Explore the relationship between environmental management practices and company performance: Evidence from Swedish manufacturing industry

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Abstract
The relationship between environment management practices (EMPs) and company performance has been on the debate in literature and also of interest for company managers. This paper focuses on Swedish manufacturing industry for an empirical examination. With the support of data from standard environmental reports, we attempt to adopt content analysis and multivariate data analysis, and to replicate the evaluation of Montabon et al. (2007) [1]. However, the difference not only lies on that we applied group analysis to sample companies in different manufacturing industries in Sweden, but also due to our inclusive of both companies with and without GRI reporting systems.

Our finding indicates no significant correlations between EMPs and financial performance. But some EMPs such as environmental design and specific design targets are both significantly correlated to both product and process innovation. Remanufacturing is significantly related to the return of capital. It indicates that the easiest EMPs to start working on for a company may use a bottom-up approach to environmental issues. Though as the literature shows companies make their strategy for corporate sustainability always in a top-down process [2].

Our research also shows that industry which consumes relatively more energy and resource such as process industry has significantly lower score on operational practices. Moreover, EMPs such as recycling, reduction of waste (reactive) and money spent on environmental are used to a slightly different degree in process industries.

1. Introduction
Literature shows that operations management researchers are increasingly curious about the relationship between environmental management practices (EMPs) and company performance [3-5]. In industries, many companies try to include environmental issues into the strategy agenda due to stakeholders’ needs and competitive pressures [6]. One case in point is that more manufacturing facilities introduce Environmental Management System (EMS) to improve their performance [7]. By analyzing a sample of Standard & Poor’s 500 companies, Khanna and Anton [8] explore different motivations driving corporate environmentalism. Their main finding is that factors including company characteristics, proxies for the incentives faced by the companies will determine the type of EMPs to be chosen. Their empirical research also indicates that regulatory pressures will motive companies to have an internal environmental policy, corporate environmental standards and environmental audit system. However, the main drivers for environmental
reporting and quality environmental management are from the desire to gain potential competitive advantage and improve relationships with different stakeholders.

In addition, companies are facing the common conceptions that green management will increase costs and reduce the profits, which discourage green management efforts. Empirical research in this field is still limited. By analyzing the reports from US and non-US corporates, Montabon et al. [1] investigate the link between EMPs and company performance and further conclude a positive and significant relationship between them. Nevertheless, such study does not distinguish sample companies based on either geographic location or industrial area. It is still an open question whether the link of EMPs and performance varies in different industries and distinct countries. In our study, the Swedish manufacturing industry has been selected as our focus.

As Epstein (2008) stated in his book, companies operating worldwide have to decide whether to implement their sustainability strategy globally or locally [2]. The company only identify, measure, and report their environmental impact until the board and CEO are committed to improving sustainability management [2]. In other words, sustainability strategy is, according to literature, often developed according to a top-down framework. It is also of interest to investigate whether companies always implement it in this manner.

Based on the above discussion, we attempt to develop the following hypothesis in order to contribute to the previous debate on EMPs, company performance and sustainability strategy.

**Hypothesis 1:** There are correlations between environmental practices and financial performance in manufacturing industry.

In this study, our investigation is mainly based on data from Global Reporting Initiative (GRI) reports. Since the time lag between one environmental management practice implementation and its specific effect on company performance, the companies who follow the GRI reporting system may not necessarily perform better than others in the short run. However, their transparency in sustainability reporting system should enhance their opportunity to gain potential competitive advantage and improve relationships with internal and external stakeholders in the long run. Thus we further develop the following hypotheses.

**Hypothesis 2:** Regarding the financial performance in a short time, there is no significant difference between companies with GRI reporting system and those without.

**Hypothesis 3:** There is a positive impact on their financial performance in the long run for companies using the GRI reporting system, compared with the companies not using it.

