How Sustainability Accounting contributes to improved Information Management and Management Control

Zvezdov, Dimitar

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EMAN – Environmental and Sustainability Management Accounting Network

ABSTRACTS

15th EMAN Conference on Environmental and Sustainability Management Accounting in collaboration with the CSEAR International Congress on Social and Environmental Accounting Research

Environmental Management Accounting for a Sustainable Economy

Helsinki, 24-26 September 2012

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A warm welcome to the EMAN 2012 conference in collaboration with CSEAR.

This collaborative event brings scholars and practitioners together who represent a large spectrum of thinking and approaches. The conference theme challenges academia and corporate practice alike to reflect on the role and (potential) contribution of environmental management accounting to sustainable development. Can – and if yes, how can – information systems create more and sufficient transparency with regard to unwanted societal and ecological problems and support decision making for managers to successfully contribute to a more sustainable economy and society?

The organizers with Dr Tuula Pohjola and the Corporate Responsibility Network (CRnet) have made an excellent effort to attract a diverse group of engaged managers and scholars. This is a promising setting to exchange fundamental philosophical, theoretical, methodological and practical ideas and share real world experiences.
I wish all participants inspiring discussions and encouragement for further research and practical achievements.

Stefan Schaltegger

Prof. Dr. rer. pol.
Full professor of management
Center for Sustainability Management (CSM)
Leuphana University

Welcome to EMAN 2012 and the second collaborative conference between EMAN and CSEAR.

It seems both strange and rather wasteful in a world of seriously constrained resources and increasing pressure on time-scales that two bodies with such similar intentions should try and re-invent wheels on their own. So it is very important that we do everything we can to merge the efforts of EMAN and CSEAR and communicate with each other so that we might better understand how to address the very serious matters which concern us all. I look forward to bringing some critical and theoretical insights to bear on your deliberations in exactly the same way as you bring pragmatic (and, perhaps, practical) considerations to bear on the work of CSEAR.

I thank all the organisers for their hard work and wish everybody a most enjoyable and productive meeting

Rob Gray

Professor of Social and Environmental Accounting
Director of the Centre for Social and Environmental Accounting Research
School of Management
The Gateway
University of St Andrews

PROGRAMME

Monday 24th of September		
16.30 - 18.30	Helsinki City Tour	
18.00 – 19.00	Registration	
19.00 – 20.30	Get-together party at Hotel Haaga	
Tuesday 25th of September		
08.00 - 09.00	Morning coffee and registration	
09.00 - 09.45	**Conference opening session /Chair Olli-Pekka Mäkirintala** Minister of the Environment of Finland Ville Niinistö Dr. Tuula Pohjola EMAN Professor Stefan Schaltegger EMAN Professor Rob Gray CSEAR	
09.45 - 10.45	**Plenary session I /Chair Olli-Pekka Mäkirintala** Do professional accounting bodies constrain the diffusion of sustainability accounting (and is this a good thing)? Professor Roger Burritt, University of South Australia Governance and Sustainable Business Practice in Africa Professor Cosmas M. Ambe, University of Limpopo EMA and MFCA as the missing link between CP and EMS - The UNIDO Test Approach for SMEs Dr Christine Jasch, Vienna Institute for Environmental Management and Economics	
10.45 - 11.00	Coffee	
11.00 - 12.30	**Parallel session I** Presentation of conference papers	**Business Case I** CR & Communication, Edita Oyj
12.30 - 13.30	Lunch	
13.30 - 14.30	Plenary session II /**Chair Ilpo Penttinen** **Sustainable Business - Issues and opportunities** Senior Principal Scientist Lennart Swanström, ABB **How do stakeholders count? Communication in open fora.** Environmental Director Martti Hyvönen, Helsinki Energy	
14.30 - 15.00	Coffee	
15.00 - 16.30	**Parallel session II** Presentation of conference papers	**Business Case II:** Carbon Footprint, Tulikivi Oyj and HYY Group
17.00 - 17.45	Nordic walking	

18.00 - 19.30	Finnish Sauna	
20.00 - 23.00	Conference Dinner	

Wednesday 26th of September

09.00 - 10.00	**Plenary session III /Chair Olli-Pekka Mäkirintala** Accounting for un-sustainability or sustainability accounting? Notions, concepts and consequences for research. A debate Professor Stefan Schaltegger EMAN and professor Rob Gray CSEAR	
10.00 -10.30	Is accounting for less bad still good enough? Reflections from the Zero Impact Growth Monitor 2012 Ralph Thurm Deloitte	
10.30 - 11.00	Coffee	
11.00 - 12.30	**Parallel session III** Presentation of conference papers	**Workshop:** Framework of Sustainable Economy: Outotec Oyj, UPM Oyj, Stockmann Oyj and Reilua.fi
12.30 - 13.00	**Concluding remarks and closing session** Professor Stefan Schaltegger EMAN and professor Rob Gray CSEAR	
13.00 - 14.00	Lunch	
14.00	Conference ends, transportation to the airport	

Parallel session I, Tuesday 25th, 11.00-12.30

"Haaga Sali", chair Rob Gray					
11.00 - 11.30	*Charl De Villiers:* Sustainability reporting integrated into management control systems	11.30 - 12.00	*Marileena Koskela:* Monetary information in sustainability reports	12.00 - 12.30	*Dimitar Zvezdov*: How sustainability accounting contributes to improved information management and management control
"Mestari", chair Stefan Schaltegger					
11.00 - 11.30	*Seakle Godschalk:* The integrated application of EMA, MFCA and CP: a systematic approach	11.30 - 12.00	*Katsuhiko Kokubu:* Introducing MFCA into the Supply Chain: Japanese Evidence	12.00 - 12.30	*Akira Higashida:* How MFCA can be connected with a management accounting system? Comparing MFCA to operations management
"Niitty", chair Cosmas Ambe					
11.00 - 11.30	*Norio Minato:* A new model of capital investment appraisal and decision-making for environmentally conscious project	11.30 - 12.00	*Natalie Crutzen:* Sustainability Performance Management in Large Firms: A Qualitative Research Amongst Seven Western European Firms	12.00 - 12.30	*Yousuf Kamal:* Stakeholder's Expectation for CSR-related Corporate Governance Disclosure Practices: Evidence from a Developing Country
"Hovi", chair Christine Jasch					
11.00 - 11.30	*Elvia Shauki:* Issues for Building Sustainable Businesses - Is This a Case of Enlightened Self-Interest or Genuine Accountability?	11.30 - 12.00	*Susan Lambert:* Recognizing commitment to sustainability through the business model	12.00 - 12.30	*Clémence Rannou:* Towards a more critical understanding of management accounting and the environment: the case of capital budgeting
"Seniori", chair Hannele Mäkelä					
11.00 - 11.30	*Haslinda Yusoff:* Environmental management systems (EMS) ISO 14001 implementation in construction industry: a Malaysian case study	11.30 - 12.00	*Anne Toppinen:* Motives and pressures for investing in responsibility practices in global forest industry	12.00 - 12.30	*Luana Joppert Swensson:* The development of a high-quality coffee market in Brazil: the importance of technological innovation and the role of contractual design in promoting it
"Nuija", chair Maria Csutora					
11.00 - 11.30	*Maija Mattinen:* Accounting and visualizing regional greenhouse gas emissions from housing	11.30 - 12.30	*Nuwan Gunarathne:* Sustenance of Environmental Management Accounting (EMA) Practices in Hotels: A Case of a Sri Lankan Organisation	12.00 - 12.30	*Ki-Hoon Lee:* Exploring the relationship between carbon productivity and economic performance: An empirical analysis of Japanese manufacturing firms
"Aulakabinetti", chair Tuula Pohjola					
11.00 - 12.30	Business Case I : Edita Oyj ***CR & Communication***				

Parallel session II, Tuesday 25th, 15.00-16.30

"Haaga-Sali" , chair Ilpo Penttinen					
15.00 - 15.30	*Michael B. Fakoya:* Applying material flow cost accounting in waste-reduction decisions: case of a micro-brewery in South Africa	15.30 - 16.00	*Roope Husgafvel:* Measuring sustainability within process industry	16.00 - 16.30	*Michiyasu Nakajima:* Material Flow Cost Accounting (MFCA) Management to establish Green Supply Chain: based on a questionnaire research in Japan
"Mestari" , chair Hannele Mäkelä					
15.00 - 15.30	*Angela Pinilla-Urzola:* Assurance in corporate sustainability reporting: the stakeholder perspective	15.30 - 16.00	*Marita Elizabeth Pietersen:* The qualitative characteristics of financial-, sustainability- and integrated reporting: A comparison for now and the way forward	16.00 - 16.30	*Anna Rowe:* Exploring Sustainable Growth of Social Micro-enterprises (SGSMEs) in an Emerging Economy
"Niitty" , chair Roger Burritt					
15.00 - 15.30	*Jorge Tejedor-Nunez:* Linking corporate social responsibility and financial performance: A meta-analytical approach from environmental performance	15.30 - 16.00	*Igor Alvarez:* The interaction between CSP and CFP in Spanish companies; the impact of the global financial crisis	16.00 - 16.30	*Amel Ben Rhouma:* Does the 2008 financial crisis change the sustainability reporting of the European banks? : Analysis of the application of the materiality principle
"Hovi" , chair Christine Jasch					
15.00 - 15.30	*Angélica Peña Cortés:* The social dimension of Sustainability Accounting Model (SAM)	15.30 - 16.00	*Rob Gray:* Developing the Social Audit: An exploratory study of compliance auditing in the Bangladesh garment industry	16.00 - 16.30	*Faizah Darus:* The Impediments of CSR Assurance Practices in Malaysia: Evidence from the Manufacturing Sector
"Seniori" , chair Pentti Viluksela					
15.00 - 15.30	*Lucila Almeida:* Transnational Private Regulation on the Sugar Cane Sector: the impact of Bonsucro Sustainable Standards on the Sugar Supply Chain	15.30 - 16.00	*Paola Iamiceli:* Private Regulation, Standards Compliance and the role of Contractual Networks for a Sustainable Economy	16.00 - 16.30	*Kaisa Sorsa:* Transnational private regulation (TPR) and system level innovations in the business – consumer and in business to business interface
"Nuija" , chair Marileena Koskela					
15.00 - 15.30	*Cosmas Ambe:* Environmental management practices and firm performance on South African mining firms	15.30 - 16.00	*Delphine Gibassier:* Developing Carbon Accounting: Between driving carbon reductions and complying with a carbon reporting standard	16.00 - 16.30	*Maria Csutora:* Calculating the carbon costs sensitivity of sectors using hybrid accounting methodology
"Aulakabinetti" , chair Tuula Pohjola					
15.00 - 16.30	Business Case II: Tulikivi Oyj & HYY Group /Hotel Domus Academica ***Carbon Footprint***				

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Parallel session III, Wednesday 26th, 11.00-12.30

"Haaga-Sali" , chair Cosmas Ambe							
11.00 - 11.30	*Dimitar Zvezdov:* Exploring corporate reality of sustainability accounting practices	11.30 - 12.00	*Ki-Hoon Lee:* Identifying Drivers and Barriers to Energy Efficiency in Steel Industry: Implications for Environmental and Sustainability Management Accounting (EMA)	12.00 - 12.30	*Stefan Schaltegger:* Glancing into the Applied Tool Box - Surveying operational sustainability accounting practice		
"Niitty" , chair Tuula Pohjola							
11.00 - 11.20	*Haslinda Yusoff:* Raising environmental accountability: the impact of corporate social responsibility framework (CSRF) on reporting practices	11.20 - 11.40	*Minna Suutari:* Locally identifiable financial environmental information for use of owners and stakeholders	11.40 - 12.00	*Michael B. Fakoya::* Environmental Management Performance Measurement - Toward a Sustainable Economy	11.40 - 12.00	*Tuula Pohjola:* Eco-efficiency and urban sustainability
"Hovi" , chair Ilpo Penttinen							
11.00 - 11.30	*Helena Wessman:* Development of water footprint as an environmental indicator - challenges from company perspective	11.30 - 12.00	*Jan Endrikat:* Biotechnology and Sustainable Development: Mapping the Field by Means of a Systematic Review of Life Cycle Assessments Conducted on Biotechnological	12.00 - 12.30	*Ilpo Penttinen:* The Connections Between Green Economy and Biomimicry		
"Seniori" , chair Hannele Mäkelä							
11.00 - 11.30	*Tatsumasa Tennojiya:* Material Flow Cost Accounting Change in Japan: Reconstruction by Consultants	11.30 - 12.00	*Katri Valkokari:* Defining pros and cons of sustainable development – case study in Finnish furniture industry	12.00 - 12.30	*Gabriela Rajdlová:* Quality Costs Calculation using the Material Flow Cost Accounting		
"Aulakabinetti" , chair Olli-Pekka Mäkirintala							
11.00 - 12.30	Business Case III: Outotec Oyj, UPM Oyj, Stockmann Oyj and Reilua.fi ***Framework of sustainable economy***						

Sustainability Reporting Integrated into Management Control Systems

Jennifer Kerr, Paul Rouse, Charl de Villiers*

Jennifer Kerr
Department of Accounting and Finance
The University of Auckland Business School
Auckland
New Zealand

Paul Rouse
Department of Accounting and Finance
The University of Auckland Business School
Auckland
New Zealand

* Corresponding author
Charl de Villiers
Department of Accounting
The University of Waikato and University of Pretoria
Hamilton
New Zealand
cdev@waikato.ac.nz

ABSTRACT

Purpose: We examine three different solutions to integrating sustainability reporting into management control systems.

Design/methodology/approach: We examine by way of case study and interpret by way of appropriate frameworks the sustainability reporting integrated into management control systems in three New Zealand organisations.

Findings: We conclude that the integration of sustainability reporting into organisation's management control systems holds advantages for organisations in terms of operationalising sustainability objectives, broadening stakeholder accountability as well as intensifying interactions with stakeholders, formalising organisation beliefs and improving communication of sustainability measures internally. While frameworks such as the Balanced Scorecard can facilitate implementation of sustainability reporting, some organisations may choose to fully integrate it into their management control system contingent upon their circumstances.

Originality: Sustainability reporting tends to be seen as an external reporting philosophy that can be managed as a separate project. We show that it can be integrated into management control systems either entirely or with the use of frameworks such as the balanced scorecard.

Keywords: balanced scorecard, triple bottom line, social and environmental accounting, sustainability, management control, levers of control.

Article Classification: Research paper

Monetary information in sustainability reports

Marileena Koskela
University of Turku, Finland Futures Research Centre, Pinninkatu 47, 33100 Tampere, Finland
University of Jyväskylä, School of Business and Economics, Corporate Environmental Management
E-mail: marileena.koskela@utu.fi

***Abstract*: A problem of sustainability reporting is said to be the lack of monetary information. This abstract addresses the problem by finding out how three case companies use monetary information in their sustainability reporting. The reporting of 2007–2011 is content analysed. This analysis showed interesting variation in the reporting of monetary information. The reasons for the lack of environmental monetary information should be researched further.**

***Keywords*: sustainability reporting, case study, monetary information**

I. INTRODUCTION

Companies use sustainability reporting to report their sustainability performance to stakeholders [1]-[3]. Regardless of decades of reporting, quality problems are associated with the sustainability reporting. One such problem is the lack of monetary information [4], [5]. The previous content analysis research has addressed monetary information by categorising the content of reporting – one type of information being monetary [6]-[8]. However, in this research, the focus is solemnly on monetary information. The aim of this paper is to find out how companies use the monetary information in their sustainability reporting. A case study is made by using three companies from three different industrial sectors.

II. METHODS

The sustainability reports of three companies of 2007–2011 are used in the analysis. The type of the reports varied between environmental reports, corporate social responsibility reports, annual reports and web-based annual reports. The reports are analysed with content analysis. The monetary information is charted in the body text, tables and graphs. The used monetary information is divided into economic, environmental and social responsibility. Also, it is categorised by the years the information addresses.

III. RESULTS

By far, the most of the monetary information was presented in the body text of the reports. As, the amount of information in text increased over the years, there was variation in the use of monetary information in the tables and as indicators. Graphs were very seldom provided. When looking at the areas of responsibility the monetary information is provided variously (see Table 1). Most of the monetary information relates with social and economic responsibility and information of environmental responsibility is provided less often. When the monetary information related with time, the information was most often of one year or two years. The range was from one to 11 years. There was also variation between years of reporting and between the companies.

TABLE 1: THE AMOUNT OF ECONOMIC, ENVIRONMENTAL AND SOCIAL MONETARY INFORMATION 2007-2011

	Economic	Environ-mental	Social
2007	22	9	28
2008	36	5	22
2009	17	3	23
2010	36	17	50
2011	54	24	46

IV. CONCLUSION

This analysis shows interesting variations of the reporting of monetary information in the sustainability reports in the time frame of five years. This analysis does not show a common trend of increased reporting of the monetary information. As there is also variation in the reporting in each company between the years it seems that the reporting practises are still evolving in these case companies. The most interesting result of this analysis is the low amount of environmental monetary information. As social monetary information is reported abundantly the reasons of the lack of environmental information should be researched further.

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How sustainability accounting contributes to improved information management and management control

Dimitar Zvezdov
Centre for Sustainability Management, Scharnhorststr. 1, 21335 Lüneburg, Germany
E-mail: zvezdov@uni.leuphana.de

***Abstract*: Despite the increasing body of literature on measuring, managing and communicating corporate sustainability this research has largely focused on individual cases. These studies have mostly – if not entirely – focused on the sustainability accounting practice framed within the individual context within which the research was conducted. Hence, extant literature has been criticised for failing to explicate the extent to which the identified aspects can be transferred to other situations. This limits their explanatory power and renders them of limited use to practitioners and management science researchers. Apart from few exceptions, an in-depth investigation of corporate practice to address this gap is virtually non-existent to date. This unveils the need to systematically depict and analyse possible situations of relevance to other companies and decision situations by analysing them beyond their specific context.**

Therefore, this paper (as well as the research presented therein) draws a comprehensive account of numerous aspects of sustainability accounting that contribute to improved information management and management control. By putting together the findings, the paper approaches the question: How does sustainability accounting contribute to improved information management and management control?

I. Introduction

Against that background, and being aware of fundamental organisational differences yet to be researched, this paper focuses on the decision situations (as opposed to the decisions made within these decision situations) that can be identified by means of or can become apparent in the course of applying sustainability accounting. To achieve this, the research discerns a number of similarities and dissimilarities in information management and management control across the researched companies. Examples of relevant decision situations which influence corporate success include decisions on what information to focus on, how it is to be used and who (which functions) can benefit from using this information.

II. Research design

There are various approaches to linking the components of accounting: information management, management control and external reporting. Schaltegger and Wagner propose an 'inside-out' approach that locates the information management as a starting point. The information collected and prepared is then used for management control. Subsequent external reporting can is based on the information and the outcome of management control. This inside-out approach serves as a framework in linking and presenting the outcomes of this paper.

III. Findings

The arguments presented in this paper add new insights to and refines the existing understanding of the managerial relevance of sustainability accounting. The presented research expands extant research in terms of comprehensiveness by revealing a number of relevant decision situations. Putting together the pieces of research on decision situations whose consideration contributes to improved corporate success reveals additional aspects. These have either remained unidentified in previous research or have been identified but their relevance for the success of management activities has been only insufficiently understood. This deepens the domain of sustainability accounting thus justifying and even suggesting a logical separation of the field from others due to its specific assumptions, methods, application, and target readers and users.

IV. Contribution

This paper adds to a 'practice-orientated theory' by listing the various components of sustainability accounting's contribution to corporate success and proposes how these are related. The explorative nature of this paper does not leave much room for adequately testing the causality proposed here; however "such restrictions in methods do not invalidate the inherent causal nature of [thus built] theory". Thus, it is the task of future research to test and refine the causality suggested herein.

V. Future outlook

The research presented here is extensively based on logical argumentation. In the course of supporting or disproving the validity of this argumentation, logic will be replaced by data. The theoretical model proposed serves as a useful guide for research, due to a multitude of relationships that have been proposed but not tested yet. Subsequent research on operationalising and testing this model could challenge, expand and refine the propositions made in this paper. It is, however, important that the propositions derived in this paper are extended by conceptual work rather than by 'straight' measurement. Focusing the discussion on the implications of the study's results requires that the statements be tested under consideration of the logic that underlies the models proposed herein, rather than merely measuring its validity empirically.

The integrated application of EMA, MFCA and CP: a systematic approach

Seakle K.B. Godschalk and Maryna Möhr-Swart
Environmental & Sustainability Solutions, 911 Eighth Avenue, Wonderboom South, 0084 Pretoria, South Africa
E-mail: envsustsol@mweb.co.za

***Key words*: environmental management accounting, material flow cost accounting, cleaner production, cost benefit analysis**

Abstract

Environmental Management Accounting (EMA), Material Flow Cost Accounting (MFCA) and Cleaner Production (CP) all share the reduction of environmental impacts as well as financial savings as major objectives. However, these three approaches differ in respect of origin, level of application, scope of issues addressed, focus and methodology.

In a 2010 paper at the 13th Conference on Environmental and Sustainability Management Accounting in Scotland (*EMA, MFCA and CP – three facets of the same diamond?* by Seakle Godschalk, Don Huisingh, Christine Jasch, Katsuhiko Kokubu and Maryna Möhr-Swart), the differences and commonalities between EMA, MFCA and CP were explored and positive indications on synergy to be achieved by the integrated application of these three approaches were identified.

This paper suggests a structured approach for the integrated application of EMA, MFCA and CP to achieve optimal synergy.

The first step is to apply EMA to the organisation as a whole to obtain a holistic picture of the physical quantities of all materials used and waste generated, as well as the monetary values of these physical flows. In addition, the EMA assessment quantifies the value of all other environmentally related costs. This assessment will identify major physical or monetary flows for further analysis.

Where significant physical quantities of materials or energy are involved, a MFCA analysis is most suited for detailed analysis of these flows over the different components (or quantity centres) of the production process. This analysis will identify the nature and extent of physical losses and associated monetary value thereof at each step of the process.

Finally, a CP assessment is used to analyse non-quantitative aspects and causes of these losses. Following this, CP is used to generate options for improvement. These options can then be subjected to a MFCA based cost-benefit-analysis to assist in the evaluation of options. Subsequently, if deemed necessary or beneficial, a higher order cost-benefit-analysis can be performed using EMA as basis.

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Introducing MFCA into the Supply Chain: Japanese Evidences

Katsuhiko Kokubu[1] and Hirotsugu Kitada[2]
1Graduate School of Business Administration, Kobe University, Kobe, Japan
E-mail: kokubu@kobe-u.ac.jp
2 Faculty of Business Administration, Hosei University, Tokyo, Japan

***Abstract*: Material flow cost accounting (MFCA), a major environmental management accounting tool, has been developed worldwide. As indicated in ISO 14051, MFCA can be extended to multiple organizations within a supply chain, to help them develop an integrated approach to more efficient use of materials and energy. However, the difficulty for sharing cost data across the organizations prevent successful MFCA introduction into the supply chain. The purpose of this paper is to discuss the significance and issues for introducing MFCA in the supply chain based on the case studies sponsored by Japanese government.**

I. INTRODUCTION

MFCA is a method of measuring the monetary value and physical quantity of material flow—that is, the cost of not only products but also waste—thereby motivating business owners to reduce waste. Therefore, this measure contributes to the enhancement of resource efficiency. MFCA is noted internationally as a powerful method of environmental management accounting. ISO14051 (MFCA) was issued in 2011[1].

Although MFCA has tended to be developed and applied to a single company, it is applicable to the supply chain, from extraction of resources to disposal of products. Based on the Ministry of Economy, Trade and Industry (METI)'s project in FY 2008-2011, we examine the significance of the introduction of MFCA into the supply chain and discuss some measures and policies for overcoming issues in realizing it.

II. SIGNIFICANCE OF THE INTRODUCTION OF MFCA INTO THE SUPPLY CHAIN

As Figure 1[2] shows, even if the material loss is small for each single company, it would be large amount for the supply chain. METI's report suggests the types of material loss and the possibility of its reduction in supply chain: loss due to the shape of purchased materials, loss due to quality standards, loss due to product design methods, and loss due to production information (ordered lots and sizes).

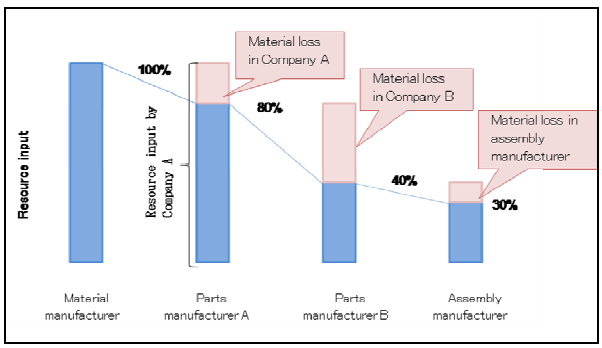

Figure 1 Transition of material loss in the supply chain
Source: METI (2011a), p. 6.

III. CASE & ISSUES FOR MFCA INTRODUCED IN THE SUPPLY CHAIN

In this paper, we examine two case studies from METI's project [3], Kyosha Co. Ltd. and Sanden Corporation. These cases suggest that introducing MFCA into supply chain facilitates technical communication between engineers and managers among production functions. However, we understood there are some difficulties for successful introduction of MFCA into the supply chains mainly due to selling and purchasing relationship.

IV. POLICIES TO PROMOTE RESOURCE-SAVING ACTIVITIES THROUGH APPLICATION OF MFCA TO THE SUPPLY CHAIN

In order to define and create eco-conscious supply chain, we need to establish evaluation scheme for it. Introducing MFCA provides one possibility by calculating the input-output ratio as indicator of resource productivity. Government can facilitate such activities by preparing certification system and providing financial supports. Such a policy, if it attracts the attention of green consumers who are interested in environmental conservation, will lead to strengthening the companies' competitive capabilities.

V. CONCLUSION

Introduction of MFCA into the supply chain makes it possible to deal with issues that cannot be solved by a single company, thereby bringing about a huge benefit. However, because inter-company relationship in supply chains are strongly structured based on economical motivation, it prevent companies to work collaboratively due to resource saving and reduction of environmental burdens. To overcome this difficulty, governmental supports are required and some potential policy directions are discussed in this paper.

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How can MFCA be connected with a management accounting system ? Comparing MFCA to operations management tools

Akira Higashida
Meijo University, Shiogamaguchi, Tempaku-ku, 468-8502, Nagoya-City, Japan
E-mail: ahigashi@meijo-u.ac.jp

***Abstract*: This study examines the relationship between Material Flow Cost Accounting (MFCA) and a management accounting system (MA). In order to reduce material losses, it needs to connect MFCA with MA. The nature of MFCA makes connection with MA possible.**

I. INTRODUCTION

Many studies have shown how MFCA has been useful in motivating organizations and managers to reduce their environmental impact.

However, in some Japanese companies, not all improvement proposals that reduce material losses are executed. Some proposals that are easy to implement and generate results that can be confirmed quickly are more likely to be implemented. However, other proposals that require a long-term effort or need significant capital investigations are not implemented soon. In order to solve this problem, it is important for a top manager to understand that material losses are directory related to profits.

This presentation focuses on the relationship between production management tools and MA. Total Productive Maintenance (TPM) and Just in Time (JIT) are featured as production management tools, because many Japanese companies that introduce MFCA have employed TPM, and JIT has had a strong impact on the production management systems of Japanese companies.

II. THE RELATIONSHIP BETWEEN TPM AND MA

The purpose of TPM is plant maintenance. TPM was developed by the Japan Institute of Plant Maintenance (JIPM). It focuses on the six big losses (breakdown losses, setup and adjustment losses, idling and minor stoppage losses, speed losses, quality defects and network losses, and start-up/yield losses).

In order to measure the performance of TPM, many companies use both financial indicators and non-financial indicators. There are a few financial performance indicators, such as decrease of maintenance expense, that generate realized profit. However, many of economic performances of TPM are not directory related to profit as it is not realized profit [1]. That might not be a big problem, because TPM is an operations management tool and decisions to reduce losses are made, not by a top manager, but operations staff or plant managers.

III. THE RELATIONSHIP BETWEEN JIT AND MA

The use of JIT leads to lower inventory and increased production capacity. It improves cash flow due to better working capital utilization. However, JIT is not directory related to profit, because it does not create profit unless sales volume increases with an expansion in production capacity [2].

Toyota Motor Corporation (Toyota) uses Kaizen Budgeting, which is a management accounting system that aims to achieve targeted profits through target costing, TQM, and JIT. Kaizen budgeting is indirectly related to JIT as a budget is based on targeted profit and the relationship between JIT and profit is itself indirect [3].

IV. DISCUSSION

Many Japanese companies have employed JIT or TPM as a production management tool. In this presentation, I focused on the features of the economic performance of TPM and JIT. It is difficult to directory connect TPM and JIT with MA which aims to achieve targeted profit, because many of economic performances are not directory related to profit.

On the other hand, MFCA aims to reduce material losses or material costs, thereby resulting in lower production costs and waste costs. This is directory related to profit on the income statement. This feature is important when considering how to implement proposals that require long-term effort or need significant capital investigations to reduce material losses. In order to execute these proposals, a top manager or business unit managers need to make decisions from the point of view of the entire company. In order to do so, they need to know the financial effects of reducing material losses, because managers are evaluated by the profits they generate. Therefore, it can be useful to connect MFCA with MA, for example, through short- or mid-term profit planning or budgeting. In addition, an organization also must consider environmental issues as their strategy.

V. CONCLUSION

The features of MFCA differ from those of operations management tools, such as JIT or TPM, with respect to financial performance. The financial effect of MFCA is directly related to profit on the income statement. In order to implement proposals that would reduce material losses, it would be necessary to connect such proposals with MA because a top manager must consider reduction of material losses from a company's point of view. As short- or mid-term profit planning is based on the income statement, MFCA has the potential to connect with a management accounting system.

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A new model of capital investment appraisal and decision-making for environmentally conscious project

Norio Minato and Katsuhiko Kokubu
Kobe University, 2-1, Rokkodai, Nada, Kobe, Japan
nminato@cox.net

Abstract
The purpose of this paper is to construct a new capital investment method for environmentally conscious projects and to improve environmental management decision-making under highly volatile conditions. The new method includes, in addition to the net present value (NPV), the environmental impact reduction value by Life-cycle Impact Method based on Endpoint model (LIME) and the managerial flexibility value by real option theory. After confirming the effectiveness in the simulation, we apply it to the real corporate project and have managers' interview. As a result, the effectiveness of this method is proved in this case.

Ⅰ. Introduction

Corporate management understands that environmentally conscious products are indispensable for the conservation of the global environment but require a large capital investment and face huge technical & business uncertainties. They are accompanied by a deterioration of cash flow in short term, and also are not guaranteed a return even in the medium and long term. Environmentally conscious projects may have negative NPV and may seem unattractive to shareholders, so that company management' incentive to capital invest may be weakened.

Ⅱ. Previous Paper Review

Japanese METI (2002) established a method for capital investment environmentally conscious facilities. U.S.EPA (1992) recommended TCA method. These methods covered only internal costs that had a direct impact on profit but didn't consider environmental impact reduction value and managerial flexibility value.

Ⅲ. New Decision Making Method

The Environmental impact Reduction Value (ERV) is assessed by using LIME. The Managerial Flexibility Value (MFV) is assessed by using the real option theory. Total economic value (TEV) is indicator which is used in decision-making for capital investment in environmentally conscious projects. TEV includes NPV, ERV and MFV.

Ⅳ. Application by Simulation

This method is applied to an economic value analysis of Hybrid Electric Vehicle (HEV) project by simulation. As a result, NPV of this project is negative, but TEV is positive. This indicates that it is appropriate to make an investment to this project.

Ⅴ. Application by Real Business Project

This method is applied to a real project which is utilized internal combustion engine for Combined Heat and Power (CHP) in order to verify the effectiveness. The economic value of this project is shown Fig1. The NPV is very low compared to an investment. Therefore, the investment would be rejected due to low ROI. But TEV is relatively large by contribution of ERV then the initial investment is approved by this company's management. The effectiveness of this method is verified.

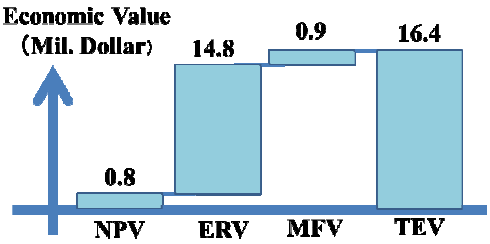

Fig1. Total Economic Value Roadmap

Ⅵ. Interview Result

The management interview for CHP project is held. As a result, they understand the meaning of environmental impact reduction value but don't understand MFV. This means it is necessary to have further education for MFV.

Ⅶ. Conclusion

The effectiveness of this method is verified and we find issue through the management's interview. It indicates that this method will contribute to the promotion of any capital investment for environmentally conscious project.

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Sustainability Performance Management in Large Firms: A Qualitative Research amongst Seven Western European Firms

Nathalie CRUTZEN
HEC-Management School of the University of Liege (Belgium), Rue Louvrex 14, 4000, Liege, Belgium,
E-mail: ncrutzen@ulg.ac.be

Abstract*: *The aim of this paper is to understand better sustainability performance management in large firms. Based on previous research in this field, this paper reports the results of a qualitative research amongst seven large Western European firms. This research examines why and how these large firms manage their sustainability performance.

