

A Study of Industry Environmental Accounting Disclosure Associated with Cost and Benefits— A Case Study of Japanese Hitachi Group

Lin Yi Hua^{1,*}, Chen Nai Hua²

¹Department of Accounting Information, Southern Taiwan University of Science and Technology, Tainan, Taiwan

²Southern Taiwan University of Science and Technology, Tainan, Taiwan

*Corresponding Author: a974gtl@mail.stust.edu.tw

Copyright © 2014 Horizon Research Publishing All rights reserved.

Abstract Within the 1970s, due to the environmental accounting began getting focus throughout the energy crisis. Recently, environmental accounting research has become an attractive area. Several studies have suggested the benefit of facilitative in disclosing company environmental accounting information. The data of this study is collected from Hitachi annual report and Hitachi group corporate social responsibility report over the period 2008-2012. The case study analyzes whether the investment in environmental protection can reduce GHG emissions, waste processing and energy conservation etc. This study mainly explores the relationship between carbon emission and financial investment in Hitachi Company according to the environmental disclosures. Furthermore, this study also observes the indicator of the efficiency of environmental load reduction and environmental economic effects. The results showed that Hitachi invests environmental protection does not definitely get positive efficiency. However, Hitachi still concerned environmental protection issue, for example, Hitachi enhances energy efficiency of their products and reduces CO₂ emissions in energy productions. In conclusion, Hitachi has long-term plans for environment protection, in order to reach the goal that they increase the ratio of eco-products which enhance energy efficiency of their products. Although the study has limitation, it presents some results of cost-benefit analysis of environmental investment through environmental accounting data that could strength the contribution of environmental accounting report..

Keywords Environmental Accounting, Corporate Social Responsibility, Cost-Benefit Analysis

1. Introduction

1.1. Research Background

In the past, most companies consider that environment

protection activities will only increase cost. In fact, it will help companies to operate sustainably. As environmental consciousness has risen in recent years, a new type of accounting has been developed: Environmental accounting which provides voluntary disclosure of environmental information about environmental activities and environmental efforts. More and more companies provide not only their financial statements, but also their nonfinancial information, such as reports on their environmental record, social responsibility and sustainability (McCrary, 2002). Eco-efficiency is one of the most popular concepts for the integrated measurement of corporate environmental and financial performance (Callens and Tyteca[1]; Ciroth[2]; Huppés and Ishikawa[8,9]; Lamberton[10]; Figge and Hahn[6]). Scholars and practitioners have suggested different kinds of eco-efficiency indicators, which relate desirable outcomes of economic activity to undesirable environmental impacts or resource use (DeSimone and Popoff [3]; Hahn et al.[7]; Huppés and Ishikawa[8]). Environmental accounting is the ecological significance of economic activity and the economic worth of natural resources. Companies may employ environmental accounting to control and reduce the costs of managing waste, remediating contaminated sites, paying environmental fines, penalties and taxes, or purchasing pollution prevention technologies. Environmental accounting data is not only used by companies or organizations for internal environmental management, but is also disclosure in public through environmental reports. The environmental accounting data in an environmental report enable stakeholders to get an understanding of the company's stance on environmental conservation and how it deals with environmental issues. At the same time, a more comprehensive grasp of the companies and other organizations' environmental information can be obtained[4,5]. Environmental accounting reports can provide information about environmental activities and benefits. Since environmental accounting in Japan have been widely used, this paper focus on Japanese companies. This paper

explores the environmental accounting of HITACHI in the period of five years (2008-2012) and investigates the HITACHI report of economic benefit and the cost and effect (in quantity and monetary value) of its environmental conservation activities.

1.2. Objectives of the Study

Exploring the environmental accounting at the corporate level helps the management to know whether corporate has been discharging its responsibilities towards sustainable development while meeting business objectives. The objective is to illustrate the benefits of environmental management accounting system and discover how to implement this system to garner better market value and position. The data of this study is collected from Hitachi annual report and Hitachi group corporate social responsibility report over the period 2008-2012. The case study analyzes whether the investment in environmental protection can reduce GHG emissions, waste processing and energy conservation etc. This study mainly investigate the cost and effect (in quantity and monetary value) of its environmental conservation activities in Hitachi Company according to the environmental disclosures. Furthermore, this study also observes the indicator of the efficiency of environmental load reduction and environmental economic effects. Whether environmental investment cost displayed in environmental accounting report can increase environmental performance?