In this study, we are also interested in distinguishing industries. In Sweden, process industry and mechanical/machinery industry contribute significant economic outputs in the country. Most of the process oriented manufacturing industry is more energy and
resource intensive, some examples in point are pulp and paper industry, chemical industry, food process industry and mining companies. Compared with other industries, they face relatively high regulatory pressures from internal and external stakeholders’ perspective. According to Khanna and Anton [8], regulatory pressures should motive companies to have some specific EMPs. Therefore we make the last hypothesis

Hypothesis 4: There are significant differences in environmental practices employed between process industry and other manufacturing industry.

With the above background, our research purpose includes:

- Replicate Montabon et al.’s empirical evaluation of corporate reporting, EMPs and company performance with Swedish manufacturing industry as a focus; and compare the results against those reported in Montabon et al. [1].
- Compare if process industries are employing different practices than the rest of the industry.
- Compare financial performance between companies using the GRI reporting method and companies that don’t.

2. Literature review and research methodology

Recent literature indicates that EMPs can lead companies to innovations and further reduce costs or increase demands [1, 5, 9]. Consequently, EMPs can improve the company performance, mainly in terms of financial performance. Yang and Hong tested the relationships between lean manufacturing practices, environmental management and business performance outcomes by using the existing data from the International Manufacturing Strategy Survey collected in 2005 [10]. They find that EMPs alone are negatively related to market and financial performance. But improved environmental performance substantially reduces the negative impact of EMPs on the market and financial performance.

Instead of using existing database, we collect data from sample companies’ published reports. The main methodology that we apply in this research is content analysis. Content analysis has been recognized as a systematic, structural, replicable methodology for compressing long text into fewer content categories based on explicit coding process [11, 12]. Moreover as the accounting research shows to classify disclosures as favorable or unfavorable, with quantitative measures that reflect the intensity or degree of favorableness, especially based on published annual reports of companies [13].

We test the relationship between one set of independent variables including 33 EMPs and the dependent variables corresponding to company performance. Innovation is measured by variables of product innovation and process innovation. Returns on investment and sales growth are used as variables to measure the impact on financial performance by EMPs. Data collection is achieved by content analysis of 21 corporate reports of manufacturing companies (mostly are Sweden origin ones) from 30 sample companies.
Regarding the rest 9 companies without GRI report, we collect only their financial performance data.

In order to obtain the EMPs in the sample companies, we use the information from their GRI reports which represent a standardized reporting approach for environmental, economic and social performance. As mentioned before, we can apply a content analysis which is a literature review method of a systematic, quantitative and qualitative description of the manifest content of literature in our specific area [14].

Content analysis has a shortcoming in clarifying reliability and validity. In order to overcome this, several independent researchers should conduct the search and coding. This helps to reduce the limitation and strengthen the scientific quality [15]. According to Krippendorff (1980 and 2004) [11], six questions have been addressed during our content analysis:

- Which data are analyzed?
- How are they defined?
- What is the population from which they are drawn?
- What is the setting relative to which the data are analyzed?
- What are the boundaries of the analysis?
- What is the essence of the inferences?

We restructure our analysis follow the four-step framework [15]:

- Material collection
- Descriptive analysis
- Category selection
- Material evaluation

This study has a focus on Swedish manufacturing industry. Firstly, we obtain a potential list including 109 manufacturing plants in Sweden. This is the same list as in a previous survey study conducted in 2006 by one of the authors [16]. But as this previous research is manufacturing plants focused instead of manufacturing companies focused, we cannot collect enough samples since many manufacturing plants belong to one company. Thus we draw more potential sample companies which are Sweden origin manufacturers from the following sources: The Dow Jones Sustainability World Index 2010 and the sustainable operations ranking list for companies by the global investment banking and securities company Goldman Sachs and financial services company UBS in 2010.

The Dow Jones Sustainability World Index 2010 provided the list of Atlas Copco, Electrolux, Sandvik, SKF, SCA, Volvo group, Assa Abloy and ABB from the sustainable operations ranking list for companies by the global investment banking and securities company Goldman Sachs and financial services company UBS in 2010. We delete the duplicates and finally obtain 30 manufacturing companies as the research sample in this study.
Data was collected from their published sustainable reports from the official website of sample companies. To avoid non-standard environmental reporting data, we only choose the companies who have introduced GRI (Global Reporting Initiative) reporting system. If their GRI report in 2010 cannot be found on their official website, we go to the Sustainability Disclosure Database [17] for a double check.