The pursuit of sustainability in business practices has necessitated the management and assessment of corporate economic, environmental and social performances (Karatzoglou, 2006). Actually, if we consider that business performance is related to the achievement of its predetermined objectives whatever their nature and their diversity (Bourguignon, 2000), it is crucial to manage, to control and to evaluate if sustainable strategic objectives have been met or not, as well as to identify the reasons for this situation in order to continuously improve performance in the future. More than before, firms are now expected to account explicitly for all aspects of their performance, i.e. not just for their financial or economic results, but also for their social and environmental performance (Cramer, 2002). This is what is traditionally called "Sustainability Performance Management" (Schaltegger et al., 2006).

Over recent years, sustainability issues have therefore progressively been integrated into the accounting and finance areas. Researchers and practitioners have proposed to develop new tools and instruments, as well as to adapt those that already exist, to permit the strategic and performance management of sustainability by businesses (Schaltegger and Burrit, 2006; Chousa and Castro, 2006).

The objective of this paper is to understand better sustainability performance management in large firms. Based on previous research in this field (such as Schaltegger and Burritt, 2000; Cramer, 2002; Figge et al., 2002; Schaltegger et al. 2003, Wagner and Schaltegger 2004; Schaltegger and Wagner, 2006; Epstein and Widener, 2011), this paper reports the results of a qualitative research (Glaser and Strauss, 1967; Mayer and Ouellet, 1991; Hlady Rispal, 2002) amongst seven large Western European firms.

Concretely, we examine the sustainability performance management in these large firms by investigating ***why*** they manage, or not, their sustainability performance (i.e. their reasons and motivations) and ***how*** they practically operate to manage and measure it (i.e. the performance management tools and systems which have been implemented).

This research reveals that all seven firms manage and measure their sustainability performance for external and internal motives (e.g. to legitimate their sustainable strategy or to improve workers' motivation). To do so, all companies use more or less complex tools (such as the Sustainability Balanced Score Card).
Nevertheless, most of the respondents assume that, while social, environmental and economic goals are simultaneously considered within their core business strategy, the related performance management is not yet integrated. Social and environmental performance management is thus generally still not integrated into the traditional (economic) performance management system. The respondents clearly mention that they are aware of the importance of this integration and that this will be their next challenge. This observation is consistent with previous literature (Figge et al., 2002; Schaltegger and Wagner, 2006). However, it would be interesting to investigate, in a future research, the reasons why traditional performance management system and sustainability performance management system are not yet integrated.
The results also suggest that, whereas all seven respondents assume there is an integration of economic, social and environmental issues into their core business strategy, this positive statement is questioned by the observations that, to date, only two of the sampled firms really integrate all three pillars of Sustainable Development into the individual objectives of their workers and that there is, in the facts, very few links between social and/or environmental objectives and incentives or bonuses. These are actually, in most cases, only related to the achievement of traditional economic goals.

As a conclusion, it comes out from this qualitative research that environmental and social issues are still not completely integrated to economic ones in most of these large companies (ie. they are not an integrative part of their organizational DNA), while all stress a strong integration of the three pillars of Sustainable Development in their core strategy. This research stresses again the difficulty to translate strategy into action (Epstein and Roy (2001), the need for a further "operationalisation" of the sustainability concept as well as the need for guidance in the management control literature on actions managers could take to drive a sustainable strategy throughout the corporation (Epstein and Wisner, 2005).

Key words: Sustainability, Performance Management, Large Firms

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Stakeholder's Expectation for CSR-related Corporate Governance Disclosure Practices: Evidence from a Developing Country

Yousuf Kamal and Craig Deegan
RMIT University, Melbourne--3000, Australia
E-mail: Yousuf.kamal@rmit.edu.au

Abstract: This paper provides evidence of stakeholders' expectations about CSR-related corporate governance practices. By using the predominant theories of social accounting such as organizational legitimacy theory, stakeholders' theory and institutional theory [1] we found that stakeholders expect from the organizations to have specific governance disclosures relating to working condition, human rights, child labor, social compliance and environmental compliance. We have also found that stakeholders often have competing and conflicting expectation and stakeholders' power is an important factor in having their expectation fulfilled by the disclosures of CSR-related corporate governance practices.

Key Words: Corporate social responsibility, Corporate governance, Stakeholders expectation, Disclosures, Developing country.

I. INTRODUCTION

From an accountability perspective, we have explored how powerful stakeholders' expectations potentially translate into the disclosure of CSR-related corporate governance practices. We have conducted 17 interviews with the powerful stakeholders to understand their expectation pertaining to the supply of information about CSR-related corporate governance practices in the textile and garment industry of Bangladesh. The powerful stakeholders of this industry include multinational buying companies (MNBCs), non-government organization (NGOs), BGMEA (Bangladesh Garments Manufacturers' and Exporters' Association), government, civil society and media [2], [3]. This industry has been chosen for its national economic importance in terms of foreign currency earnings and providing employment and the western concerns about the health, safety, human rights, and working conditions of the supply factories.

II. THEORETICAL PERSPECTIVES

We used legitimacy theory as it is believed that an organization maintains its 'license to operate' in the society by complying with the expectations of the community. Failure to comply with those expectations will lead to legitimacy threat [4]. We argue that given the global nature of the textile and clothing industry, it is the global community's expectations that shape the CSR-related corporate governance disclosures practices of the garments and textile companies of Bangladesh. If they are not disclosing their CSR-related corporate governance practices to appease their powerful stakeholders, it would seem that the survival of the Bangladeshi textile and garments companies would be at high risk and consistent with legitimacy theory, we would expect that the textile and garments companies of Bangladesh undertake action to reduce that risk through disclosures of their CSR-related corporate governance information. We also predict that the individual textile and garments companies would respond to the powerful stakeholders' expectations relating to their governance practices. We further argue that the textile and garments companies of Bangladesh might be subject to external pressure from powerful stakeholders such as MNBCs and BGMEA for change or adaptation of their governance structure or processes. Specifically, we predict the existence of 'coercive form of isomorphism' [5] in the textile and garments industry of Bangladesh.

III. RESEARCH METHODS

The evidence in this study was collected using semi-structured in-depth personal interviews with 17 stakeholders during the period of September, 2011 and January, 2012. The interviews were guided by a small number of broad open-ended questions and were conducted by one of the researchers on the interviewee's company or business offices (with two exceptions). The interviews ranged from 30 minutes to one and half hours in duration. Almost all the interviews were tape recorded, transcribed and then analyzed to draft the interview findings.

IV. FINDINGS

We find that stakeholders in general are not satisfied with the amount of disclosure as they believe the current CSR-related governance disclosures are very limited, symbolic or cosmetic in nature. However, major stakeholder such as MNBCs are satisfied as they are getting the required information they demanded in terms of CSR-related corporate governance practices and related disclosures. The potential reason could be that corporate managers are more likely to focus on meeting the expectations of powerful stakeholders such as MNBCs. They exercise their power by giving a threat of blacklisting of the companies or boycotting the purchase from particular company. We also found that the textile and garment companies of Bangladesh are getting external pressure from BGMEA for change or adaptation of their governance structure or processes and related disclosures and these pressures are coercive in nature.

V. CONCLUSION

The implication of our findings is due to the potential CSR managers to understand the expectations of major stakeholders about CSR-related corporate governance practices. CSR managers need to understand that stakeholders are not merely happy with so called CSR disclosures in general which are symbolic/ cosmetics in nature. We suggest further avenue of research to investigate corporate managers' motivation for CSR-related corporate governance disclosure and also consider potential 'expectation gap' in the reporting.

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Issues for building sustainable businesses - Is this a case of self- enlightened interest or genuine accountability

Elvia Shauki, PhD
Centre for Accounting, Governance and Sustainability (CAGS), School of Commerce,
Division of Business, University of South Australia, Adelaide, Australia
E-mail: elvia.shauki@unisa.edu.au

Purpose:

The study is aimed to achieve two main purposes: (1) exploring the issues for building sustainable business for 2 particular Australian retail companies. (2) Secondly, this study explores the extent to which Australian retail companies disclose their policies, programs and projects related to "green shopping bags". It is aimed at understanding the degree of accountability related to the selling of their *green 'claim' products''* to their shoppers, and to other stakeholders.

Background and Motivations:

The study is motivated by a question on what drives the company in disclosing their sustainability issues as outlined in company's reporting. In particular, the study is aimed to look at the disclosures motivation in relation to their green products (i.e. green shopping bags).

As per data on July 2009, Australians are the second highest producers of waste per person in the world sending 690 kilograms of waste to landfill each year, dumping 7,150 recyclable plastic bags into landfills every minute or 429,000 bags every hour (Clean Up 2012). There are two major single-use plastic bag types which are used in Australia. These are *'the singlet bag made'* of high density polyethylene (HDPE) which is used mainly in supermarkets, fresh produce, convenience stores, take-away food shops, and other non-branded applications. The second type of plastic bag is *'the boutique bag made'* of low density polyethylene (LDPE) which is generally branded and used by stores selling higher value goods such as department stores, clothing and shoe outlets. Even though Australians reduced the overall use of lightweight single use high density bag by about 34% as compared to 2002 (EPHC 2005) but still huge amount of bags was used nowadays (> 3.0 billion number of bags.

Since May 4, 2009, South Australia has become the first jurisdiction in Australia which bans lightweight single-use shopping bags. While other states still allow the shoppers to use lightweight single use bags, but it is not recommended by most of the retail companies to use these bags. Most supermarket retailers in Australia offer reusable non-woven plastic (polypropylene) 'Green Bags', for which they normally charge between $0.50 and $2.00 per bag (Hyder Consulting 2009). As community funding is involved, the selling of this reusable bag is the focus of this study, where company is demanded to be more accountable related to the usage and selling of their 'green (claim) products. Three immediate questions that are raised here are: (1) *'where does the money go?; (2) 'whether the companies have proper accountability reports prepared for their stakeholders?';* and lastly (3) '*what motivates the company to disclose their green claim products?'*.

As retail industry is believed to contribute to this massive usage of plastic bags, therefore, this study observes the disclosure motivation of two giant Australian retail companies (Westfarmers and Woolworth) in the period between 2009 and 2011 related to the sales of their green claim products (i.e. plastic bags). Many companies from different industry background earn money from its environmental products and services (or claimed to be 'environmentally friendly' products and services), an immediate question to be raised by most of the stakeholders is that whether environmental issues raised by the company are aimed to satisfy their primary stakeholders (i.e. shareholders) or public at

large known to be secondary stakeholders (stakeholders). This was also raised by Schaltegger (1998) whether this act is geared towards the eco efficiency or towards the shareholders' value.

***Literature Reviews*:**

Friedman (1962); Gray (2010) and Van Hayek (1969) mention that business is business where companies are not supposed to engage in sustainability. While in the opposite view PWC (2000); Christmann (2000); Epstein and Ray (1996); Herzig et al (2012); Bernstein (2000); Freeman (1984), Caroll and Shabana (2010); and Lee (2008) provide arguments for two issues: (1) what is a business case for sustainability?, and (2) why a business case for sustainability is important? Business case is a condition where resources were used in an attempt to support for a specific business need (better performance).

Between these two different perceptions, Schaltegger (2012) discusses that business cases for sustainability issues do not exist and suggests that company should create these actively where every company has the potential for business cases for sustainability.

In order to determine the company's motivation disclosing their green related products, two different models will be applied in this study: *the self-enlightened interest* considered to be *the business case* and the *(genuine) accountability models* considered to be *the business case for sustainability*. The self- enlightened interest model introduced by Wallich and McGowan (1970), extended by Keim (1978) is where taking community expectations into account and embracing corporate social responsibility (CSR*) in the interests of business* or doing the right thing with the community and the environment which will provide benefits to the shareholders or owners (Deegan, 2009). Self-enlightened interest model is where a firm will (only) engage in activities in which the discounted sum of the private benefit stream deducted by the discounted costs is greater than or equal to alternative opportunities for resources investment.

On the contrary, (*Genuine) Accountability Model* introduced by Berman et al (1999) originated from stakeholder theory (Freeman 1984; Ullman 1985, Roberts 1992, Gray et al 1996) assumes that company's reporting is to be responsibility driven rather than demand driven. Schlenker et al (1994) defines accountability as 'the condition of being answerable to audiences for performing up to certain standards, thereby fulfilling responsibilities, duties, expectations and other charges'. Merkl-Davies (2011) mentions that in one hand it accountability involves the obligation of one party to provide explanations and justifications to another party, while on the other hand this involves that what first party's behaviour is subject to scrutiny and sanctions of the second party.

This study contributes to the current debate by looking at business case for sustainability practices by exploring different degree of accountability related to company's motivation in disclosing their green related products especially when the two models are applied at the same time and when it's applied to the Australian retail industry in relation to the disclosures of their plastic bag products.

Research Design / Methodology/ Research Approach:

A mixed-method combining quantitative and qualitative approaches will be employed in this study. Descriptive statistics will be part of the quantitative approach, *word frequency* and *number of references* will be used as a measurement basis. Pulling out from the quantitative data, conceptual/thematic analysis is then conducted in order to analyse the themes/issues found out in the study and this will be the qualitative part of the study. Using archival data in a broad area of corporate narrative reporting related to policies, programs, projects, activities and success stories through a wide range of media , two different models will be applied to explore further the 'nature', 'meaning' and 'motivation" behind corporate reporting. Retail industry was chosen representing among others as it is believed to be the highest consumer and mediator of plastic bags. Narrative disclosures of two Australian retail giants, Woolworths and Wesfarmers will be observed in this study. These two Australian retail companies listed as the world's top 30 retail companies by Deloitte Global Powers of

Retailing (2010) are the *leaders* in the retail industry in Australia. Therefore, due to their important role in the Australian retail industry, this study observes these two companies narrative reporting especially looking at the accountability 'disclosures where community funding for environmental activities were involved (*green claims)*.

Conceptual or Thematic Analysis of Content Analysis introduced by Krippendorff (2004) as one of the social science research methodologies for analysing textual data is applied in this study. Wilkinson and Birmingham (2003) mention that content analysis can be used as a powerful research tool to determine content of a message, sound inferences concerning the attitude of corporate narrative reporting. This will involve drawing inferences from data by systematically identifying characteristics within the data as has been further applied by Clatworthy and Jones (2001). Steps in content analysis introduced by Clatworthy and Jones (2001) and applied by Merkl-Davies (2011) will be employed in analysing the disclosures from all of the two sampling companies. These are:

1. Establishing research questions and hypothesis;
2. Determine sampling unit;
3. Establish coding categories;
4. Define recording unit;
5. Pre-test coding;
6. Code all of the text; and
7. Analyse, interpret, and report the results.

Using archival data in a broad area of corporate narrative reporting related to policies, programs, projects, activities and success stories through a wide range of media , two different models will be applied to explore further the 'nature', 'meaning' and 'motivation" behind corporate reporting. Media such as (1) corporate websites, (2) corporate press release, (3) annual reports, and (4) stand-alone environmental reporting (triple bottom line or sustainability reporting). Craig et al (2010) has mentioned little has been explored about the messages that they involve, crafted and reasoning behind them. Westfarmers and Woolworth as two giant Australian retail companies will be taken out as *unit of analysis* for this study.

The population from which the sample is selected comprises of all Australian retail companies operated in Australia. This study uses purposive sampling selection with the aim to derive a sample that could represent the industry. The following are the sources of data that were used to analyse company's disclosures related to their green products:

1. Company's websites;
2. Press release launched to public (via newspaper or via company's websites); and
3. Related news launched in major Australian (not necessarily in South Australia but also across the States) and local newspapers in the period between 2009 and 2011.
4. Annual General Meeting (AGM) held between 2009 and 2011.

Besides, the following sources of data are also collected:

5. Westfarmers Ltd.:
   a. Interim and Annual Reports between 1998 and 2011;
   b. The stand-alone Sustainability Reports (or also called as Environment, Health, Safety, and Community Reports) between 2001 and 2011;
   c. Corporate Website; and
   d. Other Reports (such as Shareholders Review, National Greenhouse and Energy Report, Public Report for the Energy Efficiency Opportunities Act 2006, Community Report, and Reconciliation Action Plan) between 2009 and 2011.

6. Woolworth Ltd.:
   a. Annual Reports between 2002 and 2011;
   b. Sustainability Reports between 2002 and 2011;
   c. Corporate Website which covers the following sites: who we are; invest in us, a trusted company, a great place to work, and the news room (including sustainability site); and
   d. The Good Business Journey Report between 2002 and 2011.

Using the above sources, the data will be content analysed in order to investigate company's motivations disclosing their green related products (i.e. plastic bags). The

following themes and topics (coding) will be gathered:

1. Bags;
2. Plastic Bags;
3. Reusable bags;
4. Lightweight bags;
5. Shareholders;
6. Stakeholders;
7. Profit;
8. Income;
9. Costs;
10. Business case;
11. Shareholders value;
12. Stakeholders value;
13. Community's benefit;
14. Environmental benefit;
15. Community;
16. Sustainability;
17. Environment;
18. Waste; and
19. Landfill.

The above coding will then be investigated and classified further using words frequency and sources of references related to the following:

1. *Topic Coding*:
   - What is the topic/theme that is being discussed in the above resources?
   - How many times the company has mentioned the above themes and topics (through word frequency)?

2. *Analytical Coding*:
   - What is the content really about?
   - Why is it interesting?

3. *Descriptive or Case Coding:*
   - Who is speaking about the theme/topic?
   - What place, or organization or other entity is being observed?
   - Where do they mention the above theme and topic (websites, newspaper, annual reports, sustainability reports, or any other type of reports that the company prepared)?

The above analyses will then be used to answer the Research Questions whether there are different motivations in disclosing the usage and selling of plastic bags in two Australian retail companies either quantitatively or qualitatively.

NVivo 10 is used to process the above data following below steps:

1. By exploring what has been discussed and announced in the Australian Newspaper (nationally and locally) related to the two companies and *plastic bags* or *reusable bags* in the period between 2009 and 2011.
2. By investigating more on what has been mentioned by the two companies in their corporate websites (including announcement / press release related to Annual General Meeting) especially sites related to investors and public at large (stakeholders). Particular tasks will be emphasized in looking at the corporate mission, vision, programs and policies in relation to their sustainable activities.
3. By comparing the information content provided by Company's Annual Report and Sustainability Report as the breadth of Corporate Reporting over recent decades has extended considerably beyond the Corporate's Annual Report where many companies provide considerable information on sustainability issues nowadays (Adams and Frost 2006) .
4. By exploring and investigating the information content provided in Corporate Narrative Reporting. Narrative reporting such as the Chairman's statement or President's letter plays an important role in the Annual report where its importance have been recognized by many scholars (Merkl-Davies 2011; Baird & Zellin 2000; Courtis 2004; Elliot 2006; Frederickson and Miller 2004; and Krische 2005).

Findings:

Drawing from a variety of extensive resources on two corporate narratives reporting, it is found that accountability disclosures related to the plastic bags of two Australian retail companies are still minimum, the two companies have similar ways in disclosing their accountability related to their green products, and finally looking at the Sustainability Reports of the two companies they do have similar motivations related to the accountability and sustainability of the business where self-enlightened interest is still

dominant and play an important role. This can be seen in where do the companies disclose the information, how do the companies disclose the information, how many times they have mentioned accountability in their disclosures, accountability to whom, and lastly what dominate them in disclosing the information. At the end, the study will conclude on who is really the winner from a ban of plastic bags in the country?

Keywords:

self-enlightened interest, (genuine) accountability model, plastic (reusable) bags, corporate narrative reporting, corporate press release, stand-alone social and environmental reporting, content analysis and stakeholder theory.

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Recognising Commitment to Sustainability through the Business Model

Susan C. Lambert, Amanda J. Carter, and Roger L. Burritt

Centre for Accounting, Governance and Sustainability
University of South Australia

I. INTRODUCTION

Sustainability has become the dominant imperative for human society and businesses in the 21st century [1]. This perspective has resulted in a vast body of literature which focusses on, amongst other things, external reporting, impact on firm financial performance, and critical evaluation of the current market-based paradigm.

Traditionally, sustainability is structured around triple pillars first developed by Elkington [2] – economic/financial, environmental and social – but increasingly sustainability is becoming a governance issue [3], and perhaps the most important new governance issue for modern corporations as business cases for pursuing sustainability become more refined [4, 5, 6]. The board of directors, as the principal governance mechanism in corporations, must now take a leading role in adapting corporations to the challenges presented by sustainability and the growing expectations of society [7].

Research has shown that Board chairs and/or chief executive officers have played a pivotal role in organisations which are leaders in adopting a sustainability focus [8]. Increasingly research is adding explorations of the role of boards, directors and senior executives in disclosures [9], reporting on social and environmental issues [10, 11], as well as the role of board composition and independence in corporate sustainability [12, 13, 14]. The bulk of this literature explores external reporting and stakeholder relationships, or institutional influences on explicit adoption of sustainability policies. This narrow, externally- and stakeholder-orientated perspective ignores internal accountability issues. One of the core questions in the external accountability literature is how to assess the accuracy and completeness of corporate disclosures [10, 15, 16]. The primary conclusion drawn from this literature is that corporations are failing in accountability in terms of completeness [see for example 10, 16, 17]. This reporting is a core governance issue and the current literature assumes that corporations have successfully implemented the policies created at Board level and that strategy has been effectively operationalised. Thus assumption is challenged here by asking **how can directors know whether their sustainability policies have been implemented (as intended)?**

Implementation of policy may not result in the expected processes or performance for a variety of reasons [18, 19, 20]. Directors have the responsibility to assure themselves and others that the substance of the sustainability policies developed are translated into appropriate and effective processes and activities, that is, translating the sustainability strategies into action. A number of tools are available to assess the operationalisation of sustainability policies within corporations and other organisations and are the subject of the next section.

II. CURRENT TOOLS TO ADDRESS SUSTAINABILITY

There are at least 40 sustainability measurement and/or assessment tools exist including the variations of the Balanced Scorecard which focusses on corporate "greenness" [21] and the Extended Performance Reporting Framework [17]. The latter incorporates multiple performance elements into an integrated framework divided into three main categories: external capital, internal processes, and human capital [17: 315]. The main strength of the Extended Performance Reporting Framework is it use of existing reporting structures (the Global Reporting Initiative or GRI) with intellectual capital thereby building into the framework a strong, pre-existing corporate governance structures. However, the overriding purpose of the Extended Performance Reporting Framework is to aid external reporting processes and the empowerment of stakeholders and not the internal accountability considered here. The Extended Performance Reporting Framework has since been superseded by Integrated Reporting, a tool which combines social, environmental and economic performance reporting into a single framework [22, 23].

Two other important tools are the Sustainability Balanced Scorecard and the Environmental Management Accounting Framework. These tools provide a means by which sustainability factors can be measured and compared to benchmarks which is useful for external reporting. The Sustainability Balanced Scorecard [24, 25, 26] adapts the original Balanced Scorecard of Kaplan and Norton [27] for the purpose of identifying "the major strategically relevant issues of a business and to describe and depict the causal contribution of those issues that contribute to a successful achievement of a firm's strategy" [25: 270]. The underlying purpose of the adaptation is to effectively integrate sustainability and its non-market perspective into the

management systems of a business. It effectively develops a hierarchical system of strategic *objectives* in line with the perspectives included in the scorecard: financial, customer, internal processes and learning and growth (as represented in the original balanced scorecard) and non-market (which captures the sustainability perspective) [25]. What the Sustainability Balanced Scorecard does is take a broad approach to sustainability by integrating it into the *management* of a business; however, it largely operates as an assessment and evaluation tool – identifying key issues and their management. The core limitation of the Sustainability Balanced Scorecard is that it must be developed on a business unit basis [25] and its specific strategic objectives rather than consider the business in a holistic manner

The Environmental Management Accounting Framework [28] is a tool which classifies information needs according to specific circumstances. The Environmental Management Accounting Framework gives four dimensions to information needs – monetary versus physical, short-term versus long-term, past-orientated versus future-orientated, and ad hoc versus routinely generated – to determine the type of information required to inform decision-making at a given point in time [28]. The limitation of the Environmental Management Accounting Framework is its restriction to specific decision settings for a given point in time and relates only to the information needs of decision-makers and the type of information required.

The tools examined here are but a few of a large number of tools aimed at assisting businesses with the implementation of sustainability policies at all levels of the business. However, each has specific limitations – an external or reporting focus, a business-unit view of the firm, or a focus on information needs. Whilst these may be of assistance in determining the effective operationalisation of sustainability policy with an organisation, there is still a need for a tool which provides a common language and structure to understand sustainability within a business context. It is proposed that a business model approach would be able to provide this.

III. A NEW TOOL FOR SUSTAINABILITY

A business model simplifies business complexity, creating an architectural blue print which allows it to be seen in its entirety. These blue prints can be used to anticipate potential impacts on the business in relation to strategic decision-making, whether as a response to transformed marketplaces [29] or avoiding entropic states. It does so by using "unambiguous terminology" and an ability to rely on "real world observables" [30: 147]. In this regard, business models have a systems theory foundation consistent with the more general accounting approaches to sustainability [31: 17] and captures the benefits of visual communication through the blue print-style schema. The business model is also a relatively new unit of analysis with boundaries which extend beyond the firm itself and explains both value creation and capture [32: 1020].

The alternative tool proposed here uses a business model approach to sustainability shows management and decision-makers the structural adjustments of a business to its core sustainability issues – economic, environmental *and* social – and does so on a whole-of-business basis. By using a business model, management can see whether sustainability strategies and policies have been implemented and if so where in the enterprise business model these are reflected. It does so by depicting a business using a schematic at a highly abstract level but one which can be fleshed out to a very detailed level – a Hierarchical Business Model Framework [33]. We propose incorporating sustainability factors into business model representations thereby providing a coherent, understandable picture of sustainability in the business and how this relates to the business model of the enterprise. The sustainability characteristics of the business can be articulated using the same structure that would be used to depict operating and profitability focussed aspects of the business – its strength therefore being in the use of common structures and language irrespective of circumstances.

At the core of the traditional business model framework is the value proposition that represents "the object(s) of value offered to the customer" [33: 8]. Such objects may include products, services, information, or indeed combinations thereof. By building sustainability into the value proposition, it becomes an integral part of the fabric of the business – the business equivalent of DNA [34].

Management can build a single business model representation and use it for multiple purposes simply by collecting data about the characteristics in which they are interested, for example by using Sustainability Balanced Scorecard or Environmental Management Accounting Framework, and then displaying that data at their preferred level of detail and in relation to the sections of the business in which they are interested. Strategic decisions, including sustainability decisions, are reflected in the business model so that by applying a 'sustainability lens' to the business model representation, the sustainability factors present in the enterprise become visible. Potential consequences of sustainability decisions can be incorporated into the business model and demonstrate the impact of various scenarios on the overall business model. Thus, using a business model framework means the tool is both diagnostic and useful for evaluation through scenario analysis.

In the next section the hierarchical business model framework is described with an example of potential business model schematics that use sustainability as the conceptual focus.

IV. BUSINESS MODEL FRAMEWORK

All businesses have at least one business model and many operate more than one. However, not all businesses articulate their business models and those that do can choose from a myriad of business model frameworks and ontologies designed to facilitate the understanding of the business concept(s) that underlie the business. A limitation of most business model frameworks is that they are designed with a particular level of analysis, scope of analysis and conceptual focus in mind and although most provide schematic representations that assist communication of the business concept none perform very well in terms of providing multiple levels and units of analysis and conceptual foci [33].

The Hierarchical Business Model Framework that was developed purposefully to accommodate multiple levels and units of analysis, and multiple conceptual foci can extend traditional business model representations to reflect sustainability factors that are present in the existing business models of an entity. It does so by utilising object-orientated modelling principles which allow complexity to be abstracted and distilled into a form understandable by all [35]. Once it can be established that sustainability factors can be identified and communicated through the Hierarchical Business Model Framework, attention can be directed at using the business model as a management tool.

A. The Basic Business Model Objects

The Hierarchical Business Model Framework organises the business concept around the value proposition which is the concept that holds primacy (see Figure 1). For every value proposition there are related objects, namely, customers, value adding processes, delivery channels, some form of value in return and potentially there are other entities that are involved in creating, delivering or paying for the value proposition [33].

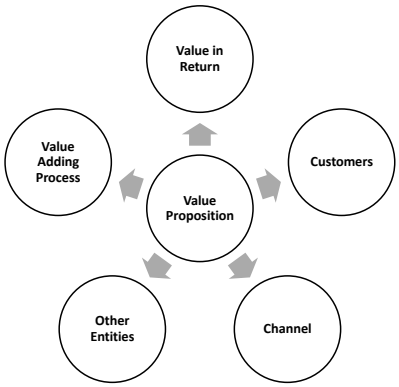

FIGURE 1: BASIC BUSINESS MODEL OBJECTS

Lambert [35] provides a concise definition for each of these objects. Customer(s) are an entity or entities targeted with the value proposition. This may be a group of consumers (individuals and other businesses or organisations), with multiple groups being recognised according to demand or servicing requirements. Value in Return is what the entity receives in return for delivering the value proposition, usually in the form of cash or cash equivalents but also non-monetary elements of value. Channel refers to how the value exchange take place and multiple channels can be used to effect a transaction. Value Adding Process encapsulates the resources, activities, and capabilities of the entity that create the value proposition and/or the channel through which it is delivered. It may include manufacturing, retailing or service processes. In its most detailed view, the Value Adding Process can be defined with precision with a process model constructed for depiction. Other Entities represents third parties, suppliers, outsourcing firms, regulators, and stakeholders, that (i) assist the enterprise in creating or delivering the value proposition to the customer, (ii) influence how the enterprise creates or provides the value proposition, or (iii) are involved with determining or providing the value in return.

B. Conceptual Focus

The conceptual focus describes the lens through which the researcher views the business and determines the information that is collected about each business model object. Traditionally the conceptual focus of the business model is monetary value or profitability [36, 37]. However, it could be social and environmental values which would provide a sustainability focus.

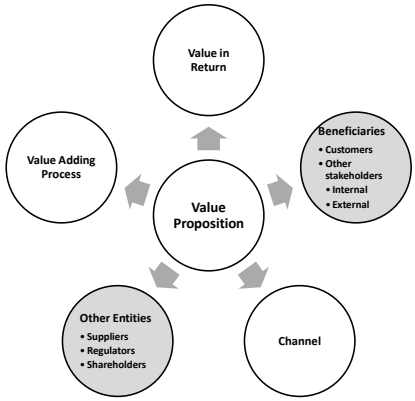

FIGURE 2: BASIC BUSINESS MODEL OBJECTS USING A SUSTAINABILITY CONCEPTUAL FOCUS

In this research we apply a sustainability conceptual focus, identifying the social and environmental sustainability factors present in the business model pertaining to a particular entity. A sustainability conceptual focus requires the basic business model objects to be modified to accommodate sustainability factors. Figure 2 demonstrates this by renaming the Customer object to Beneficiaries (of the value proposition) and

recognising two beneficiary groups, direct and indirect. Customers are direct beneficiaries, whereas other stakeholders may be indirect beneficiaries of a value proposition. The Other Entity object is also expanded to include shareholders.

C. Level of Analysis

The Hierarchical Business Model Framework allows the business model to be depicted at a range of details from a high level of abstraction to very detailed information about the business model objects and their associations. The scope that is covered by the particular business model depiction can be broad and include external entities such as suppliers, regulatory bodies and outsourcing partners that make up the value network or it can be quite narrow, zooming in on transactions with customers and other entities, or concentrating on value adding processes and the supply network.

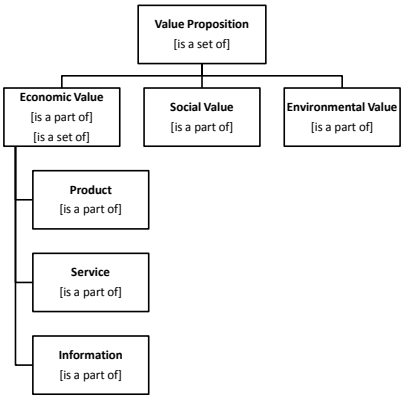

FIGURE 3: A VALUE PROPOSITION AND ITS ELEMENTS

Figure 2 indicated the most basic objects of the business model (effectively a Level 1 depiction). To obtain greater and contextually specific content, the Hierarchical Business Model Framework adds levels of detail. Level 2, for example, considers the specific products, services, and information which comprise a given value proposition [35] (see Figure 3). Here the original three elements of the Value Proposition, product, service and information, are grouped to indicate the economic value of the Value Proposition. In addition, social value and environmental value are added as elements of the Value Proposition.

The individual elements of the value proposition, such as a product, can be explored in greater detail to reveal the sub-components of the product or the value adding processes related to that product. Specific information can be seen with regards to activities and resources and in the case of human resources, the specific capabilities required to effectively deliver the value proposition [35] .

In summary, the Hierarchical Business Model Framework using a sustainability conceptual focus provides a tool which produces a schematic of the business and effectively codifies knowledge of the business which may have previously been tacit in nature. Tacit knowledge is embedded in the individual and loss of the person necessarily means this knowledge is lost to the organisation [38, 39]. Therefore, rendered previously tacit knowledge codifiable ensures knowledge of the business model is retained [40]. This tool therefore becomes a vital element of an organisation's knowledge management system.

V. CONCLUSION

The Hierarchical Business Model Framework is proposed as a new tool for sustainability management and research. The tool enables the depiction of a business and its sustainability issues using a common language and structure. The use of a visual communication device, the schematic depiction of the business model, capitalises on the increased memory retention and understanding associated with communicating complex concepts through images [41]. It is not designed to make an assessment of a business's performance or categorise and outline the information needs of a business in the way that the Sustainability Balanced Scorecard or Environmental Management Accounting Framework do. However, the modelling capability can work synergistically with other sustainability management tools to increase internal accountability and ensure those charged with corporate governance have a means to assess implementation of sustainability policies in all aspects of the business. The schematic depiction of the organisation using a sustainability conceptual focus provides an account of sustainability at the organisation level which addresses a key concern raised by Gray [42: 56-7] regarding the ability to create such an account.