2. Research Methodology

2.1. Case Study

Case studies can be used when studying “how” or “why” something is done. Case studies help researchers to bring a concrete orientation and provide a meaningful example for the study. A case study is a method for learning about a complex instance, based on a comprehensive understanding of that instance obtained through extensive description and analysis. Yin [12] distinguishes three types of case studies: exploratory, causal and descriptive case studies. In an exploratory case study, the collection of data occurs before theories or specific research questions are formulated: it is followed up by analysis of data and leads to more systemic case studies. The first stage in this type of case study is to define the issues to be researched. The causal case study will look for cause-and-effect relationships, and search explanatory theories of the phenomena. Furthermore, for case studies, theory development as part of the design phase is essential, whether the ensuing case study's purpose is to develop or test theory, with theory development taking place prior to the collection of any case study data being an essential step in doing case studies[13]. Since environmental accounting research is a new area and seldom focused in relationship between environmental investment and benefit. Therefore, this study primarily adopted case study, data-collecting methods and secondary analysis method to collect environmental accounting reports and detailed analyze environmental accounting information to investigate the relationship between environmental investment cost and environmental performance such as the water consumption, energy input and greenhouse gases emission and so on.

Table 1. Hitachi's summary of final report

| For the year | 2008 | 2009 | 2010 | 2011 | 2012 |
|----------------------|-------------|------------|------------|------------|------------|
| Net income(loss) | ¥(58,125) | ¥(787,337) | ¥(106,961) | ¥238,869 | ¥347,179 |
| Total Asset | ¥10,530,847 | ¥9,403,709 | ¥8,951,762 | ¥9,185,629 | ¥9,418,526 |
| Stockholders' equity | ¥2,170,612 | ¥1,049,951 | ¥1,284,658 | ¥1,439,865 | ¥1,771,782 |
| Capital investment | ¥969,087 | ¥788,466 | ¥546,326 | ¥556,873 | ¥649,234 |
| ROA | -0.0055 | -0.0837 | -0.0119 | 0.026 | 0.037 |
| ROE | -0.0268 | -0.075 | -0.0833 | 0.1659 | 0.1959 |
| Number of employees | 389,752 | 400,129 | 359,746 | 361,745 | 323,540 |

Unit: ¥ Millions of yen

2.2. Introduction of Hitachi

Hitachi is one of the famous companies in the world. The company releases environmental accounting data every year. We can collect more information than other Japanese companies. That is why we choose this company. Hitachi ranks among the 50 largest industrial corporations in the world and also is Japan's largest manufacturer of electrical machinery and a leading producer of semiconductors, producing over 20,000 products. Hitachi is a leading global electronics company with approximately 320,000 employees worldwide. The company is based in Tokyo, but it serves a market that circles the globe. Hitachi produces audio and video equipment and has corporate offices in Asia, America and Europe. Top competitors are Amdahl and Fujitsu. Table 1 shows information about Hitachi annual reports. It shows that net income generally increases to 347,179 million in 2012. As a result, net income for fiscal 2012 increases 108,310 million than the previous fiscal year. There is a fluctuant trend in total asset. It has the highest total asset 10,530,847 in 2008. Hitachi invests the largest capital investment ¥969,087 in 2008. After that, it declines remarkably for the next three years. Hitachi's return on asset ratio (ROA) 0.1959 is better at converting its investment into profit; it has the largest profit in 2012 compared with past four years. From 2008 to 2010, ROA is negative until 2011 became positive (0.026). Table 1 also shows that the lowest ROE (-0.0833) is in 2009. Hitachi employee numbers reveal a fluctuation trend. In 2009, there are 400,129 employees; however, the lowest number of employees is 323,540 in 2012.

Hitachi group discloses information openly and transparently in order to maintain and develop a relationship of trust and also strive to minimize environmental effects and utilize resources towards the development of a sustainable society. The aim of environmental management is "achieving a sustainable society." Hitachi committed to global warming prevention, resource conservation, and ecosystems preservation as the three pillars of vision. Therefore, their goal is to achieve a more sustainable society by promoting global production that reduces the environmental burden of a product throughout its life cycle. Based on the Global Environment Charter; Hitachi Construction Machinery promotes environmental management and set up the global environment charter and positively promotes environmental conservation activities of the group. The company is also engaged in various activities as in the sustainability compass. Hitachi established "Environmental Protection Action Guidelines" in 1993 and has promoted environmental protection activities since then. In 2005, the Group newly established "Action Guidelines for Environmental Conservation," made an environmental action plan based on the Guidelines, and has promoted environmental conservation activities. Hitachi group companies promote environmental improvement activities by each unit of certification of ISO14001 environmental management system. The company further established the

environment center in quality and environment group for the group-wide environmental management and the center communicate action policies and information to the works and the group companies and sum up achievements through environmental activities. Following that, the company recommended the establishment of management systems in Group companies and overseas establishments in order to promote improvement in environmental activities of the Group.