Finally, 21 of 30 companies achieved the same reporting standard. One of this research purpose is to investigate if any mechanisms behind the relationships between EMPs and company performance, especially in manufacturing industry. As stated before, since most of the process oriented manufacturing companies consume more energy and resource and have more regulation pressure, one of our hypothesis stated that there are significant differences in environmental practices employed between process industry and other manufacturing industry. Thus we divide the 21 selected companies into two analysis units depending on their manufacturing branches. That is to say, 21 companies who have been published GRI report has been divided into Process industry and non-Process industry.

Finally, we category our sample companies into three groups: process oriented manufacturing companies who have GRI report in 2010, companies who belong to non-process manufacturing industry but provide GRI report in 2010, and companies don’t have GRI report in 2010. The details of this list are illustrated in Table 1.

The researchers had a discussion in a seminar firstly in which we achieved:

- The same objectives of this research
- Define and have the same understanding on the code sheet
- Design a standard coding process

Since one of our research purposes is to compare the results with Montabon et al.’s [1], we proceed as closely as the definitions of the research of [1]. The appendix shows the list of definitions and a coding matrix for the sample companies. However, we found our sample companies use return on capital employed (ROC), sales growth and operating earnings more commonly as their financial performance indicators. Thus in order to evaluate the impact EMPs on financial measures, we use the following variables:

**Operating earnings:** Profits after subtracting expenses such as marketing, cost of goods sold, administration and general operating costs from revenue. Operating earnings are synonymous with EBIT (earnings before interest and taxes) [18].

Operating earnings = EBIT = Revenue - Operating Expenses

Analysts typically use operating earnings to assess the quality of a company's core business and forward prospects since it shows the relationship between sales, volume and costs.
**Return on capital employed (ROC):** This is an objective financial measure that is a reflection of success of a business in realizing its goal. It can be applied to indicate the overall efficiency and profitability of the business [18].

Return on Capital employed = EBIT/ (total assets - current liabilities)

**Sales growth:** The increase in sales over a specific period of time. In this research, we only calculated the sales growth in 2010 fiscal year.

We collected the financial data from sample companies’ published 2010 annual reports and the Affärsdata (Business data) database.

The companies’ annual environmental reports were only coded on the same time basis in 2010. The coding process was finished in seven weeks.

Table 1. Sample companies in this research

<table>
<thead>
<tr>
<th>GRI Companies</th>
<th>Non-Process</th>
<th>Non-GRI Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AAK</td>
<td>ABB</td>
<td>Atlas Copco AB</td>
</tr>
<tr>
<td>Akzo Nobel</td>
<td>Ericsson</td>
<td>Saft AB</td>
</tr>
<tr>
<td>Alfa Laval</td>
<td>Elektrolux</td>
<td>BAE Systems Hagglunds AB</td>
</tr>
<tr>
<td>Assa Abloy</td>
<td>Outokumpu Stainless</td>
<td>BD Medical</td>
</tr>
<tr>
<td>Billerud Karlsborg</td>
<td>Scania</td>
<td>Carrier Refrigeration AB</td>
</tr>
<tr>
<td>BT</td>
<td>SSAB</td>
<td>Haldex Brake Products AB</td>
</tr>
<tr>
<td>Heidelberg Cement</td>
<td>SKF</td>
<td>Megtec Systems AMAC AB</td>
</tr>
<tr>
<td>Holmen</td>
<td>Siemens</td>
<td>Seco Tools</td>
</tr>
<tr>
<td>Stora Enso</td>
<td>Volvo Cars</td>
<td>Volvo Aero Corporation</td>
</tr>
<tr>
<td>SCA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metso</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandvik</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Analysis