This paper considers sustainability and the means to implement it within businesses using a tool which has the capacity to be flexible, adaptive to context, and offers a degree of detail as desired – enabling directors of companies to understand the implementation of sustainability policies into the very fabric of a business, as well as the failure of or dysfunction in such implementation efforts.

This paper also represents a necessary first step to building a classification of business models based on a hierarchical structure which supports sustainability. While this is not an attempt to create a set of normative business models which are preferred for creating more sustainable organisations, the ability to classify and assess businesses with a sustainability lens provides the potential for not only more informed research but also indicators of best practice.

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Towards a more critical understanding of management accounting and the environment: the case of capital budgeting

C. Rannou
Université Laval/University of St Andrews, rue de la Terrasse, G1V 0A6, Canada
E-mail: cr457@st-andrews.ac.uk

***Abstract*: The purpose of this paper is to stress the benefit of a more critical and theoretical approach to environmental management accounting research, in order to better understand the practices of organisations and their obstacles. The paper provides an analysis and critique of the extent of critical theorising and use of theories in environmental management accounting research. It draws on three branches of the management accounting field, mainstream, critical and environmental, in order to present a case for research on environmental management accounting practices using critical theories and theorising. The study of the capital budgeting process is used as an example of practices that could gain a better understanding from the insights of theories.**

The paper finds that the management accounting literature is widely theorised and has a critical branch but is mainly uninterested by environmental issues. The Social and Environmental Accounting literature is also using theories but includes little management accounting. In contrast, the environmental management accounting literature remains mostly managerial and under theorised. The lack of a critical approach to environmental management accounting is found to be due to a focus on describing and enhancing management practices within a business case. The paper argues that further research into the practices of organisations with theoretical lenses will allow a better understanding of those practices and their impediments. In particular, it is argued that capital budgeting would benefit strongly of more theoretical views in order to explain the lack of systematic consideration of environmental issues by managers.

The use of theories and theorizing has the potential to give a better understanding of environmental management accounting practices and thus to enhance practices and decrease their obstacles. Drawing on the management accounting literature and the example of capital budgeting, the paper presents a way forward for researchers in environmental management accounting by suggesting where further theoretical contributions might be made by future research.

Keywords: **Environmental Management Accounting, Management Accounting, Theories, Theorising, Capital Budgeting**

I. INTRODUCTION

In recent years, the Environmental Management Accounting (EMA) literature has been growing rapidly[1]. Research however has focused mainly on the development of new tools [1], [2] and is still mostly conceptual [1] and prescriptive [2]. The use of explicit well-known theories is scarce and mostly limited to contingency theory and institutional theory [1].

This paper shows that the use of theories and theorizing has the potential to give a better understanding of environmental management accounting practices. It advocates for a greater use of both theorizing and critical theories in environmental management accounting research. Drawing on the extensive use of theories in the related fields of management accounting and social and environmental accounting (SEA) in Section II, this article stresses the current lack of theorizing of EMA and highlights some possible reasons for this (see section III). The theorizing aspect of the fields is then explored (section IV). Subsequently, long term investment decision-making, so called "capital budgeting", illustrates the potential of theories and critical theorizing by explaining EMA practices of organisations (section V). Finally, I conclude (VI) with a call for more theories and theorizing in EMA research.

II. THEORIES IN RELATED DISCIPLINES

A. Mainstream and critical management accounting

Management accounting is concerned with the identification, collect, measure, classification, and reporting of information that is useful to internal users of organisations in planning, controlling, and decision making [3]. For a long time, management accounting research focused on cost measurement [4], [5] but gradually moved their interest towards decision making [5] and added a critical branch, now big enough to be considered as part of a new "mainstream" in management accounting [6].

Malmi and Granlund note that the role of theories in management accounting research is about explaining its causes, effects, and functioning [7]. It is also about determining which practices work, and in which circumstances [7]. Thus, as in any discipline, it is about explaining and helping to understand the links between different concepts. In management accounting those concepts can be, to give a few examples: performance, control or costs. The broader aim of using a theory would be to help to develop "better" practices - whatever "better" may mean [7-9].

In management accounting research, a vast range of theories are used. It is argued that this heterogeneity is essential and should potentially even be increased [8], [10].The research ranges from a positivist perspectives (such as rational choice theory, contingency theory, agency theory, transaction cost) to a critical perspective. Along the spectrum, it covers institutional and contextual perspectives (such as legitimacy theory, institutional theory, and stakeholder theory), a naturalistic approach such as grounded theory [11] as well as interpretive approaches. Most of the theories used are borrowed from other social sciences such as economics, sociology, organisation theory and psychology [7]. In management accounting research, most researchers, (including positivists) have been advocating for more rigour, and more use of theories [12].

The critical theory perspective in management accounting is generally considered as including labour process, critical theory and post-structuralism [13]. This

[1] (for a quantitative study on the number of publications, see [1])

critical branch of (management) accounting questions the traditional neo-classical and functionalist view of organisations. It also highlights the role of accounting within the society as "an ideological weapon" [14]. Indeed management accounting can reproduce and reinforce the neo-classic view of organisational practices at an individual, organisational and social level [13]. Additionally, accounting practices stress different aspects within the organisation:

> *"What is accounted for can shape organizational participants' views of what is important"* [15].

Critical theories allow considering the broader context of management accounting practices: the social and economic context in which individuals (practitioners or managers) and organisations evolve. Thus, for example allowing the consideration of the impact of practices on social justice and equity [13]. This aspect of critical theories makes them especially interesting for social and environmental accounting research.

B. Social and environmental accounting

Social and environmental accounting (SEA) is the field interested in the integration of social and/or environmental consideration in accounting practices. By opposition to EMA, SEA has traditionally focussed on financial accounting rather than on management accounting practices. As a result, widely studied subjects in SEA include external reporting [16-18], accountability [19], [20] and shadow accounts [21], [22].

After over 25 years of research in SEA, a wide range of philosophies and theories have been used. The SEA literature ranges from a wide spectrum of philosophies, from a large "radical" critical stance (e.g. [17], [23-26]) to a much more moderate view, advocating for example for the Triple-Bottom Line [27], [28]. The two extremes have also been called "technical" versus "political" approaches: the technical being concerned with developing tools and decision-making models for organisations, and the more "political" view of SEA being linked to social movements and change [14], [29].

The wide range of philosophical views is also coupled with a wide range of theories. There seems to be a preference for legitimacy [30-33] and stakeholder theories [16], [34], as well as accountability theory (e.g. [19], [20], [35]). However, system thinking [36] and resource-based [37] perspectives, for examples, can also be found. SEA research is open to other theories such as the Laughlin's model of change [38], structuration theory [39], democratic theories such as agonistic pluralism [14] or neo-institutional theory [40] to name just a few examples.

The use of critical theories and theorizing however is particularly strong in the field (see for few examples [26]-[17] or [41]-[16]). This interest is linked to consideration for a shift from a neo-classic view of the organisation to a broader approach including not only financial aspects but also social and environmental concerns.

Critical theories offer a basis for the social change and emancipation of diverse stakeholders advocated by a 'deep' accountability theory [17], [42].

III. THEORIES IN ENVIRONMENTAL MANAGEMENT ACCOUNTING RESEARCH

The lack of use of an explicit theory or of theorizing have been noticed in EMA research [1]. Actually in their extensive bibliometric review of EMA research, Schaltegger et al. [1] found that only 13% of the papers reviewed explicitly use a well-known theory. Some authors however have already found beneficial to use well-know theories in order to understand EMA practices and implementation, as, for example, the use of contingency theory and institutional theory [2]. Despite this interest, the use of theories in EMA research has mostly used only the following two theories: contingency theory and institutional theory [1].

The lack of the use of well-known theories widely used in management accounting and SEA is due to the philosophy underlying EMA: the business case [43]. Environmental management accounting is strongly based on the idea of a business case, of "win-win" situations. This view is illustrated by the definition of EMA as the:

> *"generation, analysis and use of financial and non-financial information in order to optimise corporate environmental and economic performance"* [44].

The business case view is at the opposite end of the philosophical spectrum to critical theory [43]. This opposition would explain why theories coming from a critical theory philosophy are not used in EMA research.

What is the justification for the exclusivity of the business case view? How can such an encompassing field as EMA be researched through only one philosophy? Management accounting on the other end has a critical branch, as well as a positivist one – the two extreme ends of the spectrum. Research in SEA also has a wide spectrum of philosophies. So, why would the research into environmental considerations made in management accounting be linked to only one philosophy? This does not have to be the case! A overall field, such as EMA, can't be classified as a single a philosophy. Within a field such as EMA, concepts and practices are studied through our philosophical views. Nothing prevents researchers from having differing views on the same subject (EMA), as can be seen in management accounting and SEA. It can, however, be understood why Mathews [43] could classify the EMA research done so far as currently being mostly based on a business case view.

From a business case standpoint, the basic idea remains: profit maximisation, that is to say management as usual or good management. It is about trying to make more money by any means possible, including ways reducing environmental impact. This view is thus considered as managerial. It has also been called a "private cost approach" or a "conservative" one [45]. As noticed by the UNDSD, according to this perspective, EMA consists of:

> *"simply doing better, more comprehensive management accounting, while wearing an 'environmental hat'"* [46].

Concentrating on a managerial view of EMA, the research has focused mainly on the development of new tools, with little empirical work, mostly conducted through case studies [2]. Bouma and van der Veen [2] summarise the EMA research as:

"… contributing to the further development of tools, and often based on a limited number of case studies (e.g. Bennett and James, 1998[2]). Empirical research in environmental management accounting (…) *is scarce and is focused more on describing the current state of implementation than on analyzing or critically evaluating the effectiveness of the new tools"* [2].

As the related fields of management accounting and SEA research both benefited from a strong critical theory perspective, I believe that EMA should equally be able to benefit from a wider spectrum of philosophies.

More philosophies would bring more theories which in turns would allow a better understanding of the links between EMA concepts. Specifically, critical theories, with their concept of capitalist hegemony can help further an understanding of the obstacles to more EMA practices in organisations. Furthermore, the interest of critical theories in social change and capitalist hegemony can be easily linked to the interest in changing management practices towards environmental management practices. If more philosophical perspectives need to be included in EMA research, it is particularly important that critical theories are included in order to enhance our understanding of EMA practices and obstacles to practices in organisations.

IV. THEORIZING

"Theorizing can be a liberating effort: an attempt of making sense of our world in a more abstract level than that of merely describing the immediately perceived practice." [10].

Theorizing in research is generally understood as the use of a "well-known" (or explicit use of a) theory in order to explain data. However, theorizing goes beyond the application of a theory in the data analysis part, to become a "conceptual framing" [47]. Thus, it is possible to theorize throughout a paper in order to reflect our view, paradigm or philosophy in the literature review as well as the methodological and concluding parts. For consistency, the view reflected must be aligned with both the theories formally used in the analysis and with the methods employed.

Different levels of theorizing have been identified in qualitative research [47] and can give ideas of ways and examples of theorizing. The purpose of this paper is not to describe the different levels or to advocate for the use of one over the others but rather to advocate for more theorizing in EMA research per se.

A call for critical "reflection" or critical theorizing in management accounting research has already been made [13], [48]. Critical theorizing is to give a:

"*socially and historically contextualised view of management accounting that emphasises power and conflict, examines the multiplicity of mechanisms of commodification and is oriented to social improvement*" [13].

In management accounting, the benefit of critical theorizing is thus already recognised [13].

The SEA literature also has a strong critical theorizing tradition. This is not surprising given the similar interest of the two disciplines in: "human improvement and emancipation" [13].

However, the current theorizing found in EMA research is, thus far, almost exclusively from a neo-classical perspective: the business case. As a discipline in between management accounting and SEA, EMA would benefit from critical theorizing as much as the two related fields have already benefited from it.

Theorizing would also link the perspective of a paper with the theories and methods employed, all the way, from the beginning to the end. This means that research on EMA could also be enhanced in terms of methodological rigour if more theorizing were to take place.

V. CAPITAL BUDGETING AS AN EXAMPLE

This section will argue that the research on capital budgeting and the environment practices can benefit from the use of more critical theories than generally used by the EMA literature. Different theories will be applied to the capital budgeting process in order to highlight the benefits of using the well-known theories found in management accounting and SEA research. Following a short introduction, I will first review the possible use of two theories inspired from critical theory: Giddens' structuration theory and Laughlin's model of change. Finally, I will discuss the benefits of theorizing in enhancing the understanding of environmentally informed capital budgeting practices and their obstacles.

FIGURE 1: THE CAPITAL BUDGETING PROCESS

Capital budgeting is the process of identifying, developing, selecting and controlling investments in long term assets [49] (see FIGURE 1). This process is heavily represented in management accounting since it is considered as "one of the three foundational elements of management accounting" [4] or "one of the most important managerial activities" [50]. It is also called Strategic Investment Decision (SID) or investment appraisal, the financial evaluation part of the process.

The outcome of the capital budgeting process is a decision about long term investments in plants, equipments, R&D, new products, etc. Therefore organisations use this process as the basis for decisions concerning organisational commitment to activities and long term decisions about their production processes. Especially as it concerns long term impact commitment, there is a need to consider environmental issues within the process, if one wants to impact on the degree of environmentally friendly activities of the organisations. However, thus far, long term investment decision-making as been largely left out of EMA literature [1].

A. Structuration theory

Giddens' structuration theory was mainly developed within three pieces of work [51-53]. The main concept of the theory is the notion of duality of structure: the structure is considered as created by agents (through agency) but also as impacting on their actions. The three

[2] [44]

dimensions of structure are legitimation, signification and domination.

The theory has been used and its development expended in both the management accounting [54-58] and the SEA [39] literatures. However, it is still to be applied in EMA.

The understanding of capital budgeting and the environment could benefit widely from the application of the concepts of structuration theory: the duality of structure and its different dimensions.

Three different levels of structure can be identified: i) the society's routines and thus expectations, as a capitalist society; ii) the organisation's norms and routines; iii) and the procedures, norms and routines of the capital budgeting process per se. The final point being specific to capital budgeting. In terms of environmental issues, the norms and routines of the organisation can either enhance or prevent the integration of environmental considerations into the process. The traditional focus of the capital budgeting process on financial analysis can constraint the inclusion of the environment and be in conflict with the language (financial) of the organisation. Furthermore, in terms of domination (power), in the capital budgeting setting, the "allocative resources" (the power over things invested in) are split into: i) the property rights in the hands of shareholders, who are the superiors of the upper managers, whereas ii) the knowledge of the operating of the equipment in the hands of employees (e.g. operators). In any case, if the upper managers are the ones making the decision on an investment, they don't have a direct *allocative power* over the investments made.

The dynamic of the capital budgeting process and the consideration (or lack of consideration) of environmental information within it, can be better illustrated through the utilisation of structuration theory.

B. Theory of change

Drawing on the critical theorist Jürgen Habermas, Laughlin [59] defines a dynamic model of organisational change. In this model, organisations are considered as resistant to change but subject to "kicks" which eventually trigger change.

Laughlin [59] defines two different degrees of change: i) morphostatic (or first-order), and ii) morphogenetic (second-order) change. Smith [60] explains the two as followed: a morphostatic change is "*making things to look different while remaining basically as they have always been*"[60] while a morphogenetic change is a change *"that penetrates so deeply into the 'genetic code'; that all future generations acquire and reflect these changes"* [60].

Within the SEA literature, Gray, Walters, Bebbington and Thomson [38] have applied Laughlin's model to the greening of accounting. The authors utilise the model in order to identify the levels of "greening" of accounting practices. In the same way, the concept of morphogenetic or morphostatic changes can assist in defining the degree of change of a management accounting process or tool towards the integration of environmental issues. Is it only a change staying within the business case such as the integration of the financial effect of environment (risks, costs…) i.e. a morphostatic change (same ideology but look different)? Or, is it a deep change of philosophy where environment becomes at the heart of the process (morphogenetic change)? In the case of capital budgeting in particular, those changes can be defined by the distinction between a traditional investment made with environmental information and an environmental investment (with a purpose of reducing the impact on the environment). This distinction would permit a critical assessment of the change made in and by EMA practices in organisations.

C. Theorizing

Capital budgeting is generally talked about in a neo-classic, economic perspective. The objective of profit maximisation, through investing is not questioned. The purpose of capital budgeting research is thus traditionally to either develop "better" investment appraisal techniques, or to find out which of the techniques are used in practice.

Other perspectives of the capital budgeting process could help enhance our understanding. For example, the use of critical theorizing can help stress the hierarchical aspect of the investment decision making process (bottom-up process [61], [62]).

In an environmental setting in particular, critical theorizing is the only perspective which questions the appropriateness of profit maximisation compared to environmental (and social) concerns. By questioning the purpose of long term investments, critical theorizing can give an explanation of the (still relatively low) levels of environmental investments or use of environmental (non monetary) information within the capital budgeting process of organisations.

VI. CONCLUSION

This article highlights how the use of theories and theorizing has the potential to give a better understanding of environmental management accounting practices. It advocates for a greater use of both theorizing and critical theories in environmental management accounting research in order to enhance our understanding of organisational practices and obstacles.

While theories and theorizing are widely used both in management accounting and social and environmental accounting research, only few well-known theories are found in EMA research. Mostly due to a focus on a managerial approach within the business case, this lack of theories and theorizing can prevent EMA research to engage with its related accounting fields. It also slows the building of our knowledge.

More importantly, the lack of application of well-known theories prevents us from understanding practices and obstacles of EMA, and may prevent researchers from helping managers get their organisation "greener". The use of theories and theorizing within a business case philosophy would allow a broader development of managerial research and could ultimately provide better advice towards achieving "greener" organisations.

Capital budgeting is one of the main elements of management accounting that has been mostly left out of the EMA research. However, its long term impact on the activities of organisations implies a need to consider environmental issues in order to trigger greener

production. The use of theories, including those developed through critical theory such as structuration theory and theory of change, can greatly enhance the academic understanding of the capital budgeting and the environment practices, dynamic and their obstacles in different organisations.

The capital budgeting process is only one of the numerous examples of areas of research where EMA can benefit from the use of an explicit, well-known theory in the wide range of philosophies already widely used in management accounting and SEA research. Thus, EMA could develop through numerous applications of different theories and ways of theorizing, applied to different approaches, practices and tools. The integration of theories and theorizing would open the door to several rigorous and high standard researches in the field. Further research on long term (investment) decisions is also of great importance in order to change the long term degree of environmentally friendly practices of organisations. It would be a step towards a hypothetic sustainable business.

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ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS) ISO 14001 IMPLEMENTATION IN CONSTRUCTION INDUSTRY: A MALAYSIAN CASE STUDY

Sumiani Yusoff, Ridwan Nordin
Faculty of Engineering, University Malaya, 50603 Kuala Lumpur, MALAYSIA
Haslinda Yusoff
Accounting Research Institute & Faculty of Accountancy, Universiti Teknologi MARA, 40450 Shah Alam, MALAYSIA
E-mail: hasli229@salam.uitm.edu.my

Abstract: **This study seeks to explore the crucial part in EMS implementation; i.e. environmental aspects and impacts, Good Environmental Practice to be developed in construction site, as well as the level of awareness or understanding amongst site staffs on ISO 14001 EMS implementation in their organizations. Data were collected via interviews, surveys and site visits. A number of environmental aspects and impacts, and Good Environmental Practices based on ISO 14001:2004 have been identified. The level of understanding of the site staffs on ISO 14001 EMS requirements has been found to be good except for matters concerning Schedule Waste management. In conclusion, the successful implementation of ISO 14001 EMS mainly depends on staffs' understanding.**

Keywords: ISO 14001 EMS, environmental aspects and impacts, awareness, construction, Malaysia

I. INTRODUCTION

The rapid expansion of construction industry in Malaysia has put pressure for the implementation and certification of Environmental Management Systems (EMS) ISO 14001 Standard Series. The key objectives of this research are twofold:

a) To examine the environmental aspects and impacts from construction site activities and Good Environmental Practice.
b) To investigate the level of awareness or understanding amongst site staffs on ISO14001 EMS implementation within organization.

II. LITERATURE REVIEW

Large construction companies worldwide, using EMS, have demonstrated improved efficiency in occupational health and rise in the market share [1]. In Malaysia, despite the capability of EMS as a tool for sustainable construction, there are various constraints leading to a successful implementation of ISO 14001 EMS [2]. For instance, design and construction companies face problems such as low commitment from the top management, lack of resources and infrastructure, and in appropriateness of the EMS that is suitable to the Malaysian environmental context [3].

III. RESEARCH METHODOLOGY

Data has been collected via site visits, interviews and questionnaire surveys construction companies within Kuala Lumpur and Selangor state. Outcomes from the site visits and interviews were analysed in understanding (1) environmental aspects and impacts and (2) Good Environmental Practice. Questionnaire survey was carried out via e-mail, postal and by hand to 100 site staffs in the selected companies, in which they were required to rate their awareness (1=poor to 4=excellent) on the implementation of ISO 14001 Standard Series [4]. The responses were then summarised using *Average Index* formula:

$$\textit{Average Index} = \frac{\Sigma\, x1i1 + x2i2\ldots}{\Sigma\, x}$$

Where:
X = Number of respondents
i = Level/Rate of response

IV. FINDINGS OF STUDY

The study found a number of environmental aspects and impacts, and Good Environmental Practices relating to air quality, water quality, noise quality, construction waste, domestic waste, land contamination, and oil and petroleum product storage in the construction companies studied. It has also been found that the level of understanding amongst the site staffs on ISO 14001 EMS requirements is good except for matters concerning Schedule Waste Management. Such a finding was due to lack of knowledge among the site staffs.

V. CONCLUSION

Good environmental practices should be largely adopted into the construction site management in order to achieve greener construction and sustainable development. Staffs' awareness and understanding are essential for the successful implementation of EMS ISO 14001 hence communicating related information to staffs are indeed crucial.

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Motives and pressures for investing in responsibility practices in global forest industry

Anni Tuppura*, Anne Toppinen♦, and Kaisu Puumalainen*
*School of Business, Lappeenranta University of Technology, P.O. Box 20, 53851 Lappeenranta, Finland
♦Department of Forest Sciences, University of Helsinki, P.O. Box 27, 00014 Helsingin Yliopisto, Finland
E-mail: anne.toppinen@helsinki.fi

***Abstract*: In this study we empirically examine the motives for forest industry companies to invest in and use of forest certificates (FSC, PEFC) and environmental management system (ISO14001) as an implementation of corporate responsibility. For the empirical investigation we use quantitative survey data collected in 2010-11 from 60 of the world's leading forest industry companies. In the light of the empirical results it seems that incentives for adopting forest certification are more often external than internal, and more market than regulatory driven, which would suggest dominance of extrinsic motivation. The results for ISO14001 also represent reactive strategic approach in emphasizing customer satisfaction as a key motivation. Further, the motivations of the firms somewhat differs depending on their business sector and the geographic location of headquarter.**

I. INTRODUCTION

Among environmentally-sensitive sectors, forest industry has a crucial role in global sustainable development, not only because of its unique renewable raw material basis, but also because of the ongoing globalization of the industry. As a result, forest industry has met strong demands to invest in corporate responsibility (CR). Unlike some other extracting industries forest sector is expected to use environmentally responsible practices both in production and in purchasing raw material, for example [1]. Maybe for that reason different certifications have become important means of communicating environmental responsibility in forest industry today. Today, the discussion of sustainability, responsibility and climate change weigh heavily in the CR practices used in the industry. With dominant emphasis on business-to-business products, gaining price premium for certified products has been challenging. This shows also in empirical studies which find that the stakeholder pressure is increasing [2], [3] whereas the capital or consumer markets are not seen as source of pressure towards better environmental performance [2].

Based on the industry context it is of interest to analyse the reasons that drive forestry firms to invest in CR. In the previous literature the motives to invest in CR have been classified as instrumental (i.e., arise from the belief that investments on CR has positive influence on financial performance), institutional (i.e., primary reason for CR investments is the institutional pressure), or moral [4]. Firms are motivated both by internal values and external pressure, and these motivations overlap. Previous studies on CR motivates in forest industry has emphasized the role of regulation or government pressure [2], [5]. However, many of the CR investments, adopting voluntary certificates or standard for instance, are purely voluntary.

Certification of sustainable forest management practices and market uptake of certified forest products is the most prominent example of sustainability driven innovations in the forestry sector [6]. Forest certification according to FSC scheme was introduced in 1993 as an ENGO driven market-based mechanism helping consumers to identify products from sustainably managed forests [7]. Currently its competing system, Programme for the Endorsement of Forest Certification (PEFC), operates almost two-thirds (65%) of the world's certified forests in 22 countries [8]. Although the original aim of certification was to conserve diversity of tropical rainforests, only 8 % of global forests are already under certification, and 95 % of the certified forests are based in the product exporting boreal countries. This suggests that in practice, companies have had different motives for adopting certification.

ISO14001 was established in 1994, around the same time as the FSC forest certification, and has since then become the most widely accepted environmental standard. Adoption of ISO14001 may not only improve the quality of management and improve operational efficiencies, but also by including top-level management and goal setting for continuous improvement provide a strategic tool to help firms gain competitive advantage [9]. Based on a case study it has also been suggested that ISO14001 certification could be used as an active tool for comprehensive organizational changes leading to sustainable development and value creation [10].

In this study we use international survey data from 60 companies to examine the motives for forest industry companies to in invest and use of forest certificates (FSC, PEFC) and environmental management certificates (ISO14001).

II. MOTIVES FOR CONDUCTING RESPONSIBLE BUSINESS

The ultimate goal for a firm is to create wealth to its owners. The means that can be used to reach this goal greatly depend on the society surrounding the firm. The constantly on-going dialogue between business and society delineates the borders for companies to do business. Companies bring welfare to the surrounding society by providing employment and paying taxes, but often more than compliance is required from a business in order it to obtain its legitimacy to operate. The firm must gain the society's legitimization to survival and prosper [11], [12]. Losing legitimacy means difficulties for the company "ranging from punitive legislation to difficulties in hiring qualified people." [11] (p. 300). In short, legitimacy decreases the cost of operation. Therefore, seeking for legitimacy is likely to be an important motivation behind firms' CR investments [13], [14].

However, firms themselves are always better informed about their business than the society, and the possibilities for a consumer to assess the business practices behind the product are limited. Further, there is empirical evidence showing that CR investments often are legislation or regulation driven [15]. That would suggest that firms invest on CR if (or as much as) they must in order to stay in the business. However, in a closer look more possible motives stand out.

When there is demand for responsible business, investing in CR can be a way of staying competitive or way of seeking competitive advantage [13], [16]. In some cases the end users are willing to pay price premium for products that are produced in a responsible way, for instance the markets for organic food has been growing heavily, even if it is often more expensive than non-organic food. In some other cases the competitive advantage may realize as a greater market share rather than better profitability. For example, a large amount of the raw material traded in forest sector origins from certified forests, even though the end user willingness to pay premiums for certified products may be limited [17], and associated with certain markets for tropical timber [18]. CR investments may also have influence on the financial performance through image, as some operation costs may be lower for a firm with better image. For instance, there is empirical evidence on that a better reputation facilitates hiring quality employees [13]. More importantly, customers may want to favour "good" companies and avoid "bad" CR performers when such a choice is possible [19], [20]. As there is costs of searching information, the judgment between good and bad may be done purely based on the image of the firm. Since brand or image damages are expensive, and in general fixing damage is more expensive than prohibiting it, investment in CR can be seen as means of risk management [21], [22]. Further, CR requires communication between firm representatives and various stakeholders, increasing the comprehension of possible longer-term risks in the firm [23]. Thus, risk management may be one driver behind CR in companies.

Firms may want to invest in CR in order to avoid the government regulation [21]. Complying regulation is costly and also decreases the flexibility of action. There may further be a longer-term self-interest in firm's CR investment, since what is good to the society is in the end good for the business: "The firm which is most sensitive to its community needs will as a result have a better community in which to conduct its business" [21] (p. 313).

The existence of responsible business is related to the "normative or cultural institutions" that encourage responsible behaviour [24], and the motivation for CR investments may arise from the feeling of stakeholder or peer pressure to do so [24]. Empirical evidence suggests that stakeholder pressure has an influence on firms CR, but the effect varies according to several factors and is therefore not similar on every firm. For instance, in a study [25] focusing on the senior financial executives' integration of company's ethics codes into decision making process it was found that the felt pressure from market stakeholders (customers, suppliers, shareholders etc.) had influence on the use of codes, but the pressure felt from non-market stakeholders (regulatory agencies, government bodies) did not necessarily had influence. Based on another empirical research it has further been suggested that the perceived importance of different stakeholder groups differs depending on what is the level of environmental commitment of the firm [26]. The results show that more proactive firms find regulatory, community, and organizational stakeholder groups important, but not media, whereas in reactive firms only the media was perceived an important stakeholder [ibid.]. Moreover, the influence of stakeholder pressure on the environmental strategy is related to the firm size so that while greater perceived pressure from primary and secondary stakeholders increase the likelihood of adopting proactive environmental practices, the smaller firms are more responsive compared to the larger firms [27]. This result was evident in all stakeholder groups (value chain, internal, and regulatory stakeholders) except societal stakeholders (e.g., environmental groups, labour unions, trade association) [ibid.]. There is also evidence showing that legitimacy pressure on firm depends on the visibility of the firm to stakeholders, and firms are more active in CR when they meet greater scrutiny by stakeholders [12].

Finally, firms may be motivated to invest in CR by the feeling of what is the right thing to do [4], [13]. A study with Dutch data found stronger correlation between moral (intrinsic) motives and CR performance compared to correlation between strategic (extrinsic) motives and CR performance, indicating that moral motives are more strongly connected to the actual CR practices than strategic motives [28].

According to a recent review [29] the global forestry sector has moved towards a more holistic and encompassing approach to corporate responsibility initiatives [6], [30], and it is evident that the largest forest industry companies shape their social performance strategies to fit their geographical profiles [31].

There are some previous researches focusing on what motivates firms to carry out CR in forest sector. In a study focusing on water pollution of Norwegian paper mills between 1970 and 1997 it was found that government regulation is the most important external factor causing changes in environmental strategy of the industry [5]. The writer concludes, however, that the importance of customer pressure has increased since the mid-1990s. Further, a study (with data from 1997) of how strongly the environmental managers in Canadian pulp and paper industry perceive the pressure to improve environmental performance from different sources (legal, economic, social and internal) find the government and the general public being the most important sources of pressure, while capital and consumer markets did not show

statistically significant effects [2].

Empirical Analysis

A. *Description of the data*

In this study we use a survey data collected in 2010–2011 from large forestry companies. The survey was designed to obtain data on the construct of CR in sustainability managers' cognition, company CR motives and practises, and the corporate social performance (CSP) in the forest-based industry. For the large part the questionnaire consisted of questions concerning environmental management and CSP towards the natural environment, therefore it was directed to company's Environmental Manager, or the person in charge of environmental questions. The questionnaire was originally designed in English and also later translated from English to Portuguese to increase the participation of South-American companies.

The original sample drawn from the Thompson One Banker database (completed with PPI Top100 list) consists of companies operating in the pulp and paper (SIC 26) and lumber and wood (SIC24) industries with at least 500 employees. The companies were first contacted by phone to ensure they belong to the target group and to ask their willingness to take part to the on-line survey. Of the 750 companies in the original sample, 550 companies were not reached or turned out not to be eligible to participate. Of the 215 companies reached and eligible, 95 declined to participate. Out of the 120 companies that agreed to participate, 60 companies responded by the due date (response rate 28%). In accordance to suggested procedure [32] we compared the responses of the early and late respondents to detect any signs of non-response bias. The early and late respondents did not differ in terms of age, size, or profitability, suggesting that the data does not suffer from non-response bias.

Geographically the respondents break up so that 52% of the companies had headquarters in Europe, 23% in North America, 18% in Latin America and 7% in Asia. There was only one respondent form Africa. The main area of business was paper (paper, board or tissue) with 43% of the respondent companies, and 30% represented wood product companies, 17% printing and packaging, and 5% pulp and forestry each.

B. *Certification among the respondent firms*

Among the 60 respondents, 45 companies use FSC, 26 have PEFC (25 companies have both FSC and PEFC), and 47 companies report they employ ISO 14001. As depicted in Figure 1 below, the respondents have adopted ISO 14001 more often in the end of 1990's and on the year 2000. The amount of FSC adoption has been heavier in 2000 and after, even though it was introduced already in 1993. Among the respondents the adoption of PEFC seems to have been fairly steady after its introduction in 1999.

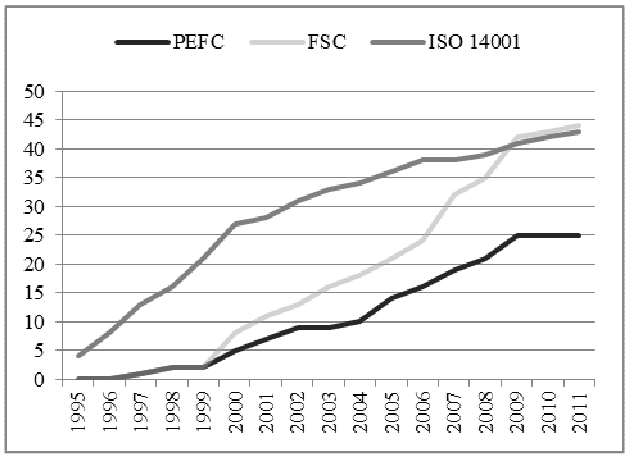

FIGURE 1: CUMULATIVE ADOPTION OF CERTIFICATES AMONG THE RESPONDENT FIRMS

C. *Motives for adopting FSC or PEFC*

In the questionnaire it was asked, whether the timber used in the company is required to have forest certification (for example PEFC or FSC), and if yes, to what extent the given factors (see Table 1 below) influenced on the decision to require particular certification. The respondent had to choose between values 1 to 5, so that 1 means that the given factor did not have any influence at all, and 5 that the factor had a great influence. Table 1 below shows the given motives in the same order as in the questionnaire, and the descriptive statistics of the responses. The given answers range from 1 to 5, except in "Clients' wishes or calls" where the minimum was 3.