3. Environmental Accounting and Operating Performance Results

This chapter mainly used annual reports from past five years from (2008-2012), by using balance sheets and income statements to calculate return on asset (ROA) and return on equity (ROE). We illustrate the case study of Hitachi environmental accounting reports and analyze the result of environmental accounting.

3.1. Environmental Economic Efficiency Analysis

Environmental accounting benefits analysis include two parts, one is economic benefit, and another is physical effect. The analysis of data is carried out by means of an economic benefit approach to evaluate the Hitachi environmental invest costs and performances. Environmental cost accounting is more likely to be qualified as a subset of the costs of operating a business. When substances are released into the air, water or land, the resulting pollution used to be considered a social cost, an externality. As environmental externalities become internalized, and investors start to pay attention to the environmental risks of their "investments" new costs emerge. The Hitachi's environmental expense and investment data analyses were performed in Table 2. The Hitachi continues to reduce environmental burden, with a focus on the environmental risk management. According to following tables, it was found that business area presentation cost was the highest expense and investment in 2011, subtotal accounting for 3.78 billion and 0.8 billion respectively. In the year 2008, 3.59 billion yen expense was the second largest investment. In contrast, it has the lowest expenses in business area cost in 2009, only 3.24 billion yen. In 2009, Hitachi just invests around 0.47 billion yen in environmental protection; however the environmental protection effects of physical effects has evident efficiency in 2009. The number of reduction in the amount of energy used is 191 million kWh in 2009. On the other hand, if we look at year 2011, it invested the biggest business area cost in subtotal, but it has the lowest efficiency on reduction in the amount of energy, only 93 million kWh in 2011. Reduction in the amount of final waste disposal category, it reduced significantly 6,752 tonnes in 2008. Another interesting point is that Hitachi invests high cost on business area in 2010 but reduction of final waste disposal does not show efficiency, it at the lowest point of 3,623 tonnes in 2010.

A Study of Industry Environmental Accounting Disclosure Associated with Cost and Benefits —
A Case Study of Japanese Hitachi Group

Table 2. Hitachi Five years of Environmental Costs (¥100 million)

| Cost Classification | | FY2008 | | FY2009 | | FY2010 | | FY2011 | | FY2012 | |
|--------------------------------|-----------------------------------|---------|------------|---------|------------|---------|------------|---------|------------|---------|------------|
| | | Expense | Investment |
| Business Area Costs | Pollution Prevention | 13.8 | 1.0 | 13.1 | 1.0 | 14.2 | 0.6 | 13.8 | 0.3 | 12.7 | 0.1 |
| | Global Environmental Preservation | 2.4 | 1.8 | 3.3 | 3.5 | 5.5 | 2.9 | 5.9 | 6.3 | 4.3 | 3.0 |
| | Resource Recycling | 19.6 | 0.6 | 16.1 | 0.2 | 16.9 | 0.0 | 18.1 | 1.4 | 18.7 | 0.6 |
| Subtotal | | 35.9 | 3.4 | 32.4 | 4.7 | 36.6 | 3.5 | 37.8 | 8.0 | 35.7 | 3.7 |
| Upstream and Downstream Costs | | 1.2 | 0 | 0.9 | 0 | 0.8 | 0 | 0.8 | 0 | 1.9 | 2.6 |
| Management Activity Costs | | 8.4 | 0 | 7.3 | 0 | 7.7 | 0 | 6.4 | 0 | 3.7 | 0 |
| Research and Development Costs | | 33.6 | 6.2 | 31.7 | 8.5 | 35.3 | 10.8 | 24.9 | 9.4 | 19.0 | 0 |
| Community Activity Costs | | 0.2 | 0 | 0.1 | 0 | 0.1 | 0 | 0.2 | 0 | 0.1 | 0 |
| Others | | 0.9 | 0 | 0.6 | 0 | 1.0 | 0 | 0.7 | 0 | 0.8 | 0 |
| Total | | 80.1 | 9.6 | 73.1 | 13.2 | 81.5 | 14.3 | 70.9 | 17.4 | 61.2 | 6.2 |

