47</td>
</tr>
<tr>
<td>Sales (billion yen)</td>
<td></td>
<td>2530</td>
<td>2696</td>
</tr>
<tr>
<td>Operating expenses (billion yen)</td>
<td></td>
<td>2362</td>
<td>2462</td>
</tr>
<tr>
<td>Capital Investments (billion yen)</td>
<td></td>
<td>200</td>
<td>170</td>
</tr>
<tr>
<td>R&amp;D costs (billion yen)</td>
<td></td>
<td>177</td>
<td>194</td>
</tr>
<tr>
<td>Environmental cost to sales ratio(%)</td>
<td></td>
<td>0.50</td>
<td>0.49</td>
</tr>
<tr>
<td>Environmental expense ratio(%)</td>
<td></td>
<td>0.38</td>
<td>0.39</td>
</tr>
<tr>
<td>Environmental investment ratio(%)</td>
<td></td>
<td>1.78</td>
<td>2.09</td>
</tr>
<tr>
<td>Environmental R&amp;D cost ratio(%)</td>
<td></td>
<td>0.28</td>
<td>0.24</td>
</tr>
</tbody>
</table>

### Table 2: Environmental benefits (physical unit) and related ratios

<table>
<thead>
<tr>
<th>Figures and ratios</th>
<th>Company/Year</th>
<th>Canon</th>
<th>Ricoh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental benefit indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2 reduction(t)*</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Waste reduction(t)*</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2 reduction/Sales(t/billion yen)</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Waste reduction/Sales(t/billion yen)</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Converted quantity of reduction(t-CO2)</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Converted quantity of reduction/Environmental costs(t-CO2/billion yen)</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Environmental impact indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total CO2 emission(t)</td>
<td></td>
<td>564630</td>
<td>597951</td>
</tr>
<tr>
<td>Total waste emission(t)</td>
<td></td>
<td>47124</td>
<td>44613</td>
</tr>
<tr>
<td>CO2 emission/Sales(t/billion yen)</td>
<td></td>
<td>223</td>
<td>222</td>
</tr>
<tr>
<td>Waste emission/Sales(t/billion yen)</td>
<td></td>
<td>18.6</td>
<td>16.5</td>
</tr>
</tbody>
</table>

*The figures for CO2 and Waste reduction of Canon are only for domestic business in Japan, and do not include the figures incurred by business outside Japan.*
Table 3: Economic benefits (monetary value) and related ratios

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantial economic benefits (billion yen)</td>
<td>1.86</td>
<td>1.81</td>
<td>2.23</td>
<td>2.64</td>
<td>1.96</td>
<td>1.59</td>
<td>3.30</td>
<td>4.52</td>
<td>6.98</td>
<td>10.04</td>
<td></td>
</tr>
<tr>
<td>Estimated economic benefits (billion yen)*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8.10</td>
<td>9.86</td>
<td>11.04</td>
<td>16.82</td>
<td>20.25</td>
<td></td>
</tr>
<tr>
<td>Total economic benefits / Environmental costs (%)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.20</td>
<td>1.11</td>
<td>1.15</td>
<td>1.52</td>
<td>1.87</td>
<td></td>
</tr>
<tr>
<td>Social benefits (billion yen)</td>
<td>-</td>
<td>-</td>
<td>18.77</td>
<td>20.87</td>
<td>27.20</td>
<td>-</td>
<td>2.15</td>
<td>2.99</td>
<td>2.67</td>
<td>3.07</td>
<td></td>
</tr>
</tbody>
</table>

*Ricoh treated “Contribution to gross margin through environmental research and development” as “Expected effect” before 2001 and treats it as “Substantial effect” after 2002. However, in Table 3, to ensure consistency, the amount of “Contribution to gross margin through environmental research and development” is included in “Environmental estimated benefits” for the 5 years.

Table 4: Social costs and social net profit

<table>
<thead>
<tr>
<th>Indicators (billion yen)</th>
<th>Company / Year 2001</th>
<th>Ricoh 2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social costs</td>
<td>6.9</td>
<td>6.8</td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>Net profit</td>
<td>61.6</td>
<td>72.5</td>
<td>91.7</td>
<td></td>
</tr>
<tr>
<td>Social net profit</td>
<td>34.7</td>
<td>65.7</td>
<td>85.4</td>
<td></td>
</tr>
</tbody>
</table>