TABLE 1: DESCRIPTIVE STATISTICS FOR MOTIVATION FOR REQUIRING FSC OR PEFC CERTIFICATED TIMBER.

	N	Mean	Std. Dev.
Control/legislation/orders of the authorities	42	2.50	1.44
Shareholders, General Meeting	41	2.80	1.23
Clients' wishes or calls	45	4.38	0.75
Other stakeholders' wishes or calls	42	3.55	1.11
Improving one's image	44	4.16	0.89
Distinguishing oneself from competitors	44	4.02	1.00
Strive for new markets	43	3.91	1.11
Increasing internal control	43	3.21	1.08
Risk management	43	3.47	1.12
Long-term profitability	42	3.67	1.18

Based on the answers it seems that the so called instrumental motives (motives that arise from the management's beliefs that investing on CR can have a direct influence on profitability) have on average had greater influence on the decision to require certified timber. Especially distinguishing from competitors, image improving, and clients' wishes has had comparably great influence. Clients' wishes or calls can be seen both as an

instrumental and institutional motive, client's may require certified products but that does not necessarily mean that they would be willing to pay more for certified products. Managers may believe that certification brings price premium, or that they legitimacy is greater if they use certified timber.

Because companies' understanding and practice of CR is shown to be somewhat context specific [3] we tested further whether the geographical location of the company's headquarter has any influence on the motives. For this purpose we use the Kruskall-Wallis test, which is a non-parametric alternative for ANOVA. There are four statistically significant results with alpha level at least 0.10 between the three main geographical groups (North-America, South-America, and Europe). Table 2 below shows mean ranks for all motives where differences were statistically significant. It seems that the client's wishes or calls (Chi-Square 6.997, Asymp. Sig. 0.030) are on average a greater reason to require certified timber in North-America compared to Europe and South-America. Further, distinguishing oneself from competitors (5.684; 0.058), strive for new markets (7.553; 0.023), and increasing internal control (5.158; 0.076) has been stronger motives in South-America compared to companies in other regions.

TABLE 2: MEAN RANKING FOR MOTIVES IN DIFFERENT GEOGRAPHIC GROUPS.

	Geographic group	N	Mean Rank
Clients' wishes or calls	Europe	22	19.32
	North-Am.	11	28.91
	South-Am.	9	17.78
Distinguishing oneself from competitors	Europe	21	19.38
	North-Am.	11	17.73
	South-Am.	9	28.78
Strive for new markets	Europe	21	17.98
	North-Am.	11	19.27
	South-Am.	9	30.17
Increasing internal control	Europe	21	22.26
	North-Am.	11	14.64
	South-Am.	9	25.83

We further divided the companies into four groups depending on the nature of their end products (diversified firms, pulp or paper manufacturers, wood product manufacturers, and board or packaging companies) in order to test whether the importance of different motives depends on the type of business the firm represents. However, there were no statistical differences between the four groups.

D. Motives for adopting ISO 14001

Concerning ISO 14001 it was asked in the questionnaire, how important the given reasons were for the decision to implement ISO 14001. With each reason the respondent could again choose a number between 1 and 5, so that 1 meant "not at all important", and 5 "very important". The answers for all the alternative motives ranged from 1 to 5. Table 3 shows the alternative motives in the same order as in the questionnaire with descriptive statistics.

TABLE 3: DESCRIPTIVE STATISTICS FOR MOTIVATION FOR USING ISO 14001 CERTIFICATION.

	N	Mean	Std. Dev.
Competition	44	3.23	1.05
Loss of market shares	43	2.81	1.12
To improve the quality of processes and products	45	3.89	1.05
To improve productivity	43	3.05	1.25
To be perceived as market leader	43	3.56	0.93
To improve the efficiency of operations	45	3.73	0.99
To improve the customer satisfaction	41	3.93	0.91
Shareholders' wishes or calls	43	3.12	1.12
Wishes or demands of society	42	3.57	1.04

Loss of market share has on average been the least important reason, while improving customer satisfaction has been the most important reason to implement ISO 14001. The respondents on average have perceived that improvement in operational efficiency and in the quality of processes and products are fairly important reasons behind the decision to adopt the certificate. It is again difficult to say, whether the customer satisfaction as a reason to implement the certification is more so because of instrumental or institutional reasons. Taking in account the two reasons with next highest means ("to improve the quality of processes and products", and "to improve the efficiency of operations") it looks like there has been instrumental motives behind the decision, and ISO 14001 is not seen so much as a means to answer to the institutional pressure to invest on CR.

TABLE 4: THE MEAN RANKING OF MOTIVES IN DIFFERENT BUSINESS SECTORS.

	Business	N	Mean Rank
To improve the quality of processes and products	Diversified	6	16.50
	Pulp or paper production	23	26.63
	Wood products	9	15.94
	Board or packaging	6	22.50
To improve productivity	Diversified	6	16.17
	Pulp or paper production	21	24.79
	Wood products	9	14.72
	Board or packaging	6	25.50

We further tested the potential differences between the answers on firms from different geographic areas, but the data does not show any statistically significant variation. However, the importance of the motives seems to differ

somewhat between the business sectors. Using Kruskall-Wallis test (alpha level 0.10) Table 4 shows the mean ranks for the two motives where the means variance is statistically different between groups.

The respondents representing pulp or paper firms find improving the quality of processes and products (Chi-Square 6.750, Asymp.Sig. 0.080) more important reason to implement ISO 14001 compared to other three business groups. In board and packaging business improving productivity (Chi-Square 6.589, Asymp.Sig. 0.086) was seen more often as an important motive, especially in comparison to diversified firms and wood products firms.

CONCLUSIONS

The empirical results show that motives for adopting forest certificates are more often external than internal, and more market than regulatory driven. In case of forest certificates the motives of the firms somewhat differs between geographic location of headquarter, reflecting the context specificity of CR. Motives for adopting ISO 14001 do not differ along geographic location, but do differ between business sectors.

The results of this study are exploratory due to a small sample size although environmental and sustainability managers from many largest players in the global forest industry were included in the sample. Therefore, larger sample size should be used in the future studies to see whether the results of this study are also generalizable.

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The Development of a High-Quality Coffee Market in Brazil: The Importance of Technological Innovation and the Role Played by Joint-venture Contractual Agreements and Certification Schemes in Promoting it[1]

Fabrizio Cafaggi, Luana F. Joppert Swensson
European University Institute, - Via delle Fontanelle 10 , 50014 San Domenico di Fiesole (FI) - Italy
E-mail: Luana.Swensson@EUI.eu

I. ABSTRACT

Coffee is one of the most traditional and important commodity products traded in the world. It is, in fact, considered to be the second most valuable commodity exported by developing countries [1], where its cultivation and business employ around 75 million people [2]. It is of enormous importance for Latin-American countries as the region contains several of the biggest producers in the world, and it has a significant impact on most of their economies. In fact, of the world's ten biggest coffee producers, five are from Latin America, with Brazil being historically the most important coffee-producer in the world, currently responsible for around 36 per cent of world production [3].

In the last twenty years, however, there have been significant changes in the market structure that have allowed its "de-commoditisation" and the development of a new market based upon product differentiation and in the adoption of sustainability practices: the differentiated or speciality coffee market. This new market has opened up new opportunities for Latin-American producers to escape from the uncertainty of the commodity market, to add value to their product, and to obtain a greater share of the final income generated in the production chain [2], [4] – [9]. It also fostered the introduction of new sustainable practices, both regarding social and environmental criteria [10].

Among the different characteristics of this new market, we may identify distinct global value chains (GVC) structures that implicates (i) different modes and costs of access for producers, (ii) higher benefits that they may gain from access, and, also, as we may demonstrate, (iii) a different relationship with innovation and technological innovation.

In fact, access to the differentiated coffee market may requires new know-how, innovative production and trading techniques, innovative genetic research, the implementation of mechanisms to signal quality and sustainable practices, and traceability, which are connected with the need for compliance with new private standards (that can pertain both to the quality of the product itself or to the production and process methods that may include aspects related to the authenticity of origin, safety, and, especially, sustainability) [11], and/or certification schemes that may be imposed as thresholds by MNCs in order to grant them access the chain.

Based upon a case study in Brazil this paper aims to present the evolution of the differentiated coffee global value chain, and the access of Brazilian producers to it by comparing it with the commodity coffee chain in order (i) to describe the different supply chain structures and their contractual practices, (ii) to analyse the importance of technological innovation in the development of the differentiated coffee market and in the adoption of new sustainability standards, and (iii) to discuss the role of contractual design, particular that of contractual joint-venture agreements and certification schemes in the promotion of technological innovation in such a context.

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Accounting and visualizing regional greenhouse gas emissions from housing

Maija Mattinen[1], Juhani Heljo[2], Jaakko Vihola[2], Brandon Hickman[1], Antti Kurvinen[2], and Ari Nissinen[1]

[1]Finnish Environment Institute, SYKE, P.O. Box 140, FI-00251 Helsinki, Finland
[2]Tampere University of Technology, Department of Civil Engineering, P.O. Box 600, FI-33101 Tampere, Finland
E-mail: maija.mattinen@environment.fi

***Abstract*: This paper presents a regional accounting case of greenhouse gas emission from residential stock in Finland. The results are presented in a spatial form. The calculations are executed in bottom-up manner and they make use of the building and real-estate registers and population data, as well as knowledge of the heat transfer properties of building structures. The results show the energy performance of buildings in a case district. This type of analysis can be useful for policy makers in order to cost effectively prioritize the renovations or energy interventions in the residential sector.**

I. INTRODUCTION

Housing and energy use

Energy use in buildings is a major contributor to greenhouse gas (GHG) emissions, e.g. about one third of GHG emissions of Finland are caused by energy use in buildings. Housing, i.e. energy use in residential buildings, caused about 11 Mt (about 15%) of greenhouse gas emissions in Finland during 2009. Due to climate and economical reasons, there is a growing need to find innovative solutions in order to reduce the greenhouse gas emissions from residential stock. Furthermore, the increasing pressure of meeting the EU and global emission targets also explain the modelling activity in the residential sector.

Traditionally, the emissions of building stock have been modelled at national levels. However, the demand for regional accounting and modelling has increased recently due to municipalities setting their own emissions and carbon footprint targets and planning new measures.

Brecha *et al.* emphasize the importance of the geographical location for the implementation of a GHG reduction policy [1]. Since the potential for district heating, energy production based on renewable energy sources like biomass, wind, solar energy, ground source heat pumps, and renovations depend on the location and properties of the residential buildings, it is meaningful to investigate the spatial characteristics of the residential stock. This approach benefits the local policy formation and makes it possible to seek a better path towards energy efficiency and renewable energy production than the possibly limited "one size fits all" approach.

Some novel ways to reduce GHG emissions from residential sector have been studied regionally. A spatial analysis for heat pump systems and the savings due to the installation of the new systems indicated CO_2 savings up to 70% [2].

The geographical location is indeed crucial when it comes to promoting the use of renewable energy, such as forest biomass for oven-based house-specific heating, or a small-scale combined heat and power plant for e.g. 10-20 houses. In order to find the best solution for a region in both economical and environmental sense, one must consider the availability of the resources needed, e.g. forest biomass. For instance, before extending a district heating network, the pipe network needed for the system has to be assessed. Nowadays there is a growing need for these kinds of sub-national assessments.

Modelling housing

End-use energy consumption models of residential buildings can be divided into two groups: top-down and bottom-up. Typically bottom-up approaches use statistical or engineering methodologies. Top-down modelling handles housing stock as a energy sink and thus no detailed analysis on the end use can really be done. [3, 4]

Several climatic parameters, such as temperature, solar radiation and wind, influence the total energy demand of buildings. In the cold Finnish climate, temperature change of 2°C has been reported to have impact of about 10% on the heating and cooling energy demand of a house, whereas air humidity and wind speed have only minor effect. During summer, temperature and solar radiation have similar influence on the energy demand of detached houses. [5]

Some regional energy consumption and emission analyses have been conducted in Europe, see e.g. [1, 2, 6]. It has been showed that the models can be a useful tool to help policy formation at both national and sub-national level [6].

In Finland, an engineering model for heating energy and emission assessment was developed and used for analyzing North Karelian municipalities in Finland [7]. However, the model does not account for the heat gains from solar energy and occupants. The results are presented in municipal resolution.

Goal and scope

This study focuses on accounting and visualizing the GHG emissions from the residential stock using the bottom-up approach. Residential buildings include detached houses, row houses, and apartment houses. The scope is further narrowed to analyze and test the calculation method and visualization in regional level based on the location and characteristics of each house. This way very detailed spatial analyzes are possible.

The analysis could in principle be done for whole Finland. However, it is reasonable to start the method development for a small district, to get a better view of

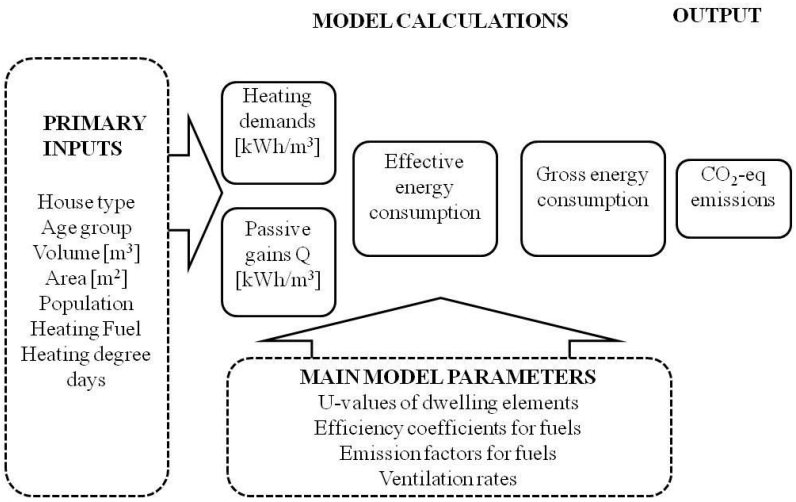

FIGURE 1: SCHEMATICS OF THE USED MODEL.

the method. A small district near Tampere city was selected for the case area, called Kaukajärvi. This paper presents the results of greenhouse gas emission evaluation for the Kaukajärvi district.

II. MATERIALS AND METHODS

Case area

Kaukajärvi district is located within the city of Tampere, that is about 170 km North-West from Helsinki. Kaukajärvi has about 11 000 habitants. The main climatic parameters in Tampere region are the following; the annual mean temperature, mean precipitation and mean wind speed are 4.4°C, 598 mm, and 3.2 m/s, respectively [8]. The residential stock in Kaukajärvi includes about 700 buildings. Relevant data on the stock are given in Tab. 1. The total volume of the residential stock is about 1.7 million cubic meters. Over 50% of the residential stock volume in Kaukajärvi consists of apartment houses. The distribution of building stock volume by primary heating fuel is given in Tab. 2. Because of the high proportion of apartment houses, the dominating heating source is district heating. It seems that most of the row and detached houses use direct electricity and light fuel oil as the primary heating sources. In this region wood or pellet using heating systems have not been installed originally as primary systems.

Models used

Tampere University of Technology (TUT) has developed the EKOREM-model for analyzing the building stock in Finland [9]. The basis of the model is the section D5 of the National Building Code of Finland [10]. The model is a bottom-up engineering model, in which the building stock is presented as in the Classification of Buildings by Statistics of Finland. EKOREM-model deals the residential stock as well as industrial and tertiary sector's buildings and their energy consumption. This study, however, focuses on analyzing the residential stock.

Buildings are divided based on the construction year into five-year-classes. Residential houses are divided into three groups; detached houses, row houses, and apartment houses. The nine categories for heating fuels are presented in Tab. 2. The table shows also the used dioxide equivalent emissions (CO_2e) emission factors for fuels. Emission factors are as in the fuel classification of Statistics Finland and in [9].

The model and its main characteristics are presented schematically in Fig. 1. The main user inputs are the building stock parameters, such as volume and area of the stock, population, and the primary source of heating. Also, the heating and cooling degree days are important input parameters. The model includes detailed information about physical characteristics, such as the U-values of dwelling elements and ventilation rates. These are the model's endogenous parameters. Based on the user inputs and model parameters, the heating demand and passive heat gains are calculated. After this, the model computes the gross energy consumption by heating fuels and the CO_2e emissions are finally obtained with the aid of the fuel-specific emission factors.

Because the building's thermal properties are taken into account in detail, the EKOREM-model is capable of analyzing how different construction and renovation practices affect the building stock's energy consumption and greenhouse gas emissions. However, for simplicity,

TABLE 1: Kaukajärvi statistics based on building and real-estate register. Year of data is 2010.

	Population	Volume [m^3]	Floor area [m^2]
Kaukajärvi, total	10726	1646801	482062
Detached houses	1605 15.0%	241608.8 14.7%	72308 15.0%
Row houses	2177 20.3%	285064 17.3%	88542 18.4%
Apartment houses	6944 64.7%	1120128 68.0%	321212 66.6%

the hybrid solutions for heating are not considered in this paper.

Data and assumptions

The Finnish Environment Institute's urban structure monitoring system (YKR) includes geographical data about buildings and their characteristics. It uses the Population Information System's data of buildings and dwellings and population data. The registered real estate information includes, among other parameters, the location of the building in Finland (zone 3 coordinates), volume and floor area of the building, originally registered heating system and the year of construction. This study used building data that were sampled in April 2011. The resident population data had been sampled in January 2011. The main calculation parameters and respective sources are presented in Tab. 3.

Building stock data was classified by the year of construction. We divided the stock into 5-year period classes, beginning from 1920. These data were used to determine the physical characteristics of buildings in order to calculate the demand for heating.

The population data were used to model the passive heat gain of people living in the houses. The lighting, other household electricity and water use were modelled based on the floor area of the house.

The building and population data had some missing values. We obtained conversion factors for volume and area from EKOREM model. If a dwellings volume or area parameters were missing, the missing value was calculated based on an average conversion factor and filled in to the original data. The missing population data was filled-in by using expert judgement. Also, some of the stock's construction years were missing. In this case, we assumed that the building belongs to the oldest age class (before 1920 constructed).

Accounting and visualization

The greenhouse gas emissions are calculated with the aid of fuel-specific emission factors and the gross energy consumption as follows:

$$Emissions = EF \cdot EG, \quad (1)$$

where *EF* is the emission factor and *EG* is the gross energy consumption.

TABLE 2: THE DISTRIBUTION OF BUILDING STOCK VOLUME BY PRIMARY HEATING FUEL AND THE USED EMISSION FACTORS. EMISSION FACTORS INCLUDE THE UPSTREAM EMISSIONS.

Heating fuels	**Share of usage in Kaukajärvi (%)**	**Emission factors of fuels [g CO_2e/kWh]**
Wood, pellets	0.0	-
Heavy fuel oil	0.3	267
Light fuel oil	2.1	279
Gas	0.0	-
Coal	<<1	370
Electricity	9.9	400
District heating	87.0	226
Geothermal	1.0	400
Other	<<1	300

All calculations were executed with the open-source statistical program R. The spatial analysis was done in commercial ArcMap software.

III. RESULTS

Emissions from residential stock in Kaukajärvi

In Fig. 2 we present the emission intensity, i.e. accounted annual GHG emissions per square meter (floor space) for all residential buildings in Kaukajärvi. In addition, Figure 2 includes the gross energy consumption by different heating sources (GWh/a as a bar charts). For clarity, the emission results of the district are not presented for each house but in a generalized form. The generalization makes use of a 500 m x 500 m grid. Each grid cell presents the total emission divided by total floor area of all the houses that are located inside the single grid cell. Red color indicates higher emission intensities, as the green color indicates low emission intensities. In the case region emission intensities are in between 37 and 65 kg CO_2e/m^2. From the figure we see that the emission intensities are higher in the North-East corner, near the lake, where there are mostly detached houses that use electricity and light fuel oil for heating. However, the absolute energy consumption is rather small in these grid cells, as there are only few houses there. The smallest emission intensities are mostly in cells in which the district heating is the dominating heating source. The absolute energy consumption is rather high, as there are a lot of houses. Nevertheless, there are couple of interesting grid cells that have considerably high energy consumption and rather high emission intensity. These orange grid cells are located diagonally in the western part of the district.

In order to further analyze the energy consumption in the whole district, we show the gross energy consumption by the building structure in Fig. 3. From this figure we clearly see that the biggest energy consumption is due to space heating. Additionally, household electricity consumption is significant.

TABLE 3: Main calculation parameters and sources in emission accounting.

Parameter	notation	source
Stock volume [m^3]	V_{stock}	YKR
Stock floor area [m^2]	A_{stock}	YKR
Fuel distribution [%]	FD	YKR
Population [persons]	pop	YKR
Emission factors for fuels [kg CO_2e/kWh]	EF	Statistics Finland and SYKE
Year of construction (age group distribution)	-	YKR
Indoor temperature [^oC]	T_{in}	expert estimation
U-values of dwelling elements* [W/m^2K]	U	expert estimation
Ventilation rates [1/h]	n	expert estimation

* i.e. walls, roof, floor, window, and doors.

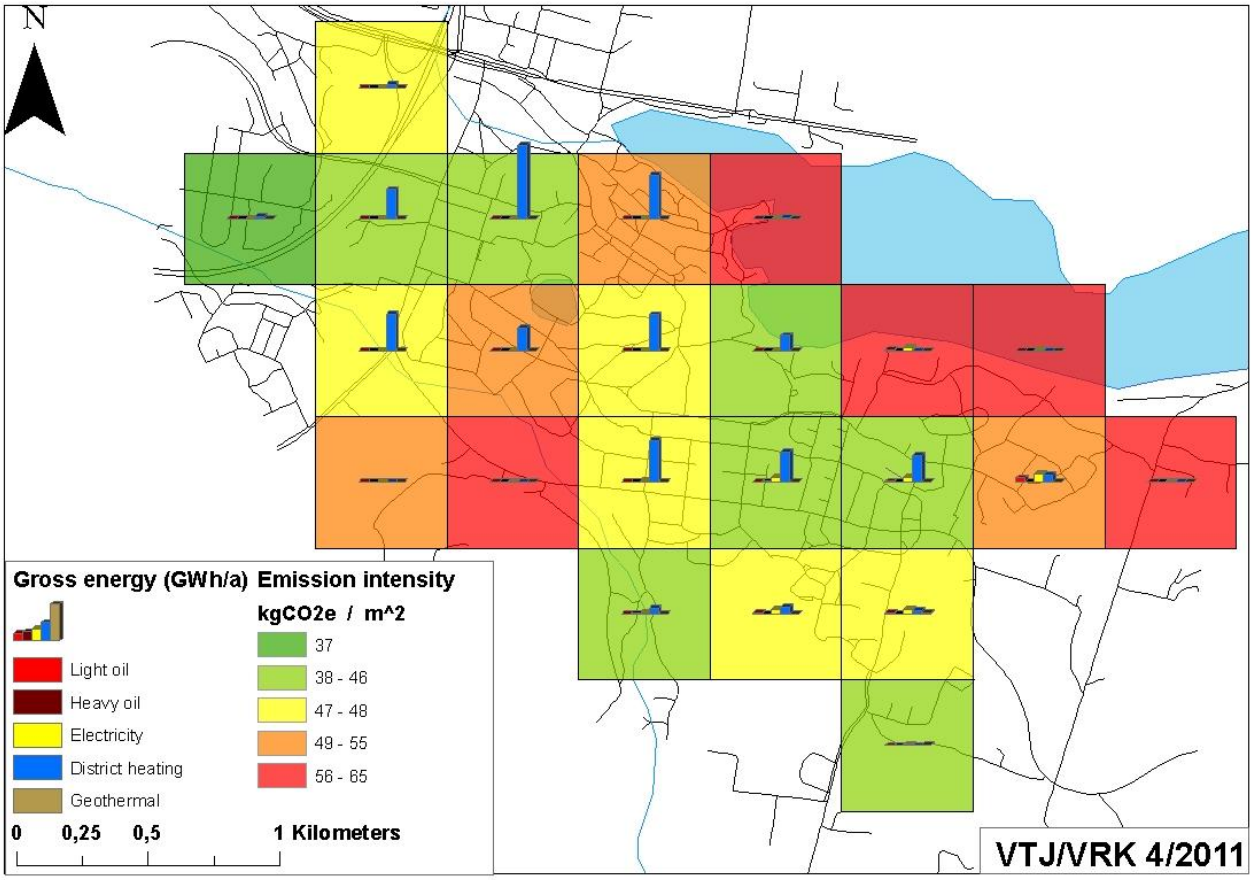

FIGURE 2: EMISSION INTENSITY (COLOR GRID) AND THE GROSS ENERGY CONSUMPTION BY FUELS (BAR CHARTS) IN KAUKAJÄRVI DISTRICT. INPUT DATA FOR CALCULATIONS FROM [14].

Sensitivity analysis

The sensitivity of the accounting method was assessed by using the simple method of introducing a small change (5%) in one of the input parameters while other parameters are kept as constants, and monitoring the effect on the output, i.e. the emissions. This procedure was repeated for all relevant input parameters that are known to have uncertainties: volume, stock area, population, U-values and emission factors. The results of the sensitivity analysis are collated in Tab. 4. Model was only a little sensitive to the change in U-values (<1% changes in the emissions).

. We can see that the change in volume has the strongest impact on the final emission result, whereas area and number of occupants in the building does not have such a strong impact. The result is most sensitive to the change in the emission factor of district heating. The second strongest impact was caused by emission factor of household electricity whereas the other emission factors affected the result very little (<0.5%).

IV. DISCUSSION

The results show that in Kaukajärvi region the emission intensity has a large range. It is evident that the knowledge of regional energy use characteristics and greenhouse gas emissions will help the energy system of the regional accounting for both production and consumption. It will also help e.g. to find the most important areas for information campaigns, e.g. related to energy efficiency renovation.

The emissions results of Kaukajärvi district are somewhat sensitive to the used emission factors. However, it is evident that the shortcomings of the input data and the sensitivity of the model need to be further explored and their consequences analyzed. More thorough sensitivity analysis could be done e.g. by employing Monte Carlo simulations. It is especially difficult to define the emission factor for direct electricity heating and district heat. This is because the actual energy mix for electricity production is very complex and involves not only the national but also the Nordic energy production [11].

The emission factors for fuels, district heating, and electricity include only direct emission. In other words, the upstream emissions related to raw material transportation, fuel refinement etc. are excluded. In future, the estimation and inclusion of the upstream emissions of the energy production for heating should be taken into account. For this LCA studies and databases can be used, e.g. LCA study of Finnish electricity [12].

The model itself has couple of shortcomings when it comes to describing the complex nature of residential stock. First, the behavioural patterns of occupants are generalized. In other words, the amount of used electricity for e.g. household appliances is estimated only based on the floor area of the house. Nowadays, the use of appliances has a growing trend. Here the concept of rebound is also relevant. This means that in some cases the increased energy efficiency in buildings is cancelled out by increased electricity use somewhere else, e.g. in appliances.

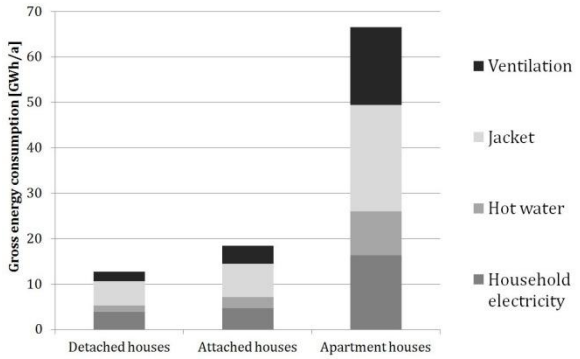

FIGURE 3: ANNUAL GROSS ENERGY CONSUMPTION IN KAUKAJÄRVI DISTRICT BY BUILDING STRUCTURES FOR THE DIFFERENT HOUSE TYPES.

Some criticism can also be given to the used building stock data. As stated above, the heating fuels of the stock are as they were registered in the first place. In reality, the originally registered heating fuel could have been changed and this information has not been registered in the data. The changes in heating systems could be further analyzed and taken into account by using results of Vihola and Heljo [13]. Today, there is increasing number of households that use not only the primary heating fuel but a hybrid system for heating the house. One typical example is the combined use of wood and electricity or oil. In addition, the number of installed air-source heat pumps has been growing in Finland during the past ten years. This is also considered as a secondary heating system that is not taken into account in our study well enough. These shortcomings are being further improved.

Also, the preprocessing of missing stock parameters such as volume or floor area, introduce an error to the accounting. However, the proportion of missing data was small.

V. CONCLUSIONS

Our results show that it is possible to analyze rather a small district and obtain practical information about the emissions of residential buildings for decision making. The used methodology and data allow us to estimate the energy consumption and greenhouse gas emissions of each building in the region. This kind of information is useful in the decision making, especially when planning the energy system of the region accounting for both production and consumption. Aspects like the availability of renewable energy sources (forest biomass, ground and solar heat, wind) and the needed infrastructure (e.g. pipes for district heat from a small scale CHP plant) can be well taken into account.

TABLE 4: SENSITIVITY ANALYSIS RESULTS. SEE TEXT FOR DETAILS.

Changed parameter	Change in emissions (%)
V_{stock}	4.1
A_{stock}	1.1
pop	0.2
EF for district heating	3.2
EF for household electricity	1.1
U-values of structures	<1

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Sustenance of Environmental Management Accounting (EMA) Practices in Hotels: A Case of a Sri Lankan Organisation

Nuwan Gunarathne
Department of Accounting, University of Sri Jayewardenepura, Colombo, Sri Lanka
E-mail: adnuwan@gmail.com

***Abstract*:**
The paper discusses how a hotel in Sri Lanka reinvigorated its environmental practices in an urgent cost-saving bid when faced with a financial crisis. It also examines how it sustains EMA practices using *a holistic approach*.

Key words: environmental management accounting, environmental practices, hotel industry, Sri Lanka

I. INTRODUCTION

EMA has been diffusing fast around the world while offering numerous benefits and challenges to organisations. Yet, there is a paucity of research in the developing countries pertaining to the adoption of EMA [1]. A few studies have suggested that even the existing EMA practices have not been systematically and comprehensively implemented [2] [3]. The objective of this study is to examine in depth how a hotel in Sri Lanka is engaged in EMA practices using *a holistic approach* and how such practices are sustained over time. For this purpose, a hotel in Sigiriya near the UNESCO declared World-Heritage site, the Lion Rock, was selected as the study's site due to its leadership in environmental initiatives in the hotel industry. The hotel has built its position as one of Sri Lanka's pioneering green hotels in the industry over the years. The success of the strategies adopted has been reflected in the various local and international awards the hotel has won.

II. RESEARCH METHOD & DISCUSSION

In order to facilitate an in-depth analysis, the case study method was followed in the study. The researcher used interviews and observations to collect data which were then triangulated by document analysis. The analysis of data revealed that the hotel had adopted environmental practices since 1996. However, when the tourism sector was adversely affected in 2007/8, the hotel was compelled to reinvigorate its environmental practices in an urgent cost-saving bid. A financial crisis therefore provided the impetus for already existing environmental practices to flourish. As the hotel was established more than forty years ago, it was not in a position to make radical changes. Further the financial crisis did not allow it to undertake capital intensive projects as well. Most of the initiatives taken by the hotel therefore are basic and easy to understand, which do not involve high capital investments. The hotel has not yet been certified for ISO 14000 or any other standards. Thus, these initiatives followed are not mainly for the compliance sake as well.

Notwithstanding its current financial success, these practices have now become routine and valued by all stakeholders of the hotel. This reveals that the forces driving environmental initiatives could change from internal to external and critical events could strengthen (or weaken) their sustenance [4] [5]. The green practices of the hotel have been well interwoven with EMA practices that include accounting for material, energy, gas, environmental impact assessment, life cycle design, etc [6]. Moreover, owing to these practices the hotel has been able to make significant cost savings in many areas by integrating these practices into the daily decision-making processes while strengthening its strategic position as a green hotel in the country.

III. CONCLUSIONS

The success of the hotel's initiatives could be attributed to three main factors. Firstly, these initiatives have been consistently followed with a clear vision. Secondly, they cover a comprehensive spectrum of aspects from water, energy and pollution to bio diversity. Thirdly, its consistent approach is supported by employees, suppliers, guests and the community on a regular basis. Hence, the study shows that the long-term sustenance of EMA goes beyond the mere application or superiority of techniques and requires the successful engagement of stakeholders on a regular basis to cover many environmental aspects comprehensively with a well defined vision, that is, *a holistic approach* to its implementation.