Table 5 shows the Hitachi efficiency of environmental load reduction in the percentage of reduction in energy and waste index, how many kilowatt hours energy used during production and the number of tonnes of the waste disposal reduction. In general, indicator of the efficiency of environmental load reduction reaches a peak trend in 2009. The percentage of energy reduction was 0.33 in 2008, and then reached a peak of 0.42 in 2009. After then, the figure dropped slightly from 0.32 in 2010 to 0.17 in 2012. Furthermore, reduction in amount of waste for final disposal also has the highest reduction, 22.9 tonnes in 2009. It shows a fluctuation period, the figure dipped to 14.7 tonnes in 2010. At the next year, there was a little increase to 18.3 tonnes. It dropped to the lowest point of 14.6 tonnes in 2012.

We can see from Table 2. What is surprising is that very few expense and investment in business area cost in 2009 just 3.24 billion yen and 0.47 billion yen respectively. However the environmental load reduction shows obvious efficiency in 2009, because Hitachi has greatly performance on energy reduction. In contrast, in 2011, company invests the biggest number of expense and investment cost, which has 3.78 billion yen and 0.8 billion yen respectively. Table 4 and Table 5 reveals that the physical effects figure at the smallest kilowatt hours, 93 million kWh in 2011. In addition, environmental load reduction also did not show obvious efficiency, the index of reduction in energy item only 0.20 million kWh, and the reduction of waste disposal tonnes, only 18.3 in 2011.

Table 3. Hitachi Environmental Protection Effects of Economic Effects

| Economic Effects*1 | | | | | | |
|--------------------------|-------------------------|--------|--------|--------|--------|---|
| Item | Costs (billions of yen) | | | | | Major FY 2012 Activities |
| | FY2008 | FY2009 | FY2010 | FY2011 | FY2012 | |
| Net income effects | 10.90 | 8.30 | 9.62 | 13.72 | 17.85 | Finding value from waste by sorting and recycling |
| Reduced expenses effects | 18.24 | 15.00 | 18.45 | 15.27 | 12.07 | Reducing resource costs through resource and energy conservation; reducing waste disposal costs through waste reduction |
| Total | 29.14 | 23.30 | 28.07 | 28.98 | 29.92 | |

*1 Economic effects include the following items:

- Net income effects: benefits for which there is real income, including income from the sale of resalable material and income from environmental technology patents
 - Reduced expenses effects: reduction in electricity and waste treatment expenses arising from environmental load reduction activities
- Source: Hitachi Sustainability Environmental Report 2013; p114

Table 4. Environmental Protection Effects of Physical Effects

| Physical Effects | | | | | |
|--|-----------------|-----------------|-----------------|----------------|-----------------|
| Item | Amount Reduced | | | | |
| | FY2008 | FY2009 | FY2010 | FY2011 | FY2012 |
| Reduction in the amount of energy used during production | 158 million kWh | 191 million kWh | 129 million kWh | 93 million kWh | 107 million kWh |
| Reduction in the amount of final waste disposal | 6,752 tonnes | 5,955 tonnes | 3,623 tonnes | 4,754 tonnes | 3,788 tonnes |

Benefits from equipment investment are calculated using the straight-line method over five years, as with costs.
Source: Hitachi Sustainability Environmental Report 2013; p115

Table 5. Efficiency of Environmental Load Reduction

| Item | FY 2008 | FY 2009 | FY 2010 | FY2011 | FY2012 |
|--|---------|---------|---------|--------|--------|
| Reduction in energy used during production (million kWh/billion yen) | 0.33 | 0.42 | 0.32 | 0.20 | 0.17 |
| Reduction in amount of waste for final disposal (tonnes/billion yen) | 19.4 | 22.9 | 14.7 | 18.3 | 14.6 |

*This is an indicator of the efficiency of environmental load reduction, calculated as the amount of environmental load reduction divided by the expenses needed for the reduction. Source: Hitachi Sustainability Environmental Report 2013; p116