At first we have investigated the correlation between environmental practices and performance. For all companies, the sum of all scores of environmental practices was calculated as well as sub scores for operational, tactical and strategic practices. The scores were then compared to the return on capital (Table 2) and the sales growth (Table 3). As can be seen in the tables, no significant correlations were found between environmental practices and the two measures of financial performance.
Table 2. Correlation between environmental practices and return on capital employed

<table>
<thead>
<tr>
<th>Corr. with ROC</th>
<th>Correlation coefficient</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational practices</td>
<td>0.257</td>
<td>0.261</td>
</tr>
<tr>
<td>Tactical practices</td>
<td>0.285</td>
<td>0.210</td>
</tr>
<tr>
<td>Strategic practices</td>
<td>0.067</td>
<td>0.772</td>
</tr>
<tr>
<td>Total</td>
<td>0.269</td>
<td>0.239</td>
</tr>
</tbody>
</table>

Table 3. Correlation between environmental practices and return on capital employed

<table>
<thead>
<tr>
<th>Corr. with sales growth</th>
<th>Correlation coefficient</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational practices</td>
<td>0.031</td>
<td>0.896</td>
</tr>
<tr>
<td>Tactical practices</td>
<td>-0.260</td>
<td>0.255</td>
</tr>
<tr>
<td>Strategic practices</td>
<td>0.153</td>
<td>0.508</td>
</tr>
<tr>
<td>Total</td>
<td>-0.075</td>
<td>0.748</td>
</tr>
</tbody>
</table>

When searching for correlations between environmental practices and performance in the process and product innovations, we used a Spearman’s Rho correlation, which is a nonparametric correlation analysis that can be used for both ranked scales and continuous scales. First we tested the overall scores for environmental practices (operational, tactical strategic and total) to see if any specific level of practices seems to have a greater impact. Neither tests returned any significant result.

Further, we perform specific tests of correlation between the 6 significant variables from Montabon et al. (2007); Recycling, Proactive waste management, Remanufacturing, Environmental design, Specific design targets and Surveillance of the market for environmental issues. The results can be found in Table 4 and conclude a correlation for three of the practices, namely Remanufacturing, Environmental design and Specific design targets. Environmental design and Specific design targets are both significantly correlated to both product and process innovation. In addition, Remanufacturing is significantly related to the return of capital.
Table 4. Correlations between 6 EMPs and company performance (* = significant p < .05, ** = significant p < .01)

<table>
<thead>
<tr>
<th>(Sign.)</th>
<th>ROC</th>
<th>Sales growth</th>
<th>Product innovation</th>
<th>Process innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycling</td>
<td>.903</td>
<td>.669</td>
<td>.991</td>
<td>.855</td>
</tr>
<tr>
<td>Proactive waste man.</td>
<td>.371</td>
<td>.316</td>
<td>.276</td>
<td>.584</td>
</tr>
<tr>
<td>Remanufacturing</td>
<td>.040*</td>
<td>.102</td>
<td>.151</td>
<td>.109</td>
</tr>
<tr>
<td>Environmental design</td>
<td>.300</td>
<td>.595</td>
<td>.004**</td>
<td>.010**</td>
</tr>
<tr>
<td>Specific design targets</td>
<td>.968</td>
<td>.328</td>
<td>.034*</td>
<td>.043*</td>
</tr>
<tr>
<td>Surveillance of markets</td>
<td>.934</td>
<td>.222</td>
<td>.140</td>
<td>.361</td>
</tr>
</tbody>
</table>

The second step in our analysis compares if there is a significant difference between process industries and the other companies in terms of practices employed. A non-parametrical Mann-Whitney-U-test was performed for each of the individual practices as well as the totals from Tables 2 and 3. We find a significantly lower (p<0.05) score on operational practices for process industries. In addition, the factors Recycling, Reduction of waste (reactive) and Money spent on environmental initiatives indicate a potential difference between the groups but the significance is only on the 10 %-level.