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Exploring the relationship between corporate environmental and economic performance: An empirical analysis of Japanese manufacturing firms

Ki-Hoon Lee*, Byung Min*, and Keun-Hyo Yook**
*Griffith Business School, Griffith University, Brisbane, Australia & **School of Business Administration, Busan University of Foreign Studies, Korea
E-mail: ki-hoon.lee@griffith.edu.au

***Abstract*: Corporate environmental and sustainability performance (CSP) have been present in management scholarship over three decades. Notwithstanding this longevity, the relationship between corporate environmental performance and corporate economic performance has remained controversial, ambiguous and difficult to research. With the Japanese manufacturing firms data, we conducted an empirical study to examine the relationship between corporate environmental and economic performance. The results show that negative corporate environmental decisions, measured by CO2 emissions in tons scaled by value of assets (co2emission), have negative association with the firm value. Co2emission variable has negative signs and statistically significant in all years (2003 – 2010). This finding strongly supports that negative corporate environmental decisions will decrease firm performance. Also we find that eco R&D, which is calculated by R&D expenditure scaled by value of asset in thousand yen, shows that eco R&D as an indication of positive corporate environmental decisions, has positive signs of impacts on firm value. This study presents positive and negative information are asymmetric that negative information has a much greater impact on individual firm's attitudes than does positive information.**

I. INTRODUCTION

Corporate environmental and sustainability performance (CSP) have been present in management scholarship over three decades. Notwithstanding this longevity, the relationship between corporate environmental performance and corporate economic performance has remained controversial, ambiguous and difficult to research. The search has been on for a statistical relationship between CSP and financial performance (FP) so as to justify or delegitimize the normative calls for corporate managers to pay attention to CSP. However, there is a lack of progress in CSP regarding corporate environmental decisions and the impacts on firm performance. We conducted extensive literature review, but there are few systematic theoretical and empirical studies of corporate environmental decisions and financial performance. We conducted an empirical research to explore the relationship between corporate environmental and economic performance.

II. MODEL

We consider the following unrestricted baseline model for firm performance (Y_{it}). Firm performance is measured by either Tobin's Q or profitability. Tobin's Q is calculated by market value of equity plus book value of liabilities divided by book value of asset. Profitability measured by return on asset (ROA). Tobin's Q will reflect market (i.e., investor) response to a firm's environmental decisions, whereas ROA will capture a firm's internal performance on the balance sheet.

$$Y_{it} = \text{constant} + \beta_1 \text{Environment}_{it} + \beta_2 \text{DUM0810}_t + \beta_3 \text{Foreignco}_{it} + \beta_4 \text{Individual}_{it} + \beta_5 \text{Finacialinst}_{it} + \beta_6 \text{Otherco}_{it} + \beta_7 \text{CSHs}_{it} + \beta_8 \text{EPS}_{it} + \beta_9 \text{Leverage}_{it} + \beta_{10} D_{jt} + \boldsymbol{\omega}_t \nu_i + \theta_t + \varepsilon_{it} \quad (1)$$

The environment is our main independent variable to reflect a firm's environmental decisions. Negative environmental decision is calculated by the emission of carbon dioxide in tons by firm in each year normalised by value of the firm's asset in million yen or energy intensiveness. Positive environmental decision is measured by R&D expenses for environmental protection. The model (1) also includes four major investor's equity ownership including foreign company (Foreignco), individual investors (Individual), financial institutions largely dominated by banks (Financial inst), and controlling shareholder's (csh) ownership. DUM0810 variable is a binary variable equals to one if year belongs to 2008 or 2009 or 2010 and zero otherwise. Two major events are overlapping during this period: implementation of the Kyoto Protocol and the Global Financial Crisis (GFC).

III. FINDINGS

TABLE 1: YEAR-BY-YEAR OLS ANALYSIS OF ASSOCIATION BETWEEN CORPORATE ENVIRONMENTAL DECISION AND FIRM PERFORMANCE

	Year							
	2003	2004	2005	2006	2007	2008	2009	20
	tobinq	tobinq	tobinq	tobinq	tobinq	tobinq	tobinq	tobin
Negative Environmental Decisions								
co2emission	-0.011**	-0.013***	-0.018***	-0.014**	-0.016***	-0.007**	-0.022***	-0.018
	[0.003]	[0.001]	[0.002]	[0.046]	[0.000]	[0.021]	[0.000]	[0.00
Intercept	1.231***	1.304***	1.537***	1.434***	1.295***	1.098***	1.258***	1.095
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.00
Industry-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Ye
N	303	334	343	346	341	323	319	24
r2_a	0.011	0.007	0.012	0.017	0.01	0.001	0.022	0.0
Positive Environmental Decisions								
ecoR&D	0.019	0.016*	0.017*	0.013	0.016**	0.006*	0.013***	0.00
	[0.109]	[0.081]	[0.084]	[0.111]	[0.036]	[0.085]	[0.001]	[0.0
Intercept	1.394***	1.455***	1.674***	1.531***	1.374***	1.203***	1.260***	1.126
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.0
Industry-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Ye
N	192	198	203	210	206	193	205	17
r2_a	0.033	0.035	0.02	0.007	0.031	0.019	0.041	0.0

	Firm Performance							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	tobinq	tobinq	tobinq	tobinq	roa1	roa1	roa1	roa1
Negative Environmental Decisions								
co2emission	-0.014***	-0.015***			-0.001***	-0.001***		
	[0.000]	[0.000]			[0.000]	[0.000]		
energyintensive			-0.177***	-0.107***			-0.003*	0.001
			[0.000]	[0.000]			[0.074]	[0.541]
Intercept	1.393***	1.329***	1.530***	1.232***	0.052***	0.050***	0.053***	0.042***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Year-Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-effects	No	Yes	No	Yes	No	Yes	No	Yes
N	2557	2557	2627	2627	2700	2700	2778	2778
r2_a	0.01	0.077	0.014	0.074	0.028	0.091	0.024	0.088
Positive Environmental Decisions								
ecoR&D	0.012***	0.013***	0.013***		-0.001 $\times 10^{-1}$	-0.001 $\times 10^{-1}$		
	[0.000]	[0.000]	[0.000]		[0.342]	[0.367]		
Intercept	1.335***	1.440***	1.229***		0.054***	0.054***		
	[0.000]	[0.000]	[0.000]		[0.000]	[0.000]		
Year-Industry	No	Yes	Yes		Yes	Yes		
Year-effects	No	No	Yes		No	Yes		
N	1582	1582	1582		1659	1659		
r2_a	0.022	0.032	0.083		0.036	0.106		

The consistent outcomes of estimation in each year in Table 1 illustrate absence of abnormality of our data and justices pooled analysis. Table 2 report our estimation results extending Table 1 by using both Tobin's Q (columns 1-4) and return on asset (ROA: columns 5-8) for firm performance over the whole sample period. The upper (lower) panel reports association between negative (positive) environmental decisions by firms and firm performance. Besides direct emission of carbon dioxide (CO2) for the negative environmental decisions, we also include a binary variable indicating one if a firm is classified as energy-intensive firm.

This comparability also implies reliability of our analysis using pooled during sample period. The estimated coefficients of energy-intensive variable illustrates that value of a firm consuming energy significantly drops more than non-energy-intensive firms by a range of 0.107-0.177. The mean of these figures are equivalent to 10.6 percent of the mean value of Tobin's Q during our sample period. Dependent variable on Columns (5)-(8) is firm profitability (ROA) to measure corporate performance on balance sheet. The results show that the emissions of CO2 negative association with profitability at 1 percent significance level, which is similar to its negative impact on the market. The energy intensiveness of firm, however, has no consistent association with the firm value and balance sheet performance. In contrast with the firm value, statistical significance of the estimated energy-intensive variable for internal performance is not consistent.

TABLE 2: OLS ANALYSIS OF ASSOCIATION BETWEEN CORPORATE ENVIRONMENTAL DECISION AND FIRM PERFORMANCE

IV. CONCLUSION

The results show that negative corporate environmental decisions, measured by CO2 emissions in tons scaled by value of assets (co2emission), have negative association with the firm value. Co2emission variable has negative signs and statistically significant in all years (2003 – 2010). This finding strongly supports that negative corporate environmental decisions will decrease firm performance. Also we find that eco R&D, which is calculated by R&D expenditure scaled by value of asset in thousand yen, shows that eco R&D as an indication of positive corporate environmental decisions, has positive signs of impacts on firm value. This study presents positive and negative information are asymmetric that negative information has a much greater impact on individual firm's attitudes than does positive information.

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Applying Material Flow Cost Accounting in Waste-Reduction Decisions: Case of a Micro-Brewery in South Africa

Michael B. Fakoya, Breggie van der Poll
University of Limpopo, Sovenga, 0727, South Africa
E-mail: Michael.fakoya@ul.ac.za

Abstract: **This paper set out to examine the effect of applying material flow cost accounting (MFCA) in a brewery waste-reduction decisions. Waste is generated throughout the whole production process from input to output. Attempts by most breweries in South Africa to reduce process waste have technologically driven. Efforts to reduce process waste quantity and costs by these breweries have been thwarted because of insufficient transparency of material flows. Conventional management accounting systems have provided insufficient waste information to managers to make informed waste-reduction decisions. Hence, we did a case study of a micro-brewery in South Africa to examine how MFCA can improve brewery waste-reduction decisions. We found that both the physical and financial information provided by the MFCA system on process waste has improved brewery managers' decision-making towards increased environmental performance and reduced production costs. MFCA enables brewery manager to become sensitive to waste costs that had previously been considered as a normal production cost. The paper concludes that MFCA will not only improve brewery managers' waste-reduction decisions but will track all process waste from input to output on a regular basis.**

Key words: MFCA, waste-reduction, decision-making, brewery.

I. INTRODUCTION

The lack of adequate measures for waste costs and the related benefits of pollution and waste prevention programs present a barrier to the full implementation of an appropriate waste reduction strategy [1]. Most often, organizations, especially in the brewery industry believes that environmental costs translates to end-of-pipe costs of environmental protection, expenditures for environmental technology, and costs for integrated environmental protection measures [2]. An effective approach to become a waste-less business should be based on problem solving and helping the organization understand why waste is generated [3]. Successful transition to a more sustainable waste management is conditional on finding practical ways for organizations to minimize and possibly eliminate their waste generation.

Brewing is an integral part of economic growth and development in South Africa contributing about 3.1% of its annual gross domestic product (GDP) but it also generates a lot of solid wastes and wastewater that contributes to the industry's negative environmental performance. In South Africa, brewing generates more than 300 000 tons of spent grain annually. Reversing environmental impact is the responsibility of all people, organizations and governments. Organizations are the greatest consumers of natural resources by reason of the continual usage of material input [4]. Pressure is on organizations to ensure that their activities do not impact negatively on their host communities and the natural environment in which they operate.

Attempts by most breweries in South Africa to reduce process waste have technologically driven. Efforts to reduce process waste quantity and costs by these breweries have been thwarted because of insufficient transparency of material flows. Conventional management accounting systems have provided insufficient waste information to managers to make informed waste-reduction decisions. This paper seeks to examine the effect of applying material flow cost accounting (MFCA) in brewery waste-reduction decisions. Hence, we did a case study of a micro-brewery in South Africa to examine how MFCA can improve brewery waste-reduction decisions. The paper intends to contribute to improving waste-reduction efforts in the South African brewery industry. Section two below discusses management accounting for the environment. Section three discusses the method applied in this paper while section four presents the case study. Finally, the conclusion is presented in section five.

II. MANAGEMENT ACCOUNTING FOR THE ENVIRONMENT

The management accounting system provides information to assist managers to make informed decisions and to improve the efficiency and effectiveness of existing operations [5]. It is responsible for provision of vital information on how best to make use of an organisation's resources in an efficient manner. Natural resource extraction is under threat from continuous use, and environmentalist, scientists, and civil societies are putting pressure on organisations to reverse negative environmental impacts caused through unsustainable practices. Reversing environmental impact is the responsibility of all and sundry. Organisations happen to be the greatest users of natural resource to create goods to meet customers need [5]. Pressure is on organisations to ensure that their activities do not continue to impact negatively on their host communities and the natural environment in which they operate. Organisations tend to see natural resource as a free gift from nature. Continuous depletion of natural resource without provision for its replacement has negative impact on the environment.

Accounting practitioners have been more comfortable in dealing with readily quantifiable information and tend to handle environment related issues with reluctance [6]. It is time for the accounting function to become responsible by providing necessary environmental information to improve waste decisions [7]. But progress has been made in recent years with corporate social responsibility reporting and that there have been important developments, such as the Global Reporting Initiative (GRI) and the Carbon Disclosure Project. Before, the accounting systems provide environment related information that is vague and non-verifiable, and inconsistent to stakeholders [6].

The accounting systems need to provide adequate financial and non-financial information. Information provided should be both external and internal since there are diverse stakeholders with diverse informational needs. It has become of essence that the accounting function work within an inter-disciplinary approach to minimise organisations' environmental impact [8]. Although, conventional accounting systems includes environmental costs in overhead accounts, but such costs are not separated in annual financial statements [8]. To manage both internal and external environmental issues effectively, adequate and accurate data should be made available to decision-makers. Waste generation is the result of inefficiencies in the production system. It is necessary that the management accounting system generate adequate data on specific points in the material flow to enable informed decisions on appropriate strategy.

III. METHODS

This paper used a case study approach with in-depth interviews as the main data collection method, however, additional information connected to the research issues are sourced from the organisations websites. A micro-brewery in South Africa was chosen as the case site. The micro-brewery is one of the best of six in South Africa having similar characteristic as the others. The in-depth interview is not to get answers to questions, nor to test hypotheses, and not to evaluate, but to understand the lived experience of participant and the meaning they make of that experience [9], [10]. The in-depth interviews questions which are open-ended are not meant to understand the participants perfectly, but used to comprehend and understand the meaning of participant's action and behaviour. Moreover, in-depth interviews minimises the chances of the researcher to report own perceptions, unlike when direct observations and documentary evidence are used [11], [12].

IV. CASE STUDY OF HOPE BREWERY

Hope Brewery is a micro-brewery that has been in operation at its site situated at the highest point of the Long Tom Pass in Mpumalanga Province of South Africa since the year 2001 with each batch being handcrafted. Just like most micro-breweries in South Africa, Hope brewery is located at the tip of a valley between two mountains. This is a common characteristic among micro-breweries in South Africa for easy access to natural spring water which is an important ingredient in beer production. Hope Brewery is rated by as one of the best six micro-breweries in South Africa. Hope Brewery is planning to expand its facilities to cater for its increasing clientele. Each batch of beer produced by Hope Brewery cannot be predictable because of its changing nuances, a shortcoming that has resulted in entire batches becoming unsalable.

The brewery is a major producer of handcrafted beer in the Mpumalanga Province of South Africa servicing well known drinking joints in its geographical area with a yearly output of about 104 000 litres packaged in returnable crates. The brewery has 8 employees as at the time of the study that supports its operation and distribution as well as a Bed and Breakfast to provide accommodation for travelling clients and those on holiday. Hope Brewery produces four different types of malt draught beer with absolutely no enhancers or unnatural additives. The beer is coarse filtered and not pasteurised but contain a small percentage of active live yeast.

A. Waste management in Hope brewery

Hope Brewery's commitment to environmental responsibility is low as a result of its location and lack of proper discharge of wastewater and brewery solid waste which is dumped into a nearby canal. Moreover, Hope Brewery has no defined environmental system in place at the inception of the study. This discovery has eliminated any opportunity to improve waste-reduction, which is fundamental to fulfilling its social, environmental and economic responsibilities. Brewery waste such as wastewater occur when some beer remain in conduit pipes. To address the research objectives, the discussion is divided into two main sections. The first section describes the current practices of managing waste information in Hope Brewery, while the second section will provide MFCA suggestions made in this study for Hope Brewery.

B. Results and Findings from the case study

The study found that currently there is no accounting system in place to monitor waste information at Hope Brewery. The clear lack of an accounting system indicates that waste information is unavailable and waste-reduction decisions are not pursued by Hope Brewery at any time in the past and at present. To determine the extent to which conventional accounting systems in Hope Brewery provides waste information to support waste-reduction, the study try to understand the current practice of generating waste information. Apparently, there is no accounting system in place to record waste flow in this brewery.

C. Accounting for waste costs

Hope Brewery relies on arbitrary or crude judgement to determine what percentage of product has been wasted in the process because there is clearly no sign of record keeping of material flows during production of beer. The owner relies heavily on his experience over the years as a means of record keeping. There is absolutely no accounting system to capture waste cost information, and do not think it is necessary to record waste information, and cannot afford the services of an accountant because of the high salary.

Waste management practices at Hope Brewery have never been an issue, because waste is considered useless and unimportant to receive any special attention. This seems to be the attitude judging from the response of the owner to issues on whether an attempt is made at least to document the input and output quantity in any form. Waste is assumed to be a necessary part of brewery process and can be controlled by being careful during production to avoid unnecessary spillage during transfer

from one process to the other. This has been the practice in Hope Brewery for a long time.

The manager at Hope Brewery is aware of municipal regulations that require them to pay for wastewater pollution on their activities but unaware of the National Waste Act that requires that producers adopt minimisation strategies to limit the amount of waste that leaves their premises. Hope Brewery pays a monthly levy to the municipality on wastewater pollution. This amount is included in the expenditure of the organisation which comprises the bread and breakfast as well as a tourist site closes by. The manager do not see the necessity of separating waste related from the main overhead account of the organisation because the brewery is small in size and cannot afford to keep a separate record. Hope Brewery wastewater is discharged into the nearby canal and for this the municipality charges a pollution levy. Despite the fact that the municipality charges wastewater pollution levy on the brewery, the manager has never thought of reducing the level of wastewater discharges.

The brewery manager is of the opinion that waste will continue to be created during production. Hence, they sometimes sell their solid waste component to pig farmers which is used in feeding livestock. Hope brewery is contemplating having a record of its waste generation because; it seems the appropriate thing to do.

D. Management of waste information

There is a lack of consciousness on capturing waste information in any form by Hope brewery. This has made waste-reduction decisions non-existence in the brewery. Although, Hope brewery explained that this is because of its small size, it nevertheless absolves it from being socially and environmentally responsible. It seems quite a practice among the micro-breweries in South Africa to ignore the management of waste information. The manager at Hope brewery attest that the waste practice among micro-breweries are almost identical because of their size and location which usually outside populated areas where they can easily access natural water like spring water. Reason for choosing a location outside populated areas is to avoid the heavy costs of water which is a main ingredient in beer production. By nature of its location, size and capacity, issues relating to wastewater control are not considered a priority. Moreover, Hope brewery's manager is convinced that it is more preferable to pay wastewater pollution costs to the municipality than stress about waste-reduction which requires time and effort. Invariably, waste-reduction decisions are accorded little or no attention in the decision-making process of micro-breweries in South Africa.

Generally, accounting systems in Hope brewery is a fundamental problem because its accounts are prepared by a consultant who is not present most of the time to verify transactions. Accounts are prepared to fulfil tax obligations since the business is registered as a closed corporation where the owner is the brew master and management in one. Waste tracking is considered a difficult task as well as measuring actual waste quantity and cost.

Understanding the amount of waste in a brewery process will help to reduce its generation. There is no waste strategy in place at present at Hope brewery. But a closer examination of waste will lead to cost savings opportunity. The amount of savings will make the waste decision process to be quicker. Knowing the cost of brewery process waste would lead to better waste-reduction decisions as attested to by the manager at Hope brewery. The production system in Hope brewery is not the most efficient; however, waste generation level at present can be reduced if adequate waste information is made available. Although, waste generation is inevitable in beer production, it can be controlled. For every waste created there is a corresponding loss of energy, systems and labour costs. It is important that micro-brewery managers know the right waste costs and its calculation for effective waste-reduction decisions.

The potential benefit of this study to the micro-breweries in South Africa is to create awareness of the importance of determining the amount of waste costs on future waste-reduction decisions. The manager believes that this study has great potential to redirect micro-brewers attention to an important aspect of their operations which has long been neglected, that is, waste-reduction decisions to make them socially, environmentally, and economically responsible. Micro-brewery managers' attitude to waste-reduction would have been attended to differently if they have had such awareness in the past.

To show that this study has great potential in practice, the manager at Hope brewery advises the researcher to consider setting up a consultancy firm to help organisations account for their waste generation. In response to this request, the researcher agreed to conduct a pilot study to show the practicability of MFCA at supporting brewery process waste-reduction decisions. The next section provides discussions on the pilot study.

E. Pilot study on hope brewery

MFCA was applied to the Hope Brewery process for a period of six months between August 2011 and February 2012. The brewing process as described above makes use of materials and energy in producing any of the four types of beer produced by Hope Brewery. In the production of beer, barley, ale, water, sugar, and yeast are input materials. The input for packaging is the bottle and crates for transporting.

F. Hope brewing process

Mashing, straining vat, and wort pan: Malted barley is mixed with water to form a mash with heat applied. Here a proportion of energy is used to convert the insoluble starches and proteins into wort which contains fermented sugars and maltose. By-products such as spent grains are generated at this stage. Carbon emissions are generated due to the boiling and heating of materials and water.

Filtering: The mash is filtered at this stage to separate the dissolved sugars of the wort from the spent grains which contains a large quantity of malt husks. The spent grain is rinsed with hot water to remove any residual wort which is sold to pig and dairy farmers for animal feeding because it contains some percentage of protein-rich trub. Water and energy is consumed at this stage in large amounts. The wort is further boiled in the wort pan where the beer colour and flavour is developed. The boiling in the wort pan is used to extract the bitter and aroma substances from the hop introduced at this point together with the sugar. The wort is allowed to cool to about 10ºC and made ready for fermentation.

Fermentation: Live yeast is added in the fermentation process to convert sugar into alcohol and carbon dioxide. At this stage, Hope Brewery had lost batches of production due to the addition of unsuitable yeast. However, these losses were not accounted for in its record. The fermentable sugars are allowed to convert for a period up to 5 days when most of the yeast would have sunk to the bottom of the fermentation vessel. The beer is allowed to mature below 0ºC for between 6 to 10 days to harmonise and produce the desired flavour. Hope Brewery produces four different beer types which include Draught, Ale, Porter, and Black Brew.

Diatomaceous earth filter: This process is used to remove yeast residue and haze particles for a sparkling beer. Again, energy is consumed at this stage which includes non-product output such as wastewater.

Filling: Filtered beer is dispensed into 330ml bottles ready for distribution to pubs in Mpumalanga. The quality control system of Hope Brewery is lacking at this point because from observation, due care has not been exercised to avoid dripping and sometimes spillage of finished beer.

G. Results and findings- Pilot study

Wastewater: Brewing is a water intensive process. Hope Brewery requires about 9 litres of water for every litre of beer produced. Although, Hope brewery source its water mainly from nearby spring, reduction in water consumption should take priority especially when the level of water scarcity in South Africa is considered. Hope Brewery does not have the capacity and technology to reuse or recycle brewery process wastewater. Wastewater is discharged into a nearby canal causing contamination to the underground water. The water source to Hope Brewery is mainly from a large storage tank and a spring water outlet close to the brewery. Therefore, the brewery manager seems not to bother about the quantity of wastewater generated. However, he failed to consider the environmental hazard and other systems cost that has gone into producing such wastewater. Water leaks occurred in production due to rusted pipes. This is a major source of water leakage apart from that at the point cleaning brewing equipment and the factory floor.

Energy usage: Every wastewater generated in the brewery process consumes energy. As such the more the wastewater and solid waste generated the more energy is wasted in production. It was discovered that energy cost accounted for about 20 percent of the production costs.

Abnormal production loss: During the study period of six months, inefficient application of yeast had resulted in losses of 4 batches of 1000 litres of beer becoming unsalable. These losses occurred because Hope Brewery lacks a good quality control system. Production control relies heavily on the experience of the production manager.

Lack of proper documentation of process flow: Production records relating to the quantity of input materials and related costs used in each production batch is unavailable in the books of Hope Brewery. The record available indicates the output quantity of completed batches. Therefore, it is difficult to determine the amount of waste generated in any given batch. Reliance was on experience which has proven to be ineffective judging from the abnormal production losses suffered.

H. Improvements to Hope brewery

- A waste record format was generated to record the quantity of input materials at the beginning of every batch. The record includes the volume of water used in each process, units of electricity consumed in process, wages paid to the production staff during a shift, cost of any repairs, and the volume of beer that results in good product. This process enables the brewery manager to determine the loss in any particular batch. Overall water usage was calculated at 9 litres for every litre of beer produced. Subsequently, due to the purchase of a new wort pan responsible for leakages, water usage dropped to 7 litres per litre of beer produced. Further, improvements include the ability of the brewery manager to determine which process is responsible for the inefficiencies.
- A new wort pan was purchased to replace the old pan which has become obsolete to reduce the water leaks in the connecting pipes to the turbidity filter. Although, replacing the wort pan is a major investment, MFCA has made it visible that the wort pan generates considerable litres of water wasted to necessitate its replacement.
- Since production takes place twice every week, wages has been re-negotiated to align with batches worked. Savings in terms of production wages attests to the importance of MFCA analysis in the brewery production process.
- A new quality checking device had been purchased to ensure that quality beer is produced in any batch and to avoid the incidence of total batch losses.
- However, wastewater treatment equipment could not be invested into due to lack of funds to embark on such a project and the fact that Hope brewery is a micro-brewery.
- Housekeeping and other cleaning activities now use less water because the notion that water is almost

free for brewery use has been replaced by the concern to save water consumption as a result of its scarcity especially in South Africa.

- During the six month period the level of water consumption was reduced to between 7 and 8 litres per litre of beer produced.

Below is a summarised MFCA cost matrix for Hope Brewery between August 2011 and February 2012.

TABLE 1: MFCA COST MATRIX FOR HOPE BREWERY

	Material cost (R)	%	Energy cost (R)	%	Labor cost (R)	%	Total cost (R)
Good product	110124	40	31350	11	15732	5.7	157206
Negative product	83076	30	23650	9	11868	4.3	118594
Sub-total	193200	70	55000	20	27600	10	275800

*R1=$0.1178

Table 1 above shows the costs incurred during the six-month period of the study and the portion that is attributable to both good and negative products. The availability of the MFCA analysis to Hope Brewery has resulted in the improvements stated above.

V. CONCLUSION

The lessons learned from the pilot study provided evidence on the potential benefit that could be derived from the implementation of MFCA as a decision tool to support waste-reduction decisions. Although, there is no previous brewery process waste related cost to which it can be compared, it nevertheless have shown that it is essential that brewery managers need to know how much it cost to generate waste in order to seek opportunities for its reduction. Not knowing the cost of waste generated in a production process could lead to waste-reduction decisions that are unsound. An advantage of the current findings is the sensitisation of a conscious awareness to micro-brewery managers on the continued benefit of generating adequate and accurate brewery process waste information to support their waste-reduction decisions. This in turn means that even micro-brewers can fulfil their social, environmental and economic responsibilities in line with current demands of being an environmentally-driven corporate entity. MFCA may be adopted by both the manufacturing and service industry. Further case study research is necessary to determine its applicability in other industries.

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Measuring sustainability within process industry

R. Husgafvel*, M. Päällysaho, N. Pajunen, I-L. Paavola, K. Heiskanen, O. Dahl, and A. Ekroos
*Aalto University, School of chemical technology, P.O.Box 16300, FI-00076 Aalto, Finland
*E-mail: roope.husgafvel@aalto.fi

I. ABSTRACT

Recently sustainability has had an important role in policy and decision-making while the public awareness towards limits of the environment has been rising. However, the indicators of industrial sustainability satisfy primarily the needs of corporate management and global investors. The information is often broad and non-specific and might occasionally even give a false impression. Moreover, contradictions between environmental, economical and social aspects also point out the unreliability of existing sustainability indexes. Accordingly, the current state of affairs serves the interests of neither the industry nor the policy makers.

Therefore, our purpose is to bring the concept of sustainability at the operational plant level within process industry. Production industries are faced with growing demands of improving their environmental and social performance and the same time sustain their economic competitiveness. Diminishing raw material resources and therefore increasing raw material prices, stricter regulation, necessary investments for more environmentally-sound technologies are only a few examples of the challenges that industry are facing at the moment. As a result, strong awareness towards overall sustainability issues is required in order to overcome the future challenges.

The purpose is to develop the sustainability metrics for process industry. The aim of the index is to become a tool for operational plant level to assess its sustainability comprehensively as well as evaluate the causes and costs of different actions. As a result, decision makers should be able to evaluate the sustainability of their actions and integrate the concept of the sustainability to their decision-making process.

Indicators must be easy to understand, represent substantial subjects of the industry, and be possible to measure. Indicators should be able to give comprehensive overview about environmental, social, and economical sustainability. As a result, sustainability index will improve mutual trust among different stakeholders. It enables the transparent information exchange between the corporation and the surrounding society, including interest groups and individual citizens. It will also improve the quality of information needed in the assessment of the ethics of investment.

More integrated industry-society-environment interactions are needed to ensure responsible approaches to industrial activities. The social part of the overall index provides information on both in-plant sustainability performance and on the direct and in-direct impacts of plant operations on the surrounding society including various stakeholders, interest groups and citizens. Further, index should be able to adjust different political and regional environments. Therefore, the legal aspect is intended to be included to the sustainability index.

The legal part of the index is meant to cover all the substance areas of the index bringing the legal aspect of the different areas of the index into discussion. Legal aspect will adapt itself with appropriate expedient into different substantial areas of the index. The frames of the legal research of the index are built on the legislation of the European Union (EU). The concrete circumstances of the country that is under exploration must be acknowledged as the legal framers and regulation is highly affected by for example political situation or corruption.

Keywords: Sustainable production, Environmental, Social and Economic impacts, Environmental legislation, Measurement of environmental impacts

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Material Flow Cost Accounting (MFCA) Management to establish Green Supply Chain: based on a questionnaire research in Japan

Michiyasu NAKAJIMA and Asako KIMURA
Faculty of Commerce, Kansai University, 3-3-35, Yamate-cho, Suita, 564-8680, JAPAN
E-mail: nakajima@kansai-u.ac.jp

***Abstract*: Based on case studies in Japan, it is clear that Material Flow Cost Accounting (MFCA) has possibility to establish Green Supply Chain. MFCA can make a transparency of material and energy inefficiency in supply chain. And MFCA can show opportunities for company to reduce costs by reducing material and energy losses with own supplier or customer. We try to understand the present supply chain by this questionnaire research, and we will show subjects and possibilities for company to introduce practically and voluntarily MFCA thinking into management information of own supply chain.**

I. INTRODUCTION

Material Flow Cost Accounting (MFCA) is one of the most useful Environmental Management Accounting (EMA) to promote material and energy efficiency in process. The general framework of MFCA was published as ISO14051 in September 2011. In Japan, we have already had more than 250 case examples since 2000, through mainly the projects sponsored by METI Japan. In the reports of these METI projects, many Japanese companies have reported to find some larger-than-expected opportunities to reduce material and energy losses in own process. Many Japanese companies generally think that MFCA is new Kaizen information in process. On the other hand, we found some material and energy losses that generated in own process but were attributed to transaction with supplier or customer. And then, in the METI projects from 2008 to 2010, MFCA had introduced to supply chain, consisted of 2-4 companies. We have 58 case examples of MFCA in supply chain. Some case examples showed successful results from MFCA in supply chain project, but MFCA in supply chain has not developed sufficiently as management method and tool yet.

II. BACKGROUND OF THIS RESEARCH

We try to develop MFCA to be relevant EMA in supply chain management. We have done a questionnaire research as a field research to understand the present information contents on own supply chain of purchasing managers. The main purpose of this questionnaire research was to analyze the strength and depth of information sharing with suppliers or/and customers, when company try to develop a new product or minor change of product. We will suggest new information sharing to establish green supply chain on the base of this questionnaire research.

We sent a set of questionnaires by post mail to purchasing managers of purchasing or supplies department in the all listed industrial companies in Japan, 1,561 companies/sites, in February 2012. The main questionnaires were to clarify the mission of the purchasing department, the information with supplier or/and customer regarding general items, environmental-conscious items and material efficiency. As the result, we received 356 companies/sites of questionnaire response. The response rate is 22.8%. The number of business-to-business company is 229, business-to-customer company is 53, business-to-business and -customer company is 42.

III. SOME RESULTS OF QUESTIONNAIRE RESEARCH

For example, to the question "What is your priority to select your supplier, Environmental consciousness, Delivery deadline, Price or Quality? You answer from No.1 to No.3.", the most highest priority is quality, about 64.5% of the total valid response, second priority is price, about 30.5%. It would appear that any changes in supply chain couldn't be done without the meeting to the defined quality. And in response to the question "How many times do you have meetings of price revision with supplier or/and customer in a year?", about 40.2% of companies answer once a year, and about 28.9% do twice. As this result, companies usually have some meeting with supplier or/and customer. It would appear that the existing supply chain is maintained by meeting. Therefore if the existing supply chain will be changed gradually to green supply chain, MFCA information should be integrated with information sharing with suppler or/and customer in this meeting.

IV. CONCLUSION

We have found some basic subjects of the present Japanese supply chain by this questionnaire research to introduce MFCA thinking in information of supply chain management. At the EMAN-Conference in Helsinki, we will show the total result of this questionnaire research and potentials of MFCA in supply chain to improve material inefficiency and carbon emission.

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STAKEHOLDERS' PERSPECTIVES ON SUSTAINABILITY ASSURANCE: THE UK CASE

Angela Pinilla-Urzola
International Centre for Corporate Social Responsibility, Jubilee Campus, NG81BB, United Kingdom
E-mail: lixlap@nottingha.ac.uk; angela.pinilla.urzola@gmail.com

Abstract: **This paper canvasses views of key stakeholders concerning the potential role of sustainability assurance in corporate sustainability reporting in promoting corporate accountability. Data was derived from semi-structured interviews conducted with representatives of civil society organisations, and the investment sector. For these stakeholders, models of sustainability assurance promoting accountability are those ones where stakeholders directly seek for answers and rectifications. All the stakeholders perceived a combination of issues that prevent the process of achievement of accountability. For example, social and environmental accounts given are inaccurate or misrepresent actual impacts. There is not redress and acceptance by the corporations of social and environmental concerns. However, main problems are associated with corporate law, liability and the governance system, and the inexistence of legitimacy in the sustainability assurance world.**

I. INTRODUCTION:

Purpose:

The aim of the research was to canvass the views of key stakeholders as to potential role of sustainability assurance in corporate sustainability reporting in promoting accountability to the stakeholders.