The figure 1 shows detail for three items concerning the environmental investments, the company invests how much money on environmental protection costs and the results of environmental economic effects. As an overall trend, environmental investment showed a downward trend over the period. The billions of yen were 10.2 in 2008, and then hit the lowest point 5.3 billions of yen in 2012. Environmental protection costs show a slight fluctuation with an upward trend, up from 98.1 billions of yen in 2008 to 127.9 billions of yen in 2012. And environmental economic effects shows a period of stability, it started at 29.1 billions of yen in 2008, after next year, it declined slightly to 23.3. At the last year, there was a gradually growth to 29.9 effects. Hitachi adopted environmental accounting helps them to raise the efficiency of environmental investments and activities by more effectively allocating management resources to our ongoing efforts that benefit the environment. The increase in R&D expenditures related to the environment in recent years have resulted in higher environmental protection costs. At the same time, environmental investments were down year on year. This is mainly because large expenditures were accelerated in fiscal 2011 to deal with changes in electric power supply and demand. (Hitachi Sustainability Environmental Report 2013; p114).

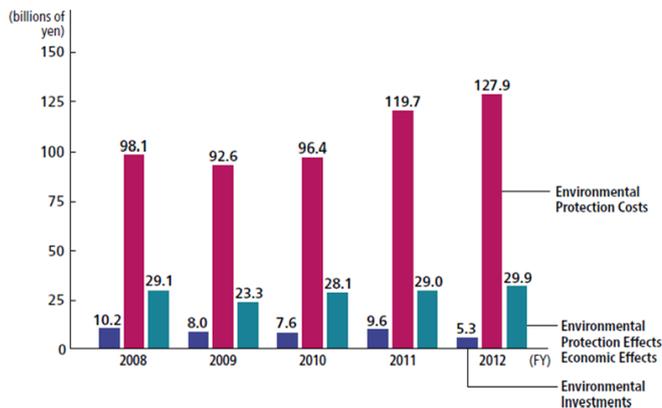


Figure 1. Trend in Environmental Investments, Environmental Protection Costs, and Economic Effects. Source: Hitachi Sustainability Environmental Report 2013; p114

3.2. Environmental Performance Indicators Analysis

Table 6 provides the results of environmental performance indicators analysis from 2008 to 2012. As can be seen from the table, it shows four environmental indicators including greenhouse gases, wastewater, and gases emission and chemical to revenue. From table 6 shows that overall the environmental performance is getting better year by year, especially the best in 2012. The company conserves the largest energy and improves efficiency almost happened in year 2009, not only in energy conservation but also in efficiency of environmental load reduction. Hitachi contributes to environmental conservation through business. In fiscal 2009, Hitachi generates electricity by nuclear results in far fewer CO₂ emissions than burning fossil fuels at thermal power plants and Wind power generates electricity being a system integrator, to use these in products and service. Hitachi have developed a modular data center that optimizes the layout of air condition and IT equipment for both cooling efficiency and space savings. Power use by air conditioners that cool serves is cut by to 67 percent and CO₂ emissions are reduces.

Hitachi produces some products helping to reduce CO₂ emission by improving the environmental efficiency of products. There are three main products contributing to CO₂ emission reductions in 2012, for example high-efficiency gas turbine generators power station, the new plant will contribute to an annual reduction in CO₂ emissions 37,000 tonnes. Hitachi will continue to develop green products to reduce CO₂ emissions, and prevention of global warming. In 2012, Hitachi improved a system that manages the status of general waste and valuable waste generated at each facility. This has made it easier to analyze waste by type, and helped them to effectively implement measures to raise the recycling rate, to recycle valuable resources, and to improve the landfill rate. Hitachi improvement in efficiency of global warming prevention and address carbon footprint to calculate the total amount of greenhouse gases. Making the GHG emission visible and encourages business to reduce the amount of carbon.