4. Results

A growing number of companies publishing GRI reports indicate the increasing engagement in standardized and effective measures for environmental performance. Not all EMPs can contribute to company performance. We were partly able to replicate the positive correlation between performance in product and process innovation and environmental practices employed that was found in Montabon et al. [1].

There is so far no easy and clear answer to the questions which practices contribute to a positive impact on business performance and with what kind of conditions. This study attempts to fill this research gap in the literature. This research shows that environmental practices such as Recycling, Reduction of waste (reactive) and Money spent on
environmental initiatives are used to a different degree in process industries, but the result is not strong enough to be conclusive. This could be explained by the small sample sizes, since we only have 10 cases per group. What the three groups have in common is that they seem to be the easiest ones to start working on for a company that uses a bottom-up approach to environmental issues. They require little from the company in terms of organizational alignment and broad investments in environmental practices.

5. Limitations

One of the main limitations is the time lag between one environmental management practice implementation and its specific effect on company performance. As the selected samples use GRI reporting standard, we will apply multiple years of their environmental reports in our future research.

In our research we have a total sample of 30 companies, which are split into three different groups. The sample size is another limitation of this paper, since more advanced statistical methods than simple tests require larger sample sizes. An increased sample size could also help achieve significant results for some of the tests that were borderline-significant.

6. Discussions

The results from the current study are compared against those reported in Montabon et al. (2007) in which the sample is a mixture of U.S. and non-U.S. companies, manufacturing and none-manufacturing industries. Our study results indicate that not all EMPs can contribute to company performance. There is so far no clear answer to the questions which practices contribute to a positive impact on business performance and with what kind of conditions. However, our empirical examination represents the first attempt to find whether or not EMPs favors company performance in a Swedish manufacturing setting. Our research also indicates that managers’ level of awareness of the audit on the environmental management performance available and their procedures was still not strong enough. From a managerial perspective, findings from this paper should further raise awareness of reporting their environmental management practices in a standard way, for example, follow the Global Reporting Initiative guideline. In this way, it enables companies to get a transparent internal and external communication system and enable themselves have a visible control of the triple bottom line on a company level [18]. Also this research should further raise awareness of potential business performance management improvement especially in the manufacturing industry field. This awareness should help decision makers to make a better choice on the environmental practice strategy and implementation.
Appendix

**Definition Sheet for raters** (Adopted from Montabon et al. [1])

Environmental practices
*Please remember that there is no right or wrong answers to the report evaluations. We simply need your evaluation of the intensity of involvement by a company in the following activities and practices.*
Key words are in bold—1: not doing it, 2: eludes to doing it . . . 5: quantitative measures, categories, and targets.

**Operational practices**
1. Recycling
2. Waste reduction (proactive)
3. Waste reduction (reactive)
4. Remanufacturing
5. Substitution
6. Consume internally
7. Packaging
8. Spreading risk
9. Creating a market for waste products
10. Energy
11. Money spent on environmental initiatives
12. Environmental information
13. Rewards as incentive for environmental project

**Tactical**
14. Supply chain management
15. Early supplier involvement
16. Environmental standards for suppliers
17. Environmental audits of suppliers
18. Environmental awards/recognition
19. Environmental participation
20. Use of life cycle analysis or design for environment
21. Product development and innovation
22. Design
23. Specific design targets
24. Environmental risk analysis
25. Environmental management systems (EMS
26. Communication

**Strategic**
27. Integration with long-term business strategy
28. Corporate policies and procedures
29. Environmental mission statement
30. Employee programs
31. Environmental department/teams (existence/extent of formal organizational structure)
32. Surveillance of the market for environmental issues
33. Strategic alliances

**Performance measures**

34. Reduction in significant environmental incidents
35. Environmental certification
36. Continuous improvement
37. Recycling performance
38. Customer and shareholder perception of environmental performance
39. Independent audits of environmental performance
40. Waste reduction
41. Resource consumption (water, energy, steam, solids, fuel)
42. Cost savings for environmental projects and activities
43. Return on Capital employed
44. Operating earnings
45. Sales growth
46. Innovation performance (products)
47. Innovation performance (process)

**References**