Research Method:

Data was derived from eight semi-structured interviews conducted with representatives of civil society organisations, and the investment sector. The qualitative analysis was undertaken conducting data display and analysis.

Contribution:

The paper contributes to the field work in sustainability assurance literature, called by Owen and O'Dwyer [1], which seeks for a more in depth understanding on the stakeholder inclusion on sustainability assurance exercises. This paper provides empirical results on the stakeholders' views on sustainability assurance exercises using qualitative data in the United Kingdom.

II. FINDINGS:

This paper provides empirical evidence on sustainability assurance exercises, and the stakeholders' views on the achievement of accountability. There was a general perception of sustainability assurance either as an empty process of verification or as a tool to enhance the integrity of the companies' actions. Actual models of sustainability assurance promoting accountability to the stakeholders are those ones where stakeholders directly seek for answers and rectifications. All the stakeholders perceived a coalition of issues within the sustainability assurance world that prevent the achievement of accountability. For example, the accounts given are not accurate or a truly representation of actual situation. There is not independence between the auditor and the accountable organisation. There is not redress and acceptance by the companies of these concerns. In the view of stakeholders more fundamental issues were related to the tendency of use financial approaches or market driven approaches. But the main problems are associated with the actual corporate law, liability and the governance system, and the no existence of legitimacy in the sustainability assurance world.

III. CONCLUSION

There was a clear dichotomy in the views of stakeholders towards sustainability assurance. In general, their views evidenced that different stakeholders have different needs of assurance [2]. All respondents were aware of limitations of sustainability assurance. Whilst representatives of the investment sector were worried that sustainability assurance was trying to satisfy too many different interests, civil society organisations were worried about the assurance on reports that do not provide transparent information on sustainability issues [3]. The trade union official expressed reservations over the practical competency of assurance providers. Similar differences of opinion were manifested toward stakeholder participation in sustainability assurance. Whilst the trade union official and civil society organisations expressed a desire to see more involvement, representatives of the investment sector were more reluctant to support this inclusion. The views expressed by stakeholder respondents also evidenced that it is unclear what the future development of the practice of sustainability assurance will be.

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The qualitative characteristics of financial, sustainability and integrated reporting: A comparison for now and the way forward

Prof Marita E Pietersen
University of Johannesburg, Department of Accountancy, corner Kingsway Avenue and University Road, Auckland Park, Johannesburg, South Africa
E-mail: maritap@uj.ac.za

Abstract
The corporate identity of companies has changed and therefor reporting is changing too. Even the triple bottom line reporting arena and there for the Frameworks that govern financial, sustainability and now integrated reporting are not static; these evolve over time. This research focuses on the different attempts that have been lately made by different global role players to identify the types of information that are likely to be more useful for financial and non-financial decision making than others. The International Accounting Standards Board (hereafter IASB) defines qualitative characteristics (hereafter QCs) as the "attributes that make financial information useful" (2010c: p11) for decision making.

The researched is based upon a detailed analysis of the more important 'QCs' that currently exists globally as contained in different reporting frameworks relating to financial, sustainability and integrated reporting according to 1) the *IASB's Conceptual Framework for Financial Reporting 2010,* 2) the Global Reporting Initiative's (hereafter GRI) *Sustainability Reporting Framework 2006,* 3) the Integrated Reporting Committee of South Africa's (hereafter IRC(SA)) *Discussion Paper on a Framework for Integrated Reporting and the Integrated Report 2011* as well as 4) the International Integrated Reporting Committee's (hereafter IIRC) *Discussion Paper on a Framework Towards Integrated Reporting: Communicating Value in the 21st Century 2011.* This paper will not only focus on the developments with regards to the QCs as contained within the said frameworks but also compares the QCs of all four frameworks with one another. It is shown that not only has financial reporting collided with sustainability reporting and melded into a new reporting format - the integrated report - but so to have the QCs been melded into a very similar 'pot' containing basically the same attributes although categorised differently.

This paper will also focus on the relevant feedback received by both the IRC(SA) and the IIRC on their proposed integrated reporting frameworks. The paper will further more focus on more recent developments relating to the GRI's proposed G4 Reporting Guidelines as well as to the related feedback gathered via surveys by the GRI. The latter not only shows that a clear link to integrated reporting is needed but it also indicates that integrated reporting could be the only way forward for reporting focussing on financial as well as non-financial information. Once more this can be seen as a case of 'less is actually more'.

Keywords
Financial reporting of the IASB:
Conceptual Framework for Financial Reporting 2010
Qualitative characteristics
Sustainability Reporting of the GRI:
Sustainability Reporting Framework 2006 and the G3.1
2011 Sustainability Reporting Guidelines
Proposed G4 Sustainability Reporting Guidelines and the related survey feedback
Principles ensuring quality of sustainability information
Integrated Reporting of the IRC(SA):
Discussion Paper on a Framework for Integrated Reporting and the Integrated Report 2011 and the related comment letters
Reporting principles
Integrated Reporting of the IIRC:
Discussion Paper on a Framework towards Integrated Reporting: Communicating Value in the 21st Century 2011 and the related responses
Guiding Principles

Exploring Sustainable Growth of Social Micro-enterprises in an Emerging Economy

Eijaz Ahmed Khan, Anna Lee Rowe, Mohammed Quaddus;
Curtin University, 78 Murray Street, Perth 6000, Australia
E-mail: Anna.Rowe@gsb.curtin.edu.au

***Abstract*: The purpose of this paper is to report on an exploratory study of the Sustainable Growth of Social Micro-enterprises within the context of informal micro tea-stall entrepreneurs in Bangladesh. Specifically, this study examines the sustainability elements of Informal Micro-Enterprises (IMEs) in terms of social, economic and environmental dimensions in introducing a tentative framework within the context of an emerging nation. Sustainability of large enterprises is well understood and focused, but less research has been done on micro-enterprises, especially in IMEs. This study is an attempt to address this gap in research. This study is part of a larger project that followed a qualitative research approach. Semi-structured interviews were utilized to explore the perceptions of micro tea-stall entrepreneurs in Bangladesh. The findings resonate well with the literature in providing a better understanding for improving the Sustainable Growth of IMEs. Incorporating lenses from entrepreneurial theory and resource theory will enrich future research in this field.**

I. INTRODUCTION

Since the 1960s and 1970s, studies on **informal micro-enterprises'** (IMEs') income-generating-activities have increasingly gained momentum[1]and by the 1980s, it became a prominent global sustainable development issue[2]. Continuing into the 1990s, poor and developing countries were addressing their needs for inspiring and nurturing economic growth through IMEs[3]. Now-a-days, it has been recognized as the engine of employment and in alleviating poverty, especially for developing countries [4]-[5]. For instance, IMEs produces 25 to 35 percent of collective output in Latin America; between 13 and 70 percent in Asian countries; and around 15 percent in OECD countries[6]. Thus, the economic contribution of IMEs in developing countries is becoming significant, due to inadequate employment opportunities in large and medium-sized enterprises and the rapid rise in urban populations [7]-[8]. In this study, an IME is defined as an economic endeavor that is managed by one or more family members, and functioning within the informal sector. It is also assumed that a IMEs owner is an entrepreneur, and that starting an enterprise is a form of entrepreneurship.

In an emerging economy like Bangladesh, the IMEs play a significant role in social economic development. According to the 2010 Household Income and Expenditure Survey (HIES), Bangladesh has improved living standers significantly by reducing poverty levels from 40 percent in 2005 to 31.5 percent in 2010 [9]. However, Bangladesh is still trying to adapt a market-oriented approach to reduce pressure from foreign donors. Whilst the extent to which these approaches have been successful may be questionable in some quarters, this principle of apparent minimalist government intervention has led to the emergence of numerous IMEs in Bangladesh; and their numbers have increased gradually over the last two decades. For example, in Bangladesh, IMEs covers a wide range of economic activities e.g., forestry, fishing, retail trade, rental services, animal farming, unorganized transport, hotel and restaurant services [10]. These IMEs are usually solely owned but can have up to a maximum of 10 employees[11]. A study of Mintoo's [11] in Bangladesh states that IMEs having only one worker contributes 26 percent share of the total Small and Medium-sized Enterprises (SMEs), followed by 51 percent by those having 2-5 workers, and 10 per cent by those having 6-10 workers. The IMEs is estimated at contributing about 64% of the total GDP and 41.53 (approximate) million people work in this sector [12]. Thus, this reflects the importance of the IMEs in the economy of Bangladesh.

The viability issues within the context of IMEs are widely acknowledged by the economist, sociologist, researchers, and policy makers. From the economic and social point of view, since a greater number of people in poor and developing countries depend on the IMEs sector for survival, the sustainability of IMEs is being seen as an essential element in the promotion of broad based economic growth, in improving the well-being of the poor[13]. More importantly, until more secure employment can be created by the formal sector, the IMEs are expected to provide employment for the unskilled workers [14]-15]. Also from the research and academic point of view, few studies have drawn a clear picture of IMEs viability which urges researchers to introduce and examine sustainability issues.

Whilst the IMEs contribute significantly to economic development and its sustainability is critical in the context of poor and developing countries, the viability issues remain largely neglected. Malik and Abed [16] also confirms that there is a lack of adequate data and research regarding the IMEs in a developing country like Bangladesh. In addition, for emerging nations where development trajectories are minimal, determining sustainability of IMEs is a must, not just an option. An effective IMEs sector provides an empowering foundation to enhance standards of living and to reduce poverty. Thus, this study seeks to take an important step towards an overall understanding of IMEs sustainability in terms of social, economic, and environmental issues.

The paper is organized as follows: the next section provides a background literature, followed by research methodology, main findings of field study and discussion of results. A tentative framework is proposed based on literature review and field study analysis. The paper concludes with a brief sketch of future directions for research.

II. LITERATURE REVIEW

There are several frameworks by which, the concept of Sustainability can be determined; for example, the Global Reporting Initiative [17], UN Commission on Sustainable Development (UNCSD) framework [18], The Human Development Index (HDI) by UNDP [19], Sustainable Consumption Indicators (SCI) by UNEP [20], the Daly–Cobb Index of Sustainable Economic Welfare (ISEW) [21], Sustainability metrics of IChemE [22], Wuppertal sustainability indicators [23], Sustainable Industrial Performance (SIP) [24], and Lowell Center for Sustainable Production (LCSP) framework [25].

The GRI is a widely embraced reporting-based initiative that covers more than 100 sustainability indicators under social, economic and environmental sustainability dimensions [24]. It is a voluntary, multi-stakeholder approach focusing particularly on corporate sustainability and to some extend SMEs. The UNCSD sustainability framework is an extension of the GRI by introducing an additional sustainability criterion: institutional sustainability. Although the UNCSD includes institutional dimension as a new tool for measuring sustainability, all dimensions under the UNCSD only highlight sustainability at national level rather than enterprise level. Apart from the GRI and UNCSD, the HDI was developed to measure development by combining indicators of life expectancy, educational attainment and income. Like the UNCSD, HDI also concentrates on development at national level. SCI in contrast, focuses on consumption and production patterns of highly industrialized regions for greater sustainability. Similarly, the IChemE framework focuses on "industrial ecology and cleaner production". On the other hand, the Daly–Cobb's ISEW was developed out of concern that Gross Domestic Product (GDP) is not an adequate indicator for either current welfare or the achievement of sustainability for future welfare. In addition, the Wuppertal framework focuses on the linkage between the various indicators [23]. Labuschagne et al. [24] suggest that the Wuppertal framework can be useable at the micro or business/industry level with some modification of social and economic sustainability indicators. Labuschagne et al.[24] developed the Sustainable Industrial Performance (SIP) by adding elements from other frameworks. The major limitation of this framework is concerning the institutional substantiality indicators and dimension. However, the SIP framework is a good introduction for enterprises to address sustainability. In the early stage (1999) the LCSP framework aimed at evaluating sustainability in production systems, but progress to focus on environmental sustainability along with social and economic sustainability [25].

These various frameworks reflect the progress of sustainability studies over the last two decades. It is still evolving. These are especially suited for corporate, regional, or national-level analysis. So far, no coherent indicators have been developed for IMEs. Existing frameworks are fairly silent on the sustainability of micro-enterprises, especially for the informal sector. Besides, until recently most of them relate to normal standard of living that may not make much sense within the context of developing countries. Nevertheless, these frameworks can provide a source for identifying areas within which, sustainability indicators and dimensions for IMEs can be developed. Furthermore, some of these frameworks can serve as aggregate indicators to develop IMEs sustainability determinants.

III. RESEARCH METHODOLOGY

The paucity in studies being conducted in this field, particularly in determining how IMEs contributes to an emerging nation's social, economic and environmental sustainability, calls for a qualitative research investigation. This approach is appropriate, as qualitative study is "particularly well suited to new research areas or research areas for which existing theory seems inadequate" [26]. Further, Denzin and Lincoln [27] assert that qualitative research involves an "interpretive and naturalistic" approach: "This means that qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them" (p. 3). This study followed a multiple case based field-study because the research is explorative in nature, and attempts to contribute in theory and practice, and where the views and experiences of the participants are important [28].

A. Sampling

Creswell [29] suggests a sampling size of five to twenty-five, whereas Morse [30] recommends at least six. This study approached fourteen cases: eight tea-stall owners, three NGOs, and three local governments' authority. Since tea-stalls represent prominently among IMEs (i.e., hotel and restaurant services: 0.21% of the total GDP) in Bangladesh[12], the tea-stall micro-enterprises have been chosen as a main sample category. This technique is appropriate as King et al., [31] state that "we could first select our community very carefully in order to make sure that it is especially representative of the rest of the country." In addition, by way of triangulation, purposeful sampling of NGOs and local governments who are knowledgeable about local conditions were interviewed as this approach "might yield better and more reliable data" [32].

B. Data Collection and Analysis

Data were obtained via one-to-one personal interview basis. This technique allows the freedom of probing for further in-depth explanations and details in specific key areas. During the interview sessions, the interviewees were able to express ideas freely, while clarification can be made by interviewers. The interview data were noted and recorded with the permission of the participants. The interviews were conducted in Bangla and then translated into English. Rigor of the data was enhanced by having the transcripts back-translated into Bangla and validated by another researcher.

The transcribed interviews were analyzed using content analysis method. Content analysis can determine key factors, constructs and the links between constructs. Miles and Huberman [33] assert that content analysis technique is useful in an exploratory research to examine

the determinants of behavioral patterns. Inductive logical thinking skills were applied to extract and classify the data and constructs. Inductive process starts with conducting, transcribing, and analyzing the interview transcripts. The transcripts were reviewed in full to uncover key patterns/themes. The indicative process was finished by using key words to indentify the emerging themes. However, it was important to ensure that all the categories, constructs, and links obtained through the qualitative study were sustained.

IV. FINDINGS

In exploring the sustainable growth of IMEs, this field study yields three emerging areas of sustainability in determining how IMEs contribute to a developing nation. This section describes the findings of the field study.

A. Social Construct

Emerging data from the field study provides several social indicators that appear to relate to the conceptual construct of IMEs social sustainability, namely: *basic needs; freedom and control; social recognition; empowerment; and child labor*. Tea-stall owners view IMEs as a way to fulfill their daily *basic needs*. Since much of large population of developing countries lives under the poverty line, meeting basic needs of the household is the primary objective of IMEs. Tea-stall owners believe that they can maintain households' expenses by running IMEs. However, few NGOs and local governments share this view. As for *freedom and control* over the course of their lifestyle, some tea stall-owners find IMEs as a tool to reach that goal. Several tea stall-owners agreed that their lifestyle is far better than previous jobs (e.g., works as a rickshaw puller or daily labor). This view is confirmed by some NGOs and local governments. In terms of *social recognition* through IMEs, whilst, a tea-stall owner's job may not be prestigious, they conceited that IMEs generate moderate social recognition in society. NGOs and local governments also supported this as evidenced from one of their comments: "*whatever, they opened a tea-stall and get some dignity in society. They get some social status.*" Majority of participants perceive IMEs as a *social empowering* tool. For example, one proud interviewee claimed that: *"I have created some wealth from my tea-stall. I bought one piece of land and deposited some amount of money in bank. I managed my daughter's marriage ceremony."* Social empowerment of IMEs as described by one of the NGOs was also acknowledged as quoted*: "Many of them also bought rickshaw, or cattle, or a piece of land. They did it because of tea-stall*." Since *child labor* is a sensitive issue, none of the tea-stall owners mentioned the involvement of children in their IMEs. However, from field observations, it is obvious that IMEs use child labor on a part time basis. NGOs and local governments have acknowledged the practice of using child labor in IMEs because *"most of the tea-stall owners do not have knowledge about child labor law."* All these opinions and observations from the field data highlight the numerous social indicators that reflect how IMEs produce and shape social sustainability of an emerging nation.

B. Economic Construct

Several emerging financial indicators were identified as crucial in shaping the conceptual economic construct of IMEs' contribution to economic sustainability of a developing nation. These include: *sales growth; income stability; profitability; and employment*. From the field research, tea-stall owners agree that their sales are increasing gradually. NGOs and local governments had also observed this positive trend in the *sales growth* of IMEs. As confirmed by one of the NGOs: *"You can find some tea-stalls were small before five years ago, but now they have grown up and become larger."* This statement reflects the growth of IMEs in terms of sales. Beside, *income stability* is also an important indicator of the economic sustainability of IMEs. Majority of tea-stall owners admitted that their IMEs' income is not stable over the time. Nevertheless, they agree that IMEs' income fluctuates at an acceptable level. NGOs and local governments portray similar arguments. Furthermore, to be economically viable it goes without saying that *profitability* is crucial. Most of the tea-stall owners as well as NGOs and local governments stressed the importance of profitability. One of the local governments affirmed that: *"Of course, they can make a profit."* Finally, *employment* was also seen as a positive indicator by the tea-stall owners, NGOs, and local governments. One of the NGOs points out that: *"It's also a way to generate employment for society. Of course it's a self-employment."* Hence, *sales growth; income stability; profitability; and employment* have been acknowledged as indicators of IMEs economic contribution to Bangladesh's sustainable development.

C. Environmental Construct

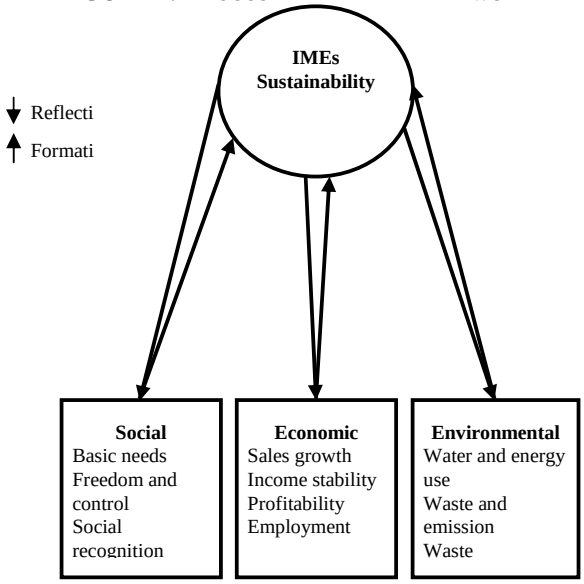
The findings uncovered various indicators that signify environmental construct, such as: *water and energy use; waste and emission; waste management; space management; and hygienic factors.* All tea-stall owners believe that their use of *water and energy* was minimal. A tea-stall owner affirmed that as he *"use chaff processing wood for making fire…I need almost 8 pitchers of water per day."* Their expenditure for water is relatively low and *"actually using environment friendly fuel"* as chaff-logs emit less smoke. Whilst NGOs blamed these IMEs for poor *waste management*, tea-stall owners beg to differ, claiming that: *"We sweep three times a day. We request customers to use the bin."* As for the use of *space*, tea-stalls have been observed to require minimal space. One of the local governments confirmed this by noting that: *"tea-stalls need very small space to operate business."* All tea-stall owners claimed to have observed *hygienic* services as they *"wash tea cups with hot water all the time for all customers…hot water probably could remove germs."* All but one NGO disputed this claim. Overall, the environmental indicators that emerged from this field study appear to indicate IMEs environmental sustainability.

V. DISCUSSION

Findings from this field study in exploring the sustainable growth of IMEs resonates well with the literature in terms of the importance of IMEs' sustainability in a developing country like Bangladesh. Social construct of IMEs has emerged from various sustainability indicators such as: *basic needs; freedom and control; social recognition; empowerment; and child labour*. IMEs have certainly provided a large population in a developing nation with basic needs [34]-[35], and freedom and control over their own lifestyle [36]-[37]. Entrepreneurial owners of these IMEs are enjoying empowerment [38] in self sufficiency and improved social recognition [30]-[38]. Although, child labor in the IME sector is a potential issue according to the NGOs and local governments, field observation appears to satisfy the researchers that this issue may not be as vulnerable, as children of tea-stall owners only helped out on a part-time basis. The conceptual construct of economic sustainability in this study is shaped by several financial indicators, including: *sales growth; income stability; profitability; and employment*. In order to be economically viable, it makes sense for IMEs to value sales growth and income stability [39]-[40]. Profitability [41]-[42] is a major indicator of financial and economic sustainability, as it motivates IMEs owners to open and run a micro-enterprise. Practically every organization is responsible for its environmental footprints and the IME sector is no difference. In the case of IMEs, the environmental impact of operation is not as great, especially for tea-stalls. Waste and emission, water and energy and space [43]-[44] created and used by IMEs are at an acceptable level. However, there are rooms for improvement in waste management and hygienic indicators [43]-[44].

Drawing from the findings and the emerging social, economic and environmental sustainability constructs, Figure 1 presents a tentative IMEs Sustainability Framework. These sustainability constructs can be labeled as *primary* level of constructs. Each first-order construct consists of a series of indicators that explain IMEs' performance. More specifically, IMEs sustainability is a higher-order construct that is built upon these core constructs of social, economic and environmental sustainability. The social, economic, and environmental performance of IMEs describes the output of IMEs driven by IMEs initiatives and activities. These performances also describe the formation of IMEs sustainability. The social construct includes basic needs, freedom and control, social recognition, empowerment, and child labour issues. All these indicators are taken to determine enterprise level and household level analysis, and to some extend national level analysis. Economic indicators such as, sales growth, income stability, and profitability determines the enterprise level of performance rather than household and national level analysis. Under the economic construct, employment represents individual level and national level performance. Finally, the environmental construct focuses on the national level as well as global level analysis. This environmental performance of IMEs analysis is based on indicators such as water and energy use, waste and emission, waste management, space management, and hygiene.

FIGURE 1: IMEs SUSTAINABILITY FRAMEWORK



This is but an exploratory study that provides a better understanding of IMEs sustainability and its crucial contribution to a developing nation. Critical reflective analysis of the tentative IMEs sustainability framework and immersion in the field data that emerged to shape the findings, lead us to contemplate further research into this arena. For instance, if it is assumed that a micro-enterprise owner is an entrepreneur, and that starting an informal tea-stall enterprise is a form of entrepreneurship, then 'entrepreneurial orientation theory' may also be a vital concept that links to IME characteristics. Entrepreneurial orientation refers to the resource utilization and strategy that provide a firm's growth with entrepreneurial decision and action [45]-46]. Subsequently, 'resource theory' [47] provides a lens to examine a firm's resource utilization strategies and competitive advantage. Resource theory is also a tool for evaluating IMEs because it is concerned with the utilization of resources and firms' sustainable results.

VI. CONCLUSION

This field study explored the sustainability elements of Informal Micro-Enterprises (IMEs) in terms of social, economic and environmental dimensions in introducing a tentative framework within the context of an emerging nation. Findings that emerged from the data appear to resonate well with the literature and contribute to the body of knowledge on the sustainable development of IMEs. The importance of IMEs is highlighted here in terms of empowering a massive population of otherwise unemployed and unskilled citizens, thereby alleviating poverty and contribution to the sustainability of a developing nation. Emerging economies, NGOs and global agencies may consider the findings of this study useful in future strategic and policy planning within the context of IMEs sectors. It is also noteworthy for

researchers to further investigate the sustainable growth of IMEs by incorporating lenses from entrepreneurial orientation theory and resource theory for a much richer understanding of this sparsely researched arena.

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Linking corporate social responsibility and financial performance: A meta-analytical approach from environmental performance

Tejedor-Núñez, Jorge; Ortas Fredes, Eduardo and Alvarez Echevarría, Igor
University of the Basque Country UPV/EHU, C /Comandante Izarduy 23, 01006 Vitoria-Gasteiz. , Spain
E-mail: jorge.tejedor@ehu.es

***Abstract*: What do we know about the relationship between environmental performance and firm performance? Social and Environmental disclosure and Corporate Social Responsibility (CSR) have been studied for decades, with an ever increasing amount of literature on the topic in recent times, due to their interest to both scholars and managers.**

However, today there is still a lack of consensus in the literature regarding the appropriate theoretical construct for these concepts, the relevant variables to measure them, and their relationship with other variables, mainly financial.

After more than four decades of theoretical and empirical research, evidence to date appears to be relatively inconclusive. In this context, the aim of this study is to provide evidence for the debate on the relationship between CSR and financial performance (FP), focusing primarily on the relationship between environmental performance (EP) and FP.

I use meta-analysis technique in order to carry out a systematic quantitative synthesis on a set of empirical studies that analyse the nexus between environmental and financial performance. The idea is to undercover the underlying factors (CEP and CFP both measure and type, type of effect, number of firms amongst others) which can influence the observed variation in the empirical results.

The main conclusion of this review is that the literature shows a generally positive relationship between CSR and the FP, but not between EP and FP. However, the studies analysed do not show conclusive results on the causality of the relationship and the existence of potential moderating variables. The results also point to the importance of appropriate time coverage and they recommend the use of exploratory multivariate models.

I. INTRODUCTION

After 40 years of research on the relationship between both variables since the seminal article [1] there is not an agreement on the relationship itself (existence, causality, sign, etc.).

The most accepted theories, widely used in literature reviews and meta-analysis, on the relationship between CSR performance and PF, are summarized in Table 1.

TABLE 1: TYPE OF CSR-FP RELATIONSHIP

CAUSAL SEQUENCE	DIRECTION OF THE RELATIONSHIP		
	POSITIVE	*NEUTRAL*	*NEGATIVE*
CSR → FP	SOCIAL IMPACT HYPOTHESIS	"MODERATOR" VARIABLES HYPOTHESIS	TRADE-OFF HYPOTHESIS
CSR ↔ FP	POSITIVE SYNERGY		NEGATIVE SYNERGY
CSR ← FP	AVAILABLE FUNDS HYPOTHESIS		MANAGERIAL OPPORTUNISM HYPOTHESIS

[2] based on [3]

II. META-ANALYSIS REVISIONS

The meta-analysis technique is used to do a systematic quantitative synthesis on a set of empirical studies that, in this case, analyse the nexus between environmental and financial performance. The idea is to undercover the underlying factors (CEP and CFP both measure and type, type of effect, number of firms amongst others) which can influence the observed variation in the empirical results.

After revise different literature reviews and meta-analysis about the relationship between CSR and FP [4]-[6] and between EP and FP [7]-[9], we follow the methodology used by [5] to analyse the relationship between EP and FP through a meta-analysis of a set of articles about this topic.

III. CONCLUSION

The main conclusion of this review is that the literature shows a generally positive relationship between CSR and the FP, but not between EP and FP. However, the studies analysed do not show conclusive results on the causality and sign of the relationship and the existence of potential moderating variables. The results also point to the importance of appropriate time and country coverage and they recommend the use of exploratory multivariate models.

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The interaction between CSP and CFP in Spanish companies; the impact of the global financial crisis

Corresponding-author

Prof. Eduardo Ortas
Accounting and Finance Dep.
University of Zaragoza
Faculty of Economics
C\ María de Luna, Campus Rio Ebro
Edificio Lorenzo Normante
Zaragoza (Spain)
CP: 50018
Phone: 0034 649519223
Fax: 0034 974228549
edortas@unizar.es

Co-author(1)

Prof. José M. Moneva
Accounting and Finance Dep.
University of Zaragoza
Faculty of Economics
C\ Gran Vía, nº2
Zaragoza (Spain)

CP: 50005
Phone: 0034 976761795
Fax: 0034 976761769
jmmoneva@unizar.es

Co-author(2)

Prof. Igor Álvarez
Accounting Dep.
University of Basque Country
School of Commerce
Plaza Oñati 1
Donostia (Spain)

CP: 20008
Phone: 34 943015771
Fax: 34 943015771
igor.alvarez@ehu.es

ABSTRACT

This study assesses the relationship between Corporate Social Performance (CSP) and Corporate Financial Performance (CFP) in the Spanish market, considering the two possible directions of causality. In the paper, it is hypothesized that either financial performance precedes social performance, or the other way round. In order to analyze this relations, we use a distributed–lag model witch is concerned with the timing of the change and the length of time its takes for an effect to take place, taking also into account also the effect of the appearance of financial crisis in 2007 during the analyzed period. Based on a sample of 42 Spanish listed companies drawn from CSR index ASSET4 witch cover the period 2001-2010, we apply a VAR model which it will allow us to text empirically the Stakeholder theory and Neoclassic Economy Theory. The results indicate a number of significant statistical relationships between CFP and CSR. Concretely we prove a significant positive causality between market profitability and CSP, and between market risk and CSP. On the other hand, we don't found a significant relation between CSP and the market value.

Does the 2008 financial crisis change the sustainability reporting of the European banks? : Analysis of the application of the materiality principle

Amel Ben Rhouma[1] and Claude Francoeur[2]

[1]University Paris-Descartes – IUT GEA
CEDAG (EA-1516)
143 avenue de Versailles 75016 Paris
[2]HEC Montréal
3000 Côte-Sainte-Catherine, Montréal, Québec, Canada, H3T 2A7

E-mail: amel.ben-rhouma@parisdescartes.fr

Abstract: **Reporting about the sustainability issues of firms' activities is an important instrument in the dialogue between business and society. This study examines the influence of the recent financial crisis in the application of the materiality principle in the sustainability reporting (SR) of the big European banks listed in the Euro Stoxx 50.**

Legitimacy theory predicts that, in a context of crisis, companies are expected to exhibit greater concern to improve the corporate image through SR. We use the Global Reporting Initiative (GRI) guidelines to develop an analytical scenario of SR within the well-known software Tropes 8.0. This software is specifically designed to analyze original verbatim text and extract its essential meaning while minimizing analysts' personal biases. Eight categories of SR are analyzed: governance, commitment and dialog, economic performance, environmental performance, social performance, human rights, product responsibility, society and financial sector-specific (FSS) issues in sustainability.

This study shows that European banks increased their SR in the three years following the financial crisis. Concerning the reporting on FSS and therefore the application of the materiality principle, only the French and Italian banks showed an increase of their reporting. Country specific context and regulations seems to affect corporate SR practices of banking institutions.

Results show that corporate governance reporting is an important part of the SR of European banks in the three categories of annual documents analyzed: Annual Report (AR), Sustainability Report (SR) and Registration Document (RD) for French banks.

We also find that sustainability reports are more apt to disclose financial sector-specific issues. This result suggests that the choice of report for information disclosure depends on the target audience. Annual reports and the registration documents required of French banks disclose more about corporate governance and economic performance, whereas environmental and human rights and FSS are covered more often in sustainability reports. Annual reports and registration documents are directed at investors and financial stakeholders who are naturally interested in corporate governance and economic performance. On the other hand, because company sustainability reports are aimed at a large number of stakeholders, including non-governmental organizations, it is natural for them to emphasize human rights and environment.

This research makes three important contributions to corporate SR research. First, it extends prior research to the banking industry, which is often excluded from sample companies due to the sector's more stringent regulatory regime. Second, it constructs a grid of analysis of SR sector-specific sustainability issues that are particularly relevant to the banking institutions and their stakeholders. Third, it analyzes all categories of annual documents published by European banks during a longitudinal period (2006–2011) surrounding the financial crisis.

Keywords: **sustainability reporting, integrated reporting, materiality, financial crisis, Europe.**

The social dimension of Sustainability Accounting Model (SAM)

Angélica Peña Cortés, Hans Silva, Carla Silva
Universidad de Santiago de Chile (USACH) - Chile
E-mail: angelica.pena@usach.cl

Abstract: **Until this moment it has not been possible to develop an accounting system which considers social and environmental dimensions. From this result society as a whole will be able to social and environmental impact of firms. This research describes an Accounting Sustainability model focused on social dimension. We will validate this model through quantitative research methodology. These variables involve factors and indicators which allow us to observe the Chilean mining sector's social dimension.**

The proposed model is a social dimension's measuring tool. This model is a practical contribution supported by those scholars who claim that the importance of measuring social dimension. This has been a theoretical problem which will be solved by this model. At the same time it involves a set of standards for sustainability reports. This model based on Chilean copper mining sector, can be adapted to whatever industry. We propose a set of generic dimension which can be adapted considering particular characteristics in other industries. This model allows us to structure social dimension information necessary to collect and expose to stakeholders and society as a whole.