Table 6. Environmental Performance Indicators Analysis

| (A)Environmental load index | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|--------|----------|----------|----------|----------|
| Greenhouse gases (GHGs)/Revenues*100,000 | | 41.13% | 49.40% | 34.41% | 33.42% |
| Total volume of wastewater/Revenues | 4.59% | 6.06% | 7.39% | 5.96% | 5.67% |
| Total gases emission/Revenues*100,000 | 27.26% | 27.13% | 30.47% | 24.47% | 23.17% |
| Total volume of chemical/Revenues*100,000 | 41.37% | 30.11% | 57.09% | 59.77% | 57.09% |
| (B)Environmental efficiency index | | | | | |
| Revenues/Total water input | 15.71% | 17.63% | 16.29% | 18.51% | 20.72% |
| Revenues/Total energy input | 5.40% | 5.35% | 4.33% | 5.26% | 5.46% |
| Revenues/Greenhouse gases (GHGs) | | 2,430.22 | 2,024.05 | 2,905.74 | 2,992.53 |
| (c) Environmental index | | | | | |
| Total water input/Revenues*100 | 6.37% | 5.67% | 6.14% | 5.40% | 4.83% |
| Total energy input/Revenues | 18.53% | 18.70% | 23.08% | 19% | 18.31% |
| Greenhouse gases (GHGs) /Revenues | | 4.11% | 4.94% | 3.44% | 3.34% |

4. Conclusions

Environmental accounting in Japan has developed rapidly during recent years. This case study Japanese company of Hitachi group established environmental protection action very early in 1993, and has promoted environmental protection activities since then. We found that disclosure environmental accounting become crucial issue, because it helps company sustainable development. In this case study, Hitachi is a good example that had better emphasize major environmental issues on accounting reports. Hitachi has already enforce industries had better implement environmental accounting in production activities was likely to yield good result on increase environmental protection costs. In addition, Hitachi increases environmental protection costs year by year and gets positive feedback in environmental load index and environmental efficiency index in year 2012. Hitachi also increases the ratio of eco-product and makes effort on reduction policy for instance, promotes energy saving through reduced electric energy consumption and promote waste reduction, recycling aiming at the cyclical use of resource reduce the use of fossil energy, and reduction of greenhouse gasses, etc. In addition, Hitachi continues improvement of the production processes and the utilization of all resources not only in Japan but also in global. For example, in Europe, a new distribution center went into operation that is equipped with a solar power generation system which contributions to CO2 emission reduction in Netherlands and at storage system manufacturing center of water conservation in France.

Although Yin[11] expresses that there is a limitation to make generalizations from case study, from the case study of Hitachi, it provide some recommendations in practice. Most companies traditionally focused on traditional accounting. It is necessary to disclosure environmental accounting expenses which can help company to know the benefits of investment of environmental area cost. From computing these environmental performance indicators in this paper, managers can evaluate whether environmental investment cost has effects and will know how to improve in the future. In addition, disclosing environmental accounting information will increase company transparency and competitiveness. Stakeholders will know what the company do for the environment and it has good impact on companies'

reputation.

REFERENCES

- [1] Callens, I., Tyteca, D., 1999. Towards indicators of sustainable development for firms: a productive efficiency perspective. *Ecological Economics* 28, 41–53.
- [2] Ciroth, A., 2009. Cost data quality considerations for eco-efficiency measures. *Ecological Economics* 68, 1583–1590.
- [3] DeSimone, L.D., Popoff, F., 1998. *Eco-efficiency. The Business Link to Sustainable Development*. MIT Press, Cambridge, MA.
- [4] *Environmental Accounting Guideline 2002* ; Ministry of the Environment Japan ; March 2002.
- [5] *Environmental Accounting Guideline 2005* ; Ministry of the Environment Japan ; February 2005.
- [6] Figge, F. & Hahn, T. 2013. Value Drivers of Corporate Eco-Efficiency: Management Accounting Information for the Efficient Use of Environmental Resources. *Management Accounting Research*, 24(4), 387-400.
- [7] Hahn, T., Figge, F., 2011. Beyond the bounded instrumentality in current corporate sustainability research: toward an inclusive notion of profitability. *Journal of Business Ethics* 104, 325– 345.
- [8] Huppel, G., Ishikawa, M., 2005. A framework for quantified eco-efficiency analysis. *Journal of Industrial Ecology* 9, 25–41.
- [9] Huppel, G., Ishikawa, M., 2009. Eco-efficiency guiding micro-level actions towards sustainability: ten basic steps for analysis. *Ecological Economics* 68, 1687–1700.
- [10] Lamberton, G., 2005. Sustainability accounting—a brief history and conceptual framework. *Accounting Forum* 29, 7–26.
- [11] Yin, R.K., (1984). *Case Study Research: Design and Methods*. Beverly Hills, CA: Sage Publications.
- [12] Yin, Robert K. (1993). *Application of Case Study Research*. Thousand Oaks, CA: Sage.
- [13] Yin, Robert K. (2003). *Case study research, design and methods* (3rd ed., vol. 5)..