Accounting Sustainability; Social Dimension

Developing the Social Audit: An exploratory study of compliance auditing in the Bangladesh garment industry

Muhammad Azizul Islam, Craig Deegan and Rob Gray

E-mail: azizul.islam@deakin.edu.au
craig.deegan@rmit.edu.au
rob.gray@st-andrews.ac.uk

Abstract: ***A source of increasing concern in the social and environmental accounting literature is the growing number of self-aggrandising claims made by organisations concerning their social and environmental qualities and the apparent lack of substance lying behind these claims. This growing concern also echoes the increasing importance of – and scepticism about – the accreditation and 'quality-stamping' of organisations, products and processes through a diverse range of mechanisms. Despite this importance, there would seem to be very little examination of this important phenomenon within the social and environmental accounting literature and, as a consequence, there seems to be an absence of information about how social/compliance audits are undertaken; the implications this has for supply chain claims; how the relationship between developed and developing country affects the process; what motivations drive the adoption of such audits and what, if anything, are the likely outcomes from the process. This paper set out to try and explore this apparent void and sought to explore the practice of compliance auditing within the context of a specific industry (the garment industry) in a specific developing country (Bangladesh).***

The Impediments of CSR Assurance Practices in Malaysia: Evidence from the Manufacturing Sector

Faizah Darus, Yussri Sawani, Mustaffa Mohamed Zain and Tamoi Janggu
Accounting Research Institute, Faculty of Accountancy, Universiti Teknologi MARA, Shah Alam 40450 Malaysia
email: faiza634@salam.uitm.edu.my

***Abstract*: This study examines the trend of third-party assurance amongst Malaysian manufacturing companies. The factors that impede the adoption of CSR assurance practices and the relationship between company characteristics and the factors that impede CSR assurance were also investigated. Findings indicate that there is a growing trend amongst the companies to embark on CSR assurance. The risk on corporate reputation was identified as the main factor impeding the adoption of CSR assurance. Company characteristics have no relationship to the impediment of CSR assurance practices.**

I. INTRODUCTION

With the new move towards integrated reporting, stakeholders will be looking for third party verification of corporate social responsibilities (CSR) reports for credibility of information. The process of providing third-party assurance on social and environmental disclosures in Malaysia is still at its formative stage.

II. LITERATURE REVIEW

Prior literature suggests that financial reasons [1], fear of stakeholders' reaction towards exposure of several liabilities [2], no external pressure [3], fear of criticism by media and the risk on company's reputation [4] as factors for the reluctance of companies to engage in CSR assurance.

III. METHODOLOGY

Data to examine the factors that impede CSR assurance were obtained via an online survey questionnaire while data for company characteristics were obtained from content analysis of companies' annual reports for the year 2010.

IV. RESULTS AND DISCUSSION

Figure 1 presents the results of the trend analysis of CSR assurance in Malaysia for the year 2009 – 2011.

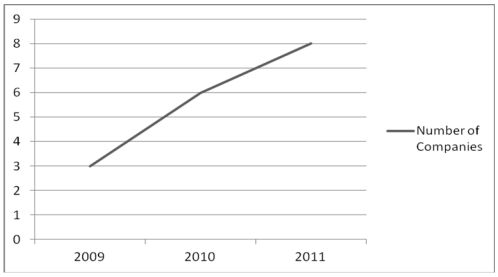

FIGURE 1: TREND ANALYSIS OF CSR ASSURANCE (CSRA)

Results reveal that there is an increase in the number of companies having CSR assurance. This is a positive development as not only the number increased over the three years but Malaysian companies are moving towards having accounting firm and certification body as assurance providers resulting in an enhanced credibility of the information assured.

Table 1 presents the ranking of the factors that impede CSR assurance amongst the Malaysian manufacturing companies.

TABLE 1: RANKING OF FACTORS THAT IMPEDE CSRA

Factors that impede CSRA	Mean	Rank
Cost factor	4.7295	2
Data management system	4.5246	3
Unclear of the benefits of CSRA	3.7672	4
Impact of CSRA	4.9705	1

The Impact of CSR assurance was ranked number one by the respondents. This implies companies were reluctant to subject themselves to the assurance process as they fear that such a move could trigger media critics and could potentially have an effect on their reputation. A correlation analysis between company characteristics namely size (Total Assets), profitability (EPS), institutional stakeholders (government ownership), foreign exposure (foreign sales) and ISO certification and the four constructs that impede CSR assurance indicates that there no significant relationships between company characteristics and the factors that impede CSR assurance.

V. CONCLUSION

Without regulation, Malaysian companies are taking their time to voluntarily adopt CSR assurance practices regardless of the characteristic of the company. This maybe because Malaysian companies are still grappling with the CSR reporting and it may be too early for them to embark on third-party assurance as they may view it as unnecessary. The risk to companies' reputation is the main deterrent impeding CSR assurance.

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Transnational Private Regulation and System Innovations: the impact of Bonsucro Standards on the sugar cane supply chain

Lucila Almeida, and Stephanie Law
Turku University of Applied Sciences, Joukahaisenkatu 3 A, 20520 Turku, Finland
E-mail: lucila.almeida@gvmail.br

***Abstract*: This paper aims to determine how the compliance with a Transnational Private Regulation (TPR) could foster system innovations. In order to answer this question, it purports to analyse whether and how the commitment to Bonsucro Standards could affect the Brazilian sugar cane supply chain by creating windows of opportunity for system innovations.**

Over the last century, the rising *integration* of the world markets and *disintegration* of the production process modified not only the dimension of the production chains – from national to multinational – but also the regulatory regimes – from a domestic to global sphere. New forms of governance emerged to regulate the global supply chain, with regards to the lack of regulatory capacity based on states' legislation.

The Transnational Private Regulation (TPR) constitutes a new body of rules, practices, and process created primarily by private actors such as firms, NGOs, and civil society. This new form of governance often encompasses multiple standards that are strict and voluntary, instead of minimum and mandatory as public standards [1]. However, firms have market incentives to comply with these private standards, e.g., the opportunity to access a new consumer market [2].

Empirical evidences show that the compliance with some private standards could require the export market to generate managerial innovation on company level [3]. As a consequence, this innovation could further foster the transition from one sociotechnical system to another, what is conceptualized as system innovations [4]. For example, a safety standard could enforce the farm producer to change the planting process affecting societal functions such as labor cultural, supply networks, infrastructure and other aligned elements.

Understanding the dynamic mechanism inside these schemes is far very limited and specialized on some specific value chains, this paper purports to analyze the relation between TPR and system innovation by develop a case study in the sugar cane sector.

During the past decade, there has been a significant increase in interest and investment in the sugar cane market. Countries listed as the biggest producers and exporters – including Brazil, India, Thailand, Guatemala, Mexico – are receiving massive investment in order to satisfy increasing market demand of sugar and bio-ethanol made from sugar cane [5].

In parallel to these changes in the sugar cane market, TPRs are emerging to regulate the sugar cane supply chain focused on social and environmental standards. Given the constraints of a multiplicity of codes of conduct and the subsequent pressures placed on companies, the most recent market-driven industry sustainability initiative is the Bonsucro - Better Sugarcane Initiative, established in 2009.

Bonsucro is a multi-stakeholder action that aims to reduce the environmental and social impact of sugarcane through the development of principles and criteria leading to certification to be adopted by the market actors. The standard covers operations from field to market, incorporating all links in the value chain. Some of the world's largest sugar buyers have signed up to the initiative and are increasingly demanding that their suppliers demonstrate sustainability and responsibility in their business functions, in accordance with the Bonsucro standards. In Brazil, the biggest producer of sugar cane, 14 millers are already certified in accordance with the Bonsucro Standards and 6 buyers have signed up to the Chain of Custody (CoC) Certification ensuring compliance with the sustainable standards along their supply chains.

Considering the recent sustainable standard-setting in the sugar cane market, *the paper aims to determine whether and how the compliance with the Bonsucro Standards could affect the sugar cane supply chain by creating system-level innovation*. The hypothesis is that a new socio-technical landscape – as that of Bonsucro – puts pressure on the existing regime thereby creating windows of opportunity for innovation in the sugar cane industry. We aim to identify where such scope arises and the manner in which innovation affects market development, and in particular, sustainable development.

In order to answer the research question and test the hypothesis, the paper is divided into two parts. In the first part, (i) it provides a theoretical approach, introducing briefly the concept of TPR and system innovations. In the second part, (ii) it focuses on the case study firstly descripting the Bonsucro Standards based on their principles and criteria that lead to certification. Secondly, it purports to analyze the impact of compliance with these standards in the sugar cane supply chain on the Brazilian market. The idea is to identify the system-level innovation created on the sugar supply chain using in-depth interviews with the Bonsucro-certified market actors in Brazil.

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Private Regulation, Standards Compliance and Contractual Governance for a Sustainable Economy: a View on Remedies against Standard Violation

F. Cafaggi
European University Institute, Via Boccaccio 121, 50133 Florence, Italy
fabrizio.cafaggi@eui.ei

P. Iamiceli
Università degli Studi di Trento, Dipartimento di Scienze Giuridiche, Via Verdi 53, 38122, Trento, Italy
paola.iamiceli@unitn.it

***Abstract*: The internationalisation of markets and trade is transforming the regulatory space and reshaping the structure of supply chains. States, as global regulators, increasingly reveal their weaknesses while private players, both market actors and NGOs, are often taking the lead. Private regulatory regimes are emerging and consolidating, often as a complement of public regulation, sometimes even as a substitute, when treaty making entities and international organisations are unable to regulate. Among other concerns, safety and sustainability recall for a private regulatory response to the emerging challenges of the global trade.**

The features of the supply chain affect the choice of the regulatory strategies but in turn the selection of the regulatory strategy may require or induce changes in the supply chain.

Within this perspective the paper investigates the relation between private transnational regulation through standards and contractual governance.

More particularly, focusing on food standards compliance and remedies against non conformity, the analysis is intended to test whether and to what extent logics underlying contractual remedies as provided under supply contract law differs from the logics underlying sanctions and other measures provided by certification schemes and standard codes. It also investigates to what extent and at which conditions measures requesting corrective actions and measures aimed to provide sanctions for non conformity can play a complementary role or should be considered as conflicting remedies due to alternative use.

I. CONTRACTUAL PRACTICES AND SUPPLY CHAINS: CHANGING UNIT OF ANALYSIS.

In this project we focus on a particular set of instruments for transnational governance: transnational contracts and agreements. We consider contracts in broad terms as including agreements that do not necessarily qualify as enforceable contracts within the traditional toolkit of private laws [1]. Secondly, we consider global supply chains rather than individual transactions as the web of contracts along and around the chain that governs production and distribution processes. Here we want to capture interconnectedness via contracts among the different yet interdependent knots of the chain. This is particularly important when considering the role of regulatory provisions and those of certification since regulatory compliance requires a higher degree of coordination than commercial exchange [2]-[4]. Thirdly and more importantly, we consider not only the contractual document but also the practices developed within the food chain, which may specify but sometimes even contradict the text. Contracts concluded by enterprises operating in different business and institutional environments are embedded into functional and territorial contexts, reflected in contractual practices rather than texts [1]. Over time, the stabilization of relationships between parties may change the function of contracts: from a substitute of trust to a trust-creating instrument. The weight of regulatory practices does not necessarily imply a dominance of the informal over the formal; rather it forces the re-consideration of the boundaries between the two [1].

Transnational commercial contracts, especially within supply chains, have come to perform multiple functions. In addition to the conventional exchange-facilitating function, they are increasingly deployed as instruments for implementation of transnational regulation [5]. The inclusion of regulatory provisions concerning safety, environmental and social standards is becoming increasingly popular in supply chains where strong leadership is exercised either by retailers or by big multinational producers [6]-[13]. Sales or distributorship contracts contain clauses with provisions making explicit references to regulatory regimes included in codes of conduct, guidelines, framework agreements, memoranda of understanding, making them binding via contract [5]. In some cases the use of standards affects on the very core of the exchange contracts (e.g. influencing price determination) or fosters the evolution of sales contracts towards more collaborative patterns and lengthy relations [13], [14]. Moreover, the source of the regulatory regime, whether internal or external to the chain, private or public, may influence the enforcement choice and the coordination of multiple co-existing remedial systems. There is a reciprocal influence between standard setting

and supply chain structure. Regulation, both public and private, does affect technologies of coordination in supply chain [15]; symmetrically, the socio-economic determinants of the supply chain structure, just highlighted, influence the choice between alternative regulatory strategies. The application of common regulatory standards along the chain influences the architecture of the chain and the contractual practices. The exchange dimension, which, in the conventional account determines the form of the chain, thence becomes only one factor and sometimes not the most important or the determinant.

II.1. COORDINATION IN GLOBAL VALUE CHAINS

Global production systems are organized around global supply value chains (GVCs). Within GVCs important variations concern (a) the structure of the contractual relationships among the different participants, (b) the allocation of contractual and market power, and (c) the criteria for the remuneration and the distribution of revenues [6], [16]. The drivers of these differences among GVCs are related to numerous factors among which worth mentioning are *(1)* the degree of market concentration at the different level of the chains, *(2)* the size of the firms involved, *(3)* the technological features of the commodity and its production process, and *(4)* the regulatory requirements to be met, including health and safety, environmental and social standards.

GVCs coordinate firms in various ways depending on how information flows, its mode and degree of codification, and its relationship with transaction specific investments [6]. Information production is related to the competences and capabilities of the participating enterprises. Asymmetric distribution of information translates into different capability sets, which in turn impinge on the choice of inter-firm coordination. Information sharing is also related to trust which affects the choice of instruments. There is some evidence that a high level of trust, linked with duration of the relationship, is correlated to informal instruments. From our perspective, this would translate into the increasing importance of practices in relation to the contractual text [4].

Building on the distinction between modular, relational and captive linkages, we claim that contractual instruments, including practices, constitute particular forms of coordination along the chain that respond to different communication systems [6], [15]. The relationship between contractual practices and information is debated. There is agreement on the fact that tacit knowledge and, more broadly, not easily codifiable information, imposes the use of relational contracting as mode of coordination [6], [14]. Much more contested is the view that codified information can result into modular or captive linkages and thence into different forms of standardized contracts characterized by higher level of completeness than relational contracts.

In the current debate the type of information and the allocation of competencies not only represent factors influencing the structure of the supply chain but also variables which may depend on the structure of the supply chain and the use of particular forms of governance, mainly the presence of inter-firm networks. The role of networks to enabling better innovation systems and fostering more sustainable development strategies, especially in the agri-food sector, is widely recognized [17]. In this perspective collaborative inter-firm relations would allow at lower costs forms of knowledge transfer, technical assistance, professional qualification, particularly in favour of small-holders [13], [17].

The length of the chains is often associated to the type of commodity which determines, together with the market structure, the number of suppliers involved and degree of modularity. The structure of the chain is also influenced by the numbers and roles of intermediaries and it affects the distribution of value across participants. The increasing role of certification is extending governance to third parties whilst reducing the direct relationship between participants to the chain [18].

These differences exist not only across but also within sectors. In the agri-food sector variations among commodities translate into very different forms of supply chains in terms of length, density and trans-nationality [14], [19], [20]. Recently the emergence of values based supply chains (VBSC) has been noted [21]. These chains are characterized by several attributes concerning the relationships among enterprises and with the final consumer. Trust, transparency, equitable allocation of costs and profits, sustainability feature prominently in these chains. They starkly depart from the conventional GVCs led by retailers or final producers where hierarchy rather than collaboration is the dominant characteristic. Despite the differences, some general patterns can be identified. Standardized commodities tend to be produced in longer chains where there are many trading intermediaries, primarily trying to reduce search costs. No standardized commodities, for example specialty food or high premium products tend, instead, to be produced within shorter chains where there are fewer intermediaries, which produce added value beyond reducing search costs [14], [20], [22].

Legal systems are mostly organized around individual contracts whose regimes are not strongly influenced by the market structure and by the size of the firms. The legal unit of analysis continues to be the individual contract, often neglecting contractual interdependence along chains and the functional differentiation of contractual relationships based on market structure [23]. Notice however that many of the economic approaches also look at individual transactions rather than capturing functional interconnectedness [24], [25].

In this paper, building on previous work, we advocate a different perspective that tries to reconcile legal approach and economic realities [26]. *We take supply chains as the functional unit of analysis and look at how contract law, and private regulatory and certification regimes sanction breaches of regulatory provisions concerning food safety*. Using commercial contracts as vehicles of regulatory implementation strengthens the contractual interdependence along supply chains and influences its governance [27]. The performance of regulatory functions via contracts results in complex contractual architectures

rather different from conventional commercial contracting, where two parties, and potentially also the arbitrators, are involved. Not only is coordination among chain's participants needed to ensure that process standards are complied with but also a transfer of knowledge between parties along the chain is necessary. Often farmers and small producers do not have sufficient knowledge about the content and the procedures to meet regulatory requirements. Assistance from buyers is therefore needed to instruct suppliers about regulatory technologies and their implementation and to ensure compliance. Contractual governance supports the development of systems-level innovation based on coordination and strict collaboration among participants [17].

We will explore the interactions among the different transnational regulatory regimes in food safety focusing on the consequences of the breach of contractual regulatory provisions which at the same time constitute regulatory violations and breach of certification contracts. By comparing different remedial regimes for the same violations we want to show how different remedial logics can complement or conflict each other, and which results these interactions may have on the contractual architecture of the supply chain and its coordination mechanisms [28]. We first address the effects of breaching regulatory provisions and then examine in details specific remedies.

II. EVALUATING THE EFFECTS ON THE SUPPLY CHAIN OF BREACHING REGULATORY PROVISIONS

When there is a breach of contract in a commercial context the current approach looks at the consequence on the party who suffers the harm but does not specifically address the further effects on the contractual relationships along the chain. If A breaches the contract with B, the effects on the contract between B and C are only partly internalized via the lost profit heading. Further down the chain what happens as a result of the first breach between C and D, D and E and so on is not a matter to be discussed in the dispute between A and B. This approach artificially fragments interdependent relationships taking place along integrated chains.

This conclusion holds true in general but becomes of paramount importance when a regulatory provision is breached. Take food safety provisions concerning the implementation of the hazard analysis and critical control points (HACCP). This is a process standard that supply chains have to implement by identifying the different control points along the chain. It implies an organizational structure that coordinates the various points linked through bilateral contracts. The objective is to detect hazards and react promptly to minimize risks of harms [29]. If one party defaults by not detecting the hazard or removing its consequences the whole system is called to intervene and react in order to minimize the potentially harmful effects. According to the regulatory perspective the consequences of the violation (breach) are fully internalized by all the other critical points that have to react and remove the hazard not detected. Not only are the consequences of individual defaults 'socialized' but so also are the obligations to react and mitigate cover the whole relevant segment of the chain.

If we were to think in traditional contractual terms, we would say that in the case of breach of regulatory provisions there is a duty to cooperate among the different control points and that in case of breach there is a duty to mitigate on each party, regardless of whether there is a direct contractual relationship with the party who committed the breach. Notice that a duty to mitigate rests on the breacher himself with important theoretical implications on the efficient breach 'doctrine'. Going back to the example above, in the context of a regulatory regime, E could be asked to cooperate and mitigate even if she is the furthest away from the contractual relationship within which the breach has occurred. While according to the traditional contractual account, it would not be legitimate to ask E to mitigate losses created by B's breach in the context of the contractual relationship with A, the regulatory regime, included in each contract along the chain, allows for this result to be achieved and expands duties to cooperate and mitigate by recognizing the functional interdependence among parties within the chain.

Such an approach requires a form of contractual governance organized around the chain or the modules of the chain involved in the implementation of the regulatory provisions going beyond contractual fragmentation still reflected in the conventional world of contract laws.

Some interim conclusions can be drawn. It appears that the approach taken by sales law and more generally, by commercial contract law, differs from that of regulatory regimes incorporated by reference and by the certification regime. (1) *The former focuses mainly on products, the latter on process*. (2) *The former concentrates on individual transactions while the latter focuses on the interdependence of contractual relationships along the chain.* (3) *The former aims at redressing the victim of the breach, the latter tries to restore compliance with regulatory process in order to pursue regulatory objectives*.

The analysis will compare the different, at times conflicting logics that today coexist when a regulatory provision is breached.

III. THE COEXISTENCE OF MULTIPLE REMEDIAL SYSTEMS FOR A SINGLE REGULATORY VIOLATION OF TRANSNATIONAL COMMERCIAL CONTRACTS.

The use of transactional commercial contracts as regulatory instruments of implementation produces important changes. When a regulatory provision is breached in transnational commercial contracts, multiple remedial systems are triggered, simultaneously or sequentially: first, the contractual regime with the different array of remedies, primarily aimed at compensating the victim of the breach but also including the replacement of unsuitable components; second, the regulatory regime referred to in the provision whose main objective is to ensure regulatory compliance; thirdly, if relevant, the certification regime which is referred to in the contract between the buyer and the seller but may be the specific subject matter of a separate contract between

the certifier and the certified (usually the seller/supplier). These remedial systems may not concern the same party if the subscriber of the regulatory body is the buyer rather than the seller. We sketch the different hypotheses.

(I) The first hypothesis occurs when the party violating the regulatory provision in the commercial contract is the same as that one who signed the code incorporating the regulatory regime and the certification contract with certifier. Here, the code violation may lead to the application of sanctions as provided by the code, by the certification contract and by the supply contract requesting standard compliance. Sanctions from the different regimes will concern the same party.

(II) A more complex situation arises when the party, who has undertaken the contractual obligation to comply with the private standard, is not the same party who has subscribed to the private regulatory regime. This occurs for instance when a buyer (e.g. a final producer) subscribes to a private food safety standard and imposes on the suppliers the contractual obligations to comply with the standard to which he committed. In this circumstance, the breach of the sale contract by the supplier may correspond to a breach of the code by the buyer for failure to monitor compliance with the regulatory commitments in the contractual supply chain. Unlike the previous example (under (I)), where the breaching party was also infringing the code, here there is a split: the seller/supplier breaches the sale contract while the buyer/final producer violates the code of conduct if the supplier is not compliant. The buyer will be subject to the sanctions of the regulatory regime, while the supplier will be subject to the sanctions for breach of contract, which presumably will incorporate some of the consequences of the violation of the code.

(II.i) When a third party certification scheme is at stake, then the situation might be more complex. Depending on the structure of the supply chain and on the type of process to be monitored, the final producer may decide to be the sole holder of the certificate or to request suppliers to be individually certified under the same regulatory regime. In the former case suppliers will be subject to contractual liability under the sale contract with the buyer/final producer whereas the buyer/final producer will be subject to sanctions for breach of both the certification contract and the code. In the latter case final producers and suppliers all fall into the situation described in the previous example (under I). It is worth mentioning that, the certifier being himself subject to accreditation, the certified parties may be subject to additional monitoring in case of delay or non-application of sanctions by the certifier when this certifier's conduct causes the revocation of her accreditation and/or the cancelation of the certification agreement with the standard setter.

(III) An even more complex situation arises when the breach of contract and the violation of the standard by the supplier imply liability, contractual or extra-contractual, for another actor along the chain in addition to the sanctions generated by the violation of the code. This is the case where a supplier or a final producer breaches a food safety code of conduct and the retailer, who sells to the final consumer, is liable vis-à-vis the consumer for non-conformity with a standard whose due compliance is shown on the label. In this case, an additional remedial regime may be triggered along the chain as induced by the consumer's action and the consequential measures activated by the retailer against the suppliers in breach.

For analytical purposes we shall focus on the first example to illustrate comparatively the different remedial logics before elaborating on the second hypothesis where, as a result of the seller's violation, two sanctioning systems concern the seller and one concerns the buyer for failure to monitor.

IV. CONTRACTUAL REMEDIES AND SANCTIONS PROVIDED UNDER CERTIFICATION CONTRACTS AND REGULATORY CODES: A COMPARATIVE VIEW.

The primary aim of contractual remedies, associated to damages, is compensating the victim for the breach and providing the party in breach with corrective incentives to choose between performance and breach. The reference for this evaluation is represented by the consequences of the breach for the creditor. In addition, in the case of non-conforming goods, parties can ask for replacement or substitution; the 'cure' however concerns the product but does not oblige the breaching party to remove the cause of the conformity from the supply chain. Therefore, if for example non-conformity is due to a defect in the monitoring system, the contractual remedy cannot seek removal of the source of non-conformity.

The remedies associated to the regulatory regime are aimed at ensuring regulatory compliance while disregarding the compensatory function. The objectives are to ensure compliance and, in case of non-compliance, to warrant that the hazard and its sources will be removed and the consequences of the harm stemming from the breach, reduced or mitigated. The breach triggers remedial or corrective action, which has to be taken by the party in breach but often involves the other participants to the supply chain. The consequences of the breach of regulatory regimes spread along the chain and compensation does not represent a viable solution to default. A similar logic informs the certification regime linked to the regulatory one. The enforcement power is here attributed to the certifier and to a limited extent, especially in case of inaction, to the regulatory body, licensing the certifier. For the time being, we assume that the breach of the provision constitutes also a violation of the certification scheme in order to avoid the technical problems of linking the sale and the certification contract.

A significant difference is thence related to the scope of the effects resulting from the remedy; while, in contracts, remedial logic limits them to the specific contractual relationship where the breach has occurred, without considering the effects on the entire chain, regulatory regimes are more prone to correlate individual breaches and collective consequences over the whole supply chain [30].

Certification schemes may have different approaches. Some tend to focus on the individual contractual party; others, following the regulatory perspective, consider also

the consequences of the breach of certification obligations over the full chain.

V. CONCLUSION

The paper analysis shows different logics underlying measures and sanctions provided by certification schemes and standard codes against non conformity, on the one hand, and contractual remedies provided under supply contract law, on the other hand.

The focus of the remedy in contract law is on the consequences, whilst in certification and regulation is on the causes of non-conformity outlined above. These different logics are related to the product/process distinction between contract and regulation. A system focusing on process addresses the causes; one focusing on products looks at the consequences. In contract the remedy, even when it goes beyond damages, looks at the subject matter of the transaction and in particular at the product, disregarding the analysis of the causes of non-conformity which remain within the sphere of the individual breacher. Not only the scope but also the finality of the inquiry is different. In contract the primary inquiry is aimed at finding liability for breach; in regulation liability and its premises are not immediately relevant, while the primary objective is to fix the problem that has caused the breach; then an inquiry about the causes may translate into specific sanctions for infringements.

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Transnational Private Regulation (TPR) and System Level Innovations in The Business – Consumer and in Business to Business Interface

K. Sorsa
Turku University of Applied Sciences, Lemminkäisenkatu 30, 20520 Turku, Finland
E-mail: kaisa.sorsa@turkuamk.fi

***Abstract*: This paper aims to investigate the system level innovations in the business-consumer interface to manage food safety risks and corporate social responsibility issues in the food value chain. The analysis is based on empirical research and on literature research related to case studies. Food safety labels are being used by businesses as a risk management tool. CSR labels aim to drive purchasing decisions and behavior change by communicating sustainability performance to consumers at the point of purchase, and by increasing awareness and changing the social norms and expectations associated with products and services.**

***Keywords*: system level innovation, transnational private regulation**

I. INTRODUCTION

This paper seeks to explore the system level innovations in the business-consumer interface to manage food safety risks and corporate social responsibility issues in the food value chain from farm to fork. In particular, this paper explores the current uses and potential expansion of eco-labels as a mechanism for the communication of sustainably produced products. It considers whether eco-labelling schemes are the feasible mode of governance for communication of sustainably produced food, and describes why CSR schemes and eco-labelling has achieved an important role in the regulatory framework that governs food safety and CSR issues, but asks why this role is different or is it in food safety and in CSR issues and in different food value chains (like coffee and fish products).

II. RESEARCH METHODS AND MATERIALS

The analysis is based on empirical research conducted in Finland in 2012 and on literature research related to the case studies in other countries. About 100 semi-structured interviews were conducted for consumers and 15 interviews for the retailers.

III. CONCLUSIONS

The analysis of interviews is in progress at the moment but they will be finalized and discussed in the paper. In Finland eco-labels (CSR labels) are used at all stages of the food chain from the b2b to the consumer communication and as a driver of change of behavior, whereas the food safety standards are used more in the b2b relationships.

So far we have found that food safety labels are being used by businesses as a basis for organizing their business-relationships in food value chain, even when not required by regulation. Using data derived from semi-structured interviews with retailers and other members of the food value chain, this paper argues that the different approach to food safety and CSR is a result of differing ideas about the role that they play in the governance of food safety and CSR, and the different concepts of the role of regulation in securing these issues.

Finally, the paper explores the role of public authorities of utilising private regulation to manage safety risks or CSR issues more generally, and raises further challenges that must be met in order to ensure that CSR and food safety can successfully fulfill its potential as a governance mechanism.

This paper contributes to the research on proactive law and research on the system level innovations. Proactive law is enabling, empowering, dynamic and user-friendly private and public regulations which enable new business opportunities, prevent risks from emerging instead of only resolving problems. The content of the proactive law concept is explained with several examples of private regulation.

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Environmental Management Practices and Firm Performance in South African Mining Firms

Gibson Nyirenda, Cosmas M Ambe, Collins C Ngwakwe
School of Accountancy
University of Limpopo
South Africa
cmambe@hotmail.com Gibbyman2003@hotmail.com

Abstract
This paper is a pilot study of a master of commerce (MCom) research degree on the impact of environmental management practices on financial performance of South African mining firms. This study is pertinent given in part the vulnerability of South Africa to climate change and apparent apathy on the part of firms in developing countries towards the environment. In recent years, remarkable development within the mining industry in South Africa is an unprecedented environmental penchant being exhibited by some mining firms. The major aim of this paper is to investigate if such practices have close relationship with the mining firms' financial performance. The approach is a case study of South African mining firms listed under the socially responsible index (SRI) of the Johannesburg Stock Exchange (JSE). However this pilot study uses the Green-Steel (pseudonym in place of the real name) as a test study. Using the multiple regression statistics, the return on equity of the Green-Steel SA is regressed on three environmental management practices of Green-Steel (carbon reduction, energy efficiency, and water usage). The result shows there is no significant relationship between the variables; and this lends credence to information gathered from Green-Steel environmental reports – that Green-Steel's environmental management practices are driven mostly by desire to abide by regulations and also by moral obligation to use environmental management practices to mitigate climate change impact. It concludes that environmental management practices of South African mining firms may likely be entrenched in proactive rather than reactive strategy and, on ethical obligation as an environmental stakeholder. This finding would be explored further in a main research study of the entire SRI mining firms in South Africa.

Keywords: ***environmental management practices; environmental management; mining firms; financial performance, return on equity.***

I. INTRODUCTION AND BACKGROUND

There are contemporary environmental and ecological problems faced by mining firms within the communities they operate in [1], [2] and [3].This has often resulted in corporate reactive measures to settle environmental problems meted to communities or in cleaning the environment [2]. But firms require proactive environmental management practices (EMP) to curtail the occurrence of environmental problems. South Africa is one of the emerging economies in which ensuing rapid growth has been accompanied by environmental degradation [4]. Consequently mining firms have been critiqued for apparent environmental neglect that contributes to climate change [4] in Africa.

Previous studies [1], [5], [6] found that the level of corporate apathy towards environmental responsibility is high. On the contrary, other researchers have engaged in discovering the drivers to corporate environmental responsibility [7], [8], [9] and [10]. Amongst other reasons, it is found that financial performance tend to motivate firms to embark on environmental management practices [11], [12] and [10]; but these studies were conducted overseas. Environmental related research in South Africa has focused more on disclosure such as [13], [14], [15], [16] and [17], but none of these earlier studies looked into the effect of mining firms' environmental management practices (EMP) on return on equity in the Republic of South Africa. Hence this research has become important to fill this gap; and in doing so; add to existing literature on environmental management practices and firm financial performance from South African perspective.

A. The Problem

Drawing from the above background, there is little prior research evidence regarding environmental management practices (EMP) [waste management, carbon emission reduction, energy efficiency and efficiency in water usage] and their effect on firm financial performance (represented in this study by Return on Equity [ROE]) of mining firms in the Republic of South Africa. But an overview of mining firms in South Africa indicates that these firms have begun to integrate environmental management practices as part of corporate strategy. Hence this study attempts to bridge this research gap and thus proceeds to find whether environmental management practices of South

African mining firms are related to financial performance (return on equity).

B. Research Questions

- Could carbon emission reduction affect firm's return on equity?
- Could energy efficiency affect firm's return on equity?
- Could efficiency in water usage affect firm's return on equity?

Objectives:

Drawing from the research questions, the objectives of this research are:

- To ascertain whether carbon emission reduction may affect firm's return on equity;
- To determine whether energy efficiency may impact firm's return on equity; and
- To evaluate whether efficiency in water usage may affect firm's return on equity.

II. RELATED LITERATURE

Assumptions have been made that environmental management practices (EMP) and firm performance are unrelated and has nothing in common [18]. Most of the existing literature on environmental management practices (EMP) has focused on the relationship between three key factors: the level of corporate sustainability performance, corporate financial performance and the quality of environmental management disclosures [19]. Over the years, different hypotheses have emerged from researchers aimed at addressing the relationship between corporate environmental performance and firm performance. These hypotheses suggest a negative, neutral or positive relationship between the aforementioned variables [10]. One perspective states that there is a negative relationship between the two variables as found in older studies [20], [21] and [11] and more recent studies [12], [22], [23]. A common reason found to cause such a negative relationship is the costs involved in adopting more environmentally friendly practices which results in resource distribution away from investors to external stakeholders such as local communities [21], [11] and [12]. A second view implies that environmental management practices (EMP) and firm performance has no association [24] and [10]. The argument raised here is that this relationship is difficult to ascertain due to the possibilities of numerous intervening influences which pose a challenge for control. This, coupled with inadequate theoretical support was deemed to be too much for anyone to expect a relationship between environmental management practices and firm performance [24]. A more recent suggestion to explain the lack of relationship found in previous studies is failure on the part of early researchers to control for firm size and industry [25] and [26]. However, contrary to these negative findings; other researchers maintain that environmental management practices and firm performance are positively associated [20], [27], [19], [12], [28], [29] and [10].

Previous positive research findings may be summarised as: financial rewards of engaging in environmental management practices outweigh the costs involved in the long run [11] and [12]; investing in environmental management practices may result in improved relationships with stakeholders such as local communities, lenders and governments. Similarly other findings hold that environmental management investment results in improved firm performance by managing stakeholders [10]. Another perspective, also known as the resource view, implies that firms that invest in environmental management practices have superior resources [20], [27] and [28]. Montabon *et al*., [30] in their paper examine the relationship between environmental management practices and firm performance. They established that a significant and positive relationship exists between environmental management practices and measures of firm performance.

A comprehensive study on the impact of waste management and carbon emissions on firm financial performance was carried out by Iwata and Okada [31]. They examine this relationship in Japanese manufacturing firms for a five year period. Using return on equity as one of the measures of firm financial performance, they find that the impact of waste management on firm financial performance is not statistically significant. Montabon *et al.,* [30] also examined the impact of waste management on firm financial performance. They found a significant relationship between waste management and firm financial performance. On the other hand, Iwata and Okada [31] also studied the impact of carbon emissions on firm financial performance. They employed return on equity as one of their measures of firm financial performance and discovered that carbon emission reductions increases long-run firm financial performance. Soyka and Powers [32] studied the effects of energy efficiency on corporate profitability performance. They found evidence suggesting that energy efficient strategies create remarkable new corporate wealth. They also discovered that investments in energy saving programs by firms used in their study resulted in statistically significant positive impacts on their operating margins.

III. METHODOLOGY

This is an initial pilot case study of a MCom dissertation on the impact of environmental management practices on financial performance of South African mining firms listed under the socially responsible index (SRI) of the Johannesburg Stock Exchange (JSE). Hence this study is at its embryonic stage and data used for the first phase of the pilot test has been collected from the Green-Steel South Africa (real name withheld for commercial confidence reason). Green-Steel SA is among the South African mining firms that have positioned environmental concern as an important component of corporate strategy. Green-Steel SA has embraced various environmental management practices to enhance natural resource efficiency and to reduce negative impact on the environment. Some of the environmental management practices of Green-Steel SA includes *inter alia*, water efficiency, energy efficiency and carbon emission reduction.

Using the multiple regression statistics at 0.05 significant levels, the return on equity of Green-Steel SA over a period of nine years is regressed on three environmental management practices (carbon reduction [CE], energy usage [EU], and water usage [WU]) of Green-Steel SA. Data on return on equity and environmental management practices were gathered from various annual and sustainability reports of Green-Steel.

From the pilot analysis in Table 1; result indicates a significant level of 15% (which is above 5%) with an adjusted r-squared of 38%. This therefore shows that there is no significant relationship existing between Green-Steel environmental management practices and its return on equity. But previous research such as Hart and Ahuja [33] and Cohen et al., [34] found positive relationship between environmental management practices and return on equity. Hence some researchers have concluded that financial performance may drive firms' environmental management practices. However, lack of significant relationship from this analysis indicates that Green-Steel environmental management practices may not be driven by potential financial value to the firm or shareholders return on equity. This leaves one to question what major factors drive Green-Steel environmental penchant.

TABLE 1: PILOT REGRESSION RESULT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.7854607
R Square	0.6169486
Adjusted R Square	0.3871177
Standard Error	11.334438
Observations	9

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	1034.574769	344.8583	2.684359179	0.157432596
Residual	5	642.347453	128.4695		
Total	8	1676.922222			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Upper 95.0%*
Intercept	-68.73005	76.19134744	-0.90207	0.408369759	-264.5861416	127.126	-264.586	127.12605
CE	-9.336743	4.90831717	-1.90223	0.115532395	-21.9539736	3.280488	-21.954	3.2804883
EU	5.5047641	3.472156975	1.585402	0.173731421	-3.420699558	14.43023	-3.4207	14.430228
WU	-4.086447	9.691663484	-0.42165	0.690797578	-28.99966108	20.82677	-28.9997	20.826767

Information obtained from financial and sustainability reports of Green-Steel South Africa does not portray financial motive as a driving force to Green-Steel environmental management practices; it shows that Green-Steel environmental management practices is rooted on its concern to meet growing environmental demands and regulations. Additionally it is also encouraging to note that, Green-Steel SA emphasizes that environmental management practice is a moral obligation on the part of the Company.

IV. CONCLUSION

This paper is a pilot study of a MCom research degree on the effect of environmental management practices of South African mining firms on financial performance (represented in this research by return on equity). Return on equity (ROE) is chosen as financial performance indicator given the importance attached to equity growth as a measure of firms' value, and also that investors are concerned about their equity and will be more willing to support environmental practices if such has immediate or latent implication for positive growth of their equity investments. The paper uses the Green-Steel South Africa as a pilot case, and using the regression statistics, return on equity is regressed on three environmental management practices. Against previous research that found positive relationship between environmental management practices and return on equity; the analysis shows no significant relationship between the environmental management practices and ROE of Green-Steel. This leads to a conjecture that other factors apart from impact on equity may be driving Green-Steel environmental practices. Information obtained from the company reports show that Green-Steel environmental management practices is spurred by moral obligation to mitigate climate change impact and by desire to meet growing environmental regulations. The paper concludes

that it may not be in all cases that firms' environmental management practices would be driven by financial motive and that firms may still possess the moral and ethical obligation to curb negative climate impact and to respect environmental regulations. The paper therefore offers agenda for further research on the impact of regulations and ethics on corporate environmental management practices in developing economies.

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Developing Carbon Accounting: Between driving carbon reductions and complying with a carbon reporting standard

Delphine Gibassier[1], Stefan Schaltegger[2]

[1]HEC Paris, 1 rue de la libération, 78351 Jouy en Josas, France

[2] Centre for Sustainability Management (CSM), Leuphana University, Scharnhorststr. 1, 21335 Lüneburg, Germany

E-mail: delphine.gibassier@hec.edu

***Abstract*: Carbon accounting is a relatively new research area. Whereas corporate carbon accounting is important for external stakeholders who expect a true and fair representation of an organization's carbon footprint and efforts in emissions reduction, organizational management issues of carbon accounting are highly relevant with regard to decision making and their influence on what is reported. In contrast to the reporting, stakeholder and regulatory focus, company-internal issues of carbon accounting have so far rarely been investigated in depth. By analysing an in-depth case study of a company's "convergence project" between two corporate carbon accounting approaches, we address questions about what could be considered an effective environmental accounting framework.**

I. INTRODUCTION

Carbon accounting is a relatively new research area and has received particular attention through the development of carbon emission trading markets with issues such as the recognition of carbon trading permits in the balance sheet [1] or the establishment of carbon registers [2]. Carbon accounting has also been studied for different regulatory, professional and societal conditions and applications [3],[4] by highlighting priorities of different stakeholders involved in carbon accounting and standardization processes.

Whereas corporate carbon accounting is important for external stakeholders who expect a true and fair representation of an organization's carbon footprint and efforts in emissions reduction, organizational management issues of carbon accounting are highly relevant with regard to decision making and their influence on what is reported. In contrast to reporting, company-internal issues of carbon accounting have so far rarely been investigated in depth. An exception is the paper of Burritt et al. [5] on carbon management accounting practices in German companies.

II. RESEARCH QUESTION AND CONTRIBUTION

The design of the carbon management accounting approach can be of strategic importance for organizations trying to measure and manage their carbon performance. Managers may expect that carbon accounting helps them identify and assess the potentials of different activities to reduce the company's emissions. This is why this paper examines how different corporate carbon accounting approaches influence the measures of the total carbon footprint of a corporation and the carbon performance representation, and what consequences these approaches have on internally incentivizing carbon emission reduction actions.

This paper aims at contributing to the further development of corporate carbon accounting by examining the carbon management accounting approach of a multinational company (Danone) that attempts to improve both environmental and financial carbon performance and by comparing their approach with the approach proposed by the Greenhouse Gas (GHG) Protocol. We are raising questions about what should be considered an effective environmental accounting approach. Should it only consider criteria which are lent from financial accounting such relevance, completeness, consistency, transparency, accuracy or are additional criteria needed? How can it best support effective and efficient action for reducing the carbon impacts?

III. RESEARCH METHOD

Whereas various standards have been developed to support the accounting of an organization's carbon footprint [6] the GHG Protocol is currently dominant and most widely used [7]. Based on a case study (Danone Stonyfield) we discuss how the application of this carbon accounting standard can be complemented with additional carbon accounting measures to increase its effectiveness in supporting internal management decisions for carbon emission reductions. The process of convergence is analysed and possibilities to link the two accounting approaches are described. With this case study we aim at contributing to the further development of corporate carbon accounting to help organizations in achieving carbon reduction goals and in informing stakeholders with transparent and comparable carbon reports.

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Calculating carbon cost sensitivity of companies using hybrid accounting

Maria Csutora, Imre Dobos
Corvinus University of Budapest, Fovam ter 8., Budapest, H-1093
E-mail: maria.csutora@uni-corvinus .hu

Abstract: **Carbon costs are usually associated with big emitters of CO2 like oil industry, aviation, cement industry etc. Downstream companies purchasing carbon related intermediate goods, however, are also impacted through embedded carbon costs accumulated along the supply chain. After calculating embedded carbon costs for different industries, this current paper argues that rising carbon costs may have higher influence on downstream manufacturers, not associated directly with carbon regulation or carbon costs, than on upstream suppliers.**

I. INTRODUCTION

There is a general agreement in the scientific community about the growing importance of carbon related information, such as energy use or carbon dioxide emission, for manufacturing companies. Carbon constraints may take different forms in companies: input side impacts, e.g. through energy prices, output or in other words emission side constraints, and information demands imposed by consumers.

Energy costs, as well as emission costs and other carbon induced costs, are accumulated along the supply chain. Carbon embodied in purchasing inputs, intermediate products and transportation, sometimes called indirect carbon emission, has a magnitude exceeding that of the direct emission of carbon dioxide. (1), (2).

Energy industry, paper and pulp industry, cement industry and aviation are most closely associated with carbon emission and stand in the focus of climate regulation as far. Spillover impacts of such regulation, however, are numerous. Downstream industries are impacted through purchasing carbon intensive or carbon related intermediate products, like energy, plastics, artificial fertilizers, concrete, or using transport, etc. Substitute products, such as fuel wood also follow the pattern of oil prices directly impacting the price of furniture wood, rarely thought of suffering such effects. Hence, carbon cost effects may be felt throughout industries along the supply chain.

The aim of the research reported in this article is to address the issue of cost implications of carbon embodied in supply chain. In this paper we focus on carbon constraints reflected in rising carbon related input prices and the company costs of climate policy in terms of costs paid for carbon emission allowances.

II. SUPPLY CHAIN MANAGEMENT AND HYBRID ACCOUNTING

The article asks the questions of which companies are most sensitive to such changes and how the vulnerability of companies could be quantified.

Thus the importance of managing carbon costs embedded in intermediate inputs and along the whole supply chain is increasing, while new concepts and methodologies are lacking to respond to this challenge. (3) .

Conceptually, supply chain carbon management aims at managing the carbon impacts for the whole supply chain, comprising the carbon emission of tier 1, tier 2, tier 3, etc. suppliers (4). The network of suppliers, however, becomes increasingly complicated as we involve outer Tiers of suppliers. Confidentiality and data protection requirements at supplier side conflict with the manufacturer's demand for more detailed information. Thus, the ability of supply chain accounting to capture the input requirements along the whole supply chain, is severely limited by the availability of primary data. Very complex networks of a large number of suppliers make the data collection, particularly from tier 2 and tier 3 suppliers onwards, difficult and expensive to manage (5).

Supply chain accounting is capable to capture a part of these costs, but 75% of costs fall outside its domain. (See Figure1). Thus auxiliary methodologies have been developed that enable producers to get a coarse estimate of indirect input requirements, or costs, accumulated by outer tiers of supply chain. This technique is called hybrid accounting or input-output assisted accounting, which is used widespread in life-cycle analysis and life cycle costing of products. It combines physical or monetary input-output information with physical environmental accounts in order to provide an estimate on environmental emission flows that could not be captured directly. Estimates based on macro level economic data are used to approximate indirect emissions of Tier 2, Tier 3 and onwards suppliers. Information from Tier 1 or Tier 2 suppliers should be used whenever this information is available. Combination of direct emission (or input) data with the estimate of indirect emission (or input) gives a picture of total emissions discharged (or input required). This way the impact of prospective environmental legislation and cost changes on the manufacturer can be forecasted.

III. MATHEMATICS OF HYBRID ACCOUNTING OF EMBEDDED CARBON COSTS

The methodology presented below is sometimes referred to as environmentally extended input-output analysis or hybrid accounting, reinvented by Bicknell et al. (6) and refined by Ferng (7). Hybrid accounting builds on calculating the ecological footprint of sectors. The methodology was designed around the combined use of input-output tables and environmental accounts and Leontief (8) was the first to propose it as early as in the 70's. The use of this approach expands worldwide and is widely used for several scenario analysis and sectoral analysis problems (see 9). It was taken up by Eurostat (10) and OECD, but has never been applied for calculating the sensitivity of manufacturers to embedded and hidden environmental costs. The methodology proposed in this paper is novel in this respect.

The term embedded carbon will be used to define carbon input accumulated along the supply chain and assigned to the manufacturer. Total carbon requirement includes both embedded carbon inputs and embedded carbon dioxide.

Carbon cost dependency, on the other hand also takes into account the price associated with carbon input and carbon output.

$$C_{dep} = C_{inp} + C_{em} \quad (1)$$

$$C_{cdep} = v_i C_{inp} + v_e C_{em,} \quad (2)$$

where

C_{dep} total carbon dependency of the company, both direct and indirect, ton,
Ci_{np} embedded carbon input of the company, both direct and indirect, ton,
C_{em} embedded carbon emission of the company, both direct and indirect,
C_{cdep} carbon cost dependency, in EUR,
v_i carbon input price, in EUR,
v_e carbon emission price, in EUR.

Carbon input dependency of a company is defined as the total carbon requirement, embedded in producing one unit of output. Carbon input is measured in tons of carbon, while output in national currency.

$$C_{inp} = c_{inp} \cdot \langle x \rangle^{-1} \cdot (I - R)^{-1} \quad (3)$$

where

C_{inp} vector of total embedded input carbon,
c_{inp} vector of direct carbon input requirements of the enterprise,
x vector of total output of the enterprise,
R matrix of direct material requirements of the enterprise.

The model in this form is an enterprise input-output model. The matrix R is the matrix of the direct requirements of the supply chain. The Leontief matrix $(I-R)^{-1}$ denotes the direct requirements of the supply chain.

Carbon emission dependency is defined as total carbon emission, measured in CO_2 equivalent, involved in producing one unit of output.

$$C_{em} = c_{em} \cdot \langle x \rangle^{-1} \cdot (I - R)^{-1} \quad (4)$$

where

C_{em} vector of total carbon emission reqirements, c_{em} vector of direct carbon emission of the enterprise.

IV. THE EFFECT OF INCREASING CARBON PRICE

The price vector p for output can be given as

$$p = v\,(I-R)^{-1} \quad (5)$$

where v refers to the vector of internal and purchasing prices (value added, intermediate products and carbon) of the firm. The vectors of the prices are assumed known.

$$v = [v_o, v_i, v_c]. \quad (6)$$

v_o is the value added of output, v_i are the internal and purchasing prices for intermediate products, and v_c are the prices for carbon input and carbon emission.

$$p := v(I - R)^{-1} \quad (7)$$

Let us now assume that purchasing and carbon prices increase in a given time interval. Let v_1 be used to indicate the purchasing and carbon prices of the firm while and v_2 is used for the new prices The change of internal, purchasing and carbon price can be written as:

$$p_2 - p_1 = (v_2 - v_1)\left[(I - R)^{-1} - I\right] \quad (8)$$

For price making companies:

$$p_2 = v_2(I-R)^{-1}. \quad (9)$$

For price taking companies:

$$v_2 = p_2(I-R), \quad (10)$$

Hence, the rise of carbon cost would impact either the value added or the price depending on the market position of the company.

The position is most likely between perfect price taking and perfect price making that is a company is able to shift some of the impact of cost rise to others in terms of increasing price, but not able to offset the whole impact. The position between the two extreme cases is influenced by its market position (e.g. monopoly or small share of the market). Thus during the last part of the paper the economic analysis will be combined with market analysis in order give an estimation on the sensitivity of companies to carbon cost rise.

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V. RESEARCH FINDINGS

The example of an energy upstream industry, refined petroleum products, and two downstream industries, automobile industry and computer industry will be used throughout our analysis, of which major input prices are linked to that of fossil fuels, and total input requirements include a high percentage of carbon related inputs.

Two kinds of carbon indicators will be defined: one for input (embedded carbon content of input) and one for output (CO_2 emission from the production process and CO_2 emission embedded in inputs). The two indicators are valued differently. The change in price of embedded carbon content of input follows the price trend of fossil fuels, while the price of emitted CO_2 heavily depends on climate policy. The latter is currently influenced by the Kyoto agreement and the market prices of the Emission Trade System market in the European Union.

CO_2 emission data as well as carbon input data were extracted from the environmental accounts database of Eurostat published online, where all required data are available for each European country. OECD also collects similar data for comparison, thus the analysis could be extended to all OECD countries. Environmental data were restructured in a way that corresponds to the NACE classification of industries in the economic database of Eurostat. Environmental data are available for solid fuel, oil and gas inputs in the same unit, total oil equivalent (toe), for all industrial sectors. For simplicity, we added the inputs for all energy sources and reported the sum in toe, but the same methodology can be repeated for distinctive energy sources in a more detailed analysis.

Then data were combined in the above described way with the industry by industry Symmetric Input Output Table, also published by Eurostat.

Based on SIOT data of Eurostat for Hungary, carbon dependency of selected sectors are presented in Table 1. Carbon input embraces both energy-related and non-energy use of carbon. The latter includes the use of oil and natural gas as raw material for producing plastics and artificial fibres, bitumen in the construction industry and other chemical products. The table indicates that certain downstream sectors accumulate embedded carbon inputs giving up as much as two or threefold of originally assigned value. On the other hand, the embedded carbon input of upstream industries is reduced as compared to direct inputs, as these industries pass on inputs to downstream industries. Embedded impacts add up the same value as total direct carbon inputs, if values for all industries are summed up.

The difference between direct and total carbon input is shocking for the automobile industry, for the furniture industry or for the hotel industry. For them, the level of carbon input costs compared to output and value added is a crucial question, together with the potential of building up rising costs in the price of products.

Data suggest that certain sectors are more impacted on the emission side, while others on the input side. Although the numbers at the emission side are much higher, the associated price impact is much higher on the input side. ETS allowances are recently quite underpriced, although predictions indicate a significant rise in costs in the near future. Thus a combined cost impact must be quantified in terms of percentage compared to net surplus.
Carbon cost dependency, is however only one factor in defining carbon cost sensitivity index. The latter also depends on the ability of sectors to devolve these costs to other economic agents in the supply chain. This ability depends on the price elasticity of the final demand and also on the market position of the sectors.

In case of rising carbon costs there are three possibilities for a downstream sector, like the furniture industry:

- Costs may not increase at all, because fuel industry and wood industry hold prices even when demand increases
- The furniture industry may absorb costs, giving up part of its operating surplus.
- It may devolve it to wholesale or retail industries.

Market structure as well as price elasticity will strongly influence the outcome of such case.
Price elasticity of final demand differs slightly from country to country in case of furniture with averaging around -1.5 (Source: http://www.furnituremanufacturers.net/). Thus the price elasticity in the industry is high. In contrary, the demand for crude oil is highly price inelastic in short run.
In shorter term, low carbon sensitive industries may eat up the operating surplus of highly carbon sensitive industries. Certain downstream industries with low direct carbon usage, but high embedded carbon input may be more vulnerable than upstream industries more often associated with carbon emission.

VI. CONCLUSION

Certain downstream sectors may be very sensitive to carbon constrains due to their weak market position. Contrary to preliminary expectations, agriculture or tourism industries might be more carbon sensitive than the oil industry itself. Certain upstream industries, considered to be very vulnerable to climate change, might be less impacted as they are able to shift consequences on downstream industries. Carbon sensitivity of sectors and companies require a more complex analysis than was supposed as far.

Hybrid input-output analysis combines macro-economic data with micro-level information. Either physical or, if not available, monetary macro-level input-output tables can be used for approximating flows among industries where no micro level data available. Using hybrid accounting, new questions can be imposed and reasonable answered that could not have been addressed using conventional accounting methodology. Such questions include the magnitude of embedded carbon cost of a certain product or the sensitivity of a certain company to increasing carbon prices.

Most countries, e.g. Germany, Finland, Japan, etc. compile detailed input-output tables for the economy, entailing 500-700 sectors. That level of detail makes it possible to extract usable information for certain sectors. Eurostat and OECD regularly publish reduced size tables for all member countries. Thus the methodology presented here can be duplicated for other countries, too.

Hybrid accounting, however, is less useful in companies with high level of value added or with very distinctive product portfolio, quite dissimilar of its industry. It may provide fallacious results when applied, for example, for the bank sector. It is highly relevant, though, for other downstream service industries, e.g. the tourism sector. Although the tourism sector is not a high emitter of carbon dioxide by itself, it purchases high impact transport services and catering from suppliers. Thus the impact of carbon cost rise cannot be neglected for the tourism industry.

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Exploring the corporate reality of sustainability accounting practice

Martin Bennett[1], Stefan Schaltegger[2] & Dimitar Zvezdov[2]
[1] University of Gloucestershire Business School, UK
[2] Centre for Sustainability Management, Scharnhorststr. 1, 21335 Lüneburg, Germany
E-mail: martindbennett@btinternet.com, schaltegger@uni.leuphana.de, zvezdov@uni.leuphana.de

Interest in sustainability and its implications for business has increased steadily since the issue first became topical two decades ago. It is increasingly recognised that sustainability not only poses ethical issues but also has direct implycations for economic performance. The development of the regulatory framework of markets, technical and organisational innovations, and new societal and consumer perceptions, have changed the business context and the determinants of corporate success.

This has implications for the professions that support business, and sustainability management in business has generated demands for new information and adaptations of conventional accounting to support it. There has been substantial research on a range of issues of sustainability accounting, but less is understood of actual practices within companies and how these are developing over time. Answers are needed to questions such as 'what is understood by sustainability accounting in business practice?', 'how is sustainability accounting carried out?', 'who within companies uses the information which is generated, and for what purposes?', and 'what expectations are there of future developments?'.

The Institute of Chartered Accountants in England and Wales (ICAEW) therefore supported this project to research the status of sustainability accounting in business in practice. Given the relative youth of the subject, an exploratory study was made of practice in 16 leading companies, with interviews being conducted with more than sixty managers and other staff involved to explore current practice.

A diversity of different information providers was observed. This diversity can largely be explained as an attempt to reduce existing information asymmetries and imperfections. These can require management to signal to stakeholders that the sustainability aspects of the business are being considered and do not pose a threat to its profitability. This can also be interpreted as a managerial attempt to legitimise activities, to both internal and external actors. Companies which have been involved with sustainability management longer tend to be those which also have more well-established information management systems. A greater involvement of the accounting function is likely to result in more efficient and effective information management practices as these can benefit from the accountant's expertise.

The information collected will vary in accordance with its purposes, though particularly topical information such as climate-related information was reported by all companies to be used due to its higher signalling potential even though there may be little immediate practical application for it. The range and scope of information collected in each company varied widely, but information which did not consume too many resources in its collection and management, such as information that was already being collected in another form such as for invoicing purposes, was reported to be dominant even if not necessarily as useful.

The diverse reasons for collecting information which were reported can also be explained from several theoretical perspectives. In many (though not all) cases diverse information was collected for producing indicators for various purposes in order to improve the efficiency of core activities (e.g. energy management), increase corporate value, or improve corporate reputation. Using sustainability information can also be perceived as a more cost-efficient alternative to other channels of communication, both internally and externally. Several cases of 'thematic coincidence' are also suggested by the results: those departments in whose areas certain sustainability issues are most directly relevant would tend to be in charge of managing them, resulting in a focus on information specifically related to them. For instance, industries that have been particularly exposed to risk arising from suppliers (such as textile and foods) are more likely to involve the procurement department in the task of managing sustainability performance related to these risks.

The users of information can be split into several categories. Typically general and sustainability managers tend to be the ultimate users of information, in order to reduce information asymmetries between them and their subordinates and to legitimise their activities to both senior management and external stakeholders. The pursuit of legitimacy, particularly externally, was also an important reason for the communication department to use such information. The research also found that the activities of the sustainability department within each company are likely to vary depending on its organisational location – for instance, those which were located in their company's communications department tended to focus on the presentation of information rather than on providing information for input into business cases.

The results suggest a wide variety of practice which is still developing rapidly, with a number of emerging trends becoming apparent. These include a tendency for sustainability accounting in a company to become more systematised over time, and an increasing need for sustainability-related information of the same quality and reliability as is expected of other business information, including financial. This suggests a number of areas where further research can support the accountancy

profession in adapting to this new challenge, including the development of a framework for sustainability accounting, ways in which sustainability accounting can be institutionalized and linked with conventional accounting, and the further development of new sustainability accounting tools.

FIGURE 1: HYBRID ACCOUNTING AND SUPPLY CHAIN ACCOUNTING.
(SOURCE: SCHALTEGGER – CSUTORA 2012)

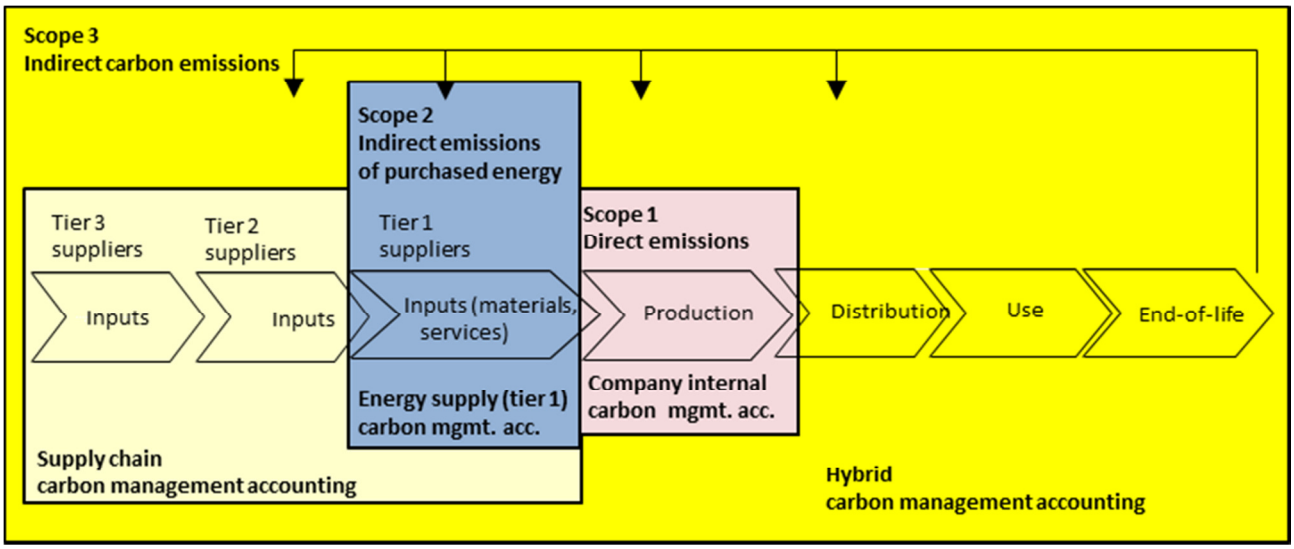

FIGURE 2: CARBON COST DEPENDENCY OF SELECTED SECTORS

	Carbon cost dependency	Direct carbon cost as % of total intermediate consumption	Total carbon cost as % of total intermediate consumption	direct as % of value added	Total as % of value added
Crop and animal production, hunting and related service activities	High	11%	14%	16%	20%
Manufacture of food products, beverages and tobacco products	High	5%	17%	21%	50%
Manufacture of textiles, wearing apparel and leather products	High	3%	19%	8%	67%
Manufacture of wood and of products		6%	17%	14%	48%
Manufacture of rubber and plastic products	Very high	7%	26%	19%	167%
Manufacture of computer, electronic and optical products	High	1%	20%	9%	24%
Manufacture of motor vehicles,	High	2%	11%	7%	44%
Manufacture of furniture;	Very high	4%	138%	9%	168%

Identifying Drivers and Barriers to Energy Efficiency in Steel Industry: Implications for and the role of Environmental and Sustainability Management Accounting (EMA)

Ki-Hoon Lee
*Griffith Business School, Griffith University, Brisbane, Australia
E-mail: ki-hoon.lee@griffith.edu.au

***Abstract*: Since the Kyoto Protocol provided impetus to reduce greenhouse gas (GHG) emissions to control global warming and make the global environment cleaner, Korea (Republic of) offered regulatory and market incentive approaches to reduce greenhouse gases emissions. In particular, emission reduction targets in the nation pressured many industries to meet the required targets, and consider seriously the impacts on business performance. Energy intensive industries such as steel industry would be experienced in a similar way. Energy efficiency is potentially one of the most important and cost-effective means for mitigating greenhouse gas emissions from industries. Industrial energy efficiency is becoming increasingly important from the point of view of both public policy and business management. Despite the availability of cost-effective energy efficiency measures in industries, these are not always implemented, due to various barriers and obstacles to energy efficiency. This research investigates the current status of energy management practices in the Korean steel industry to examine how drivers and barriers to energy efficiency operate, the circumstances in which they arise and the extent to which public policy or organisational change may overcome them. Employing a survey method, the author identified key factors to influence facilitating or hindering energy efficiency management adoptions for steel industry in Korea. The author found that regulatory factors (carbon tax) didn't affect energy efficiency adoption while economic factors (rising energy price, beneficial loans for energy efficiency investments) and organisational factors (top management commitment, corporate reputation, owner's demand) affect seriously.**

I. INTRODUCTION

Climate change is arguably the most challenging collective action problem ever to hit the international society. The institutional development and politics will need to bring a global climate agreement. Furthermore, international agreement on a post-Kyoto protocol to mitigate climate change is another challenge for global community. The issues of energy efficiency or measurement of energy efficiency in industries have risen recently, due to increased concerns about climate change challenges and energy use at local and global level. In particular, rising energy prices, tougher environmental regulations associated with CO_2 emission costs, and customer purchasing preferences regarding energy efficient products and services are important drivers for introducing energy efficiency improvements (Bunse et al., 2011).

With the turbulent environment, there are some industry sectors, mainly energy-intensive sectors including steel, oil, pulp and paper, and chemical industry have made continuous improvement in energy efficiency, economic benefits of energy efficiency potentials. The "energy efficiency gap" debate focuses on the reasons why profitable investments to reduce energy consumption at firm level are not realized in firms (Jaffe and Stavins, 1994; Paton, 2001; Eichhammer, 2004). Since energy management can be rewarding and profitable for companies to embrace environmental and economic sustainability challenges, establishing and implementing an energy management at a firm level can be a way to increase energy efficiency and to reduce the related carbon (CO_2) emissions. Bunse et al. (2011) recently noted the importance of energy management in firm production. In their study, they define energy management as control, monitoring, and improvement activities for energy efficiency.

However, a number of firms still lack of appropriate methods to effectively address energy efficiency, even energy management. Integrating energy efficiency into corporate management is difficult to operate, and current production management seem to have shortcomings in their feasibility and practicability. Energy efficiency is potentially one of the most important and cost-effective means for mitigating greenhouse gas emissions from industry (Rohdin and Thollander, 2006). Industrial energy efficiency is becoming increasingly important from the point of view of both public policy and business management (Sorrell *et al*., 2004; Thollander and Dotzauer, 2010). Despite the existence of cost-effective energy efficiency measures in industry, these are not always implemented, due to various barriers and obstacles to energy efficiency such as split incentives, principal-agent relationships, and information imperfections and asymmetries (DeCanio, 1997; Rohdin *et al*., 2007).

However, researches concerning actual energy management practices in industries with regard to strategic, organizational, and financial issues have been scarce (Rodhin *et al*., 2007; Srivastava and Oyama, 2009; Thollander and Dotzauer, 2010). Therefore, we propose the following research question in this context:
Research Question - What are the drivers and barriers to integrate energy efficiency in corporate management in order to mitigate climate change challenges?

This paper presents the current status of corporate energy efficiency in Korean steel industry. The remainder of this paper is structured as follows: The next section provides literature review and research methodology briefly. This is followed by a presentation of empirical survey findings. We then provide conclusions and implications of this study.

II. THEORETICAL FOUNDATIONS

Climate change poses strategic dilemmas for companies across a range of industries, affecting those that produce fossil fuels (e.g. oil, utilities), depend on these fuels directly (e.g. chemicals, airlines) or indirectly (e.g. automobile and aircraft manufacturers). With regard to climate change and energy efficiency, there are a number of barriers to implementing efficient energy management. These include cost and risk of production disruptions, lack of access to capital, lack of time and other priorities (Rodhin *et al*., 2007; Srivastava and Oyama, 2009; Thollander and Dotzauer, 2010). Industrial energy management is a means to overcoming barriers to energy efficiency. Caffal (1996) found that industries that adopt energy management practices could save up to 40% of their total energy use. Barriers differ depending on regional and sectoral conditions (Sorrell *et al*., 2004), indicating a need for specific regional and sectoral studies to observe these barriers. To understand and overcome the barriers, both organizational and behavioural factors such as energy strategy, top management's vision and leadership, and staff engagement, are important factors to consider (Hoffman, 2005; Lee and Ball, 2006; Lee, 2009) . While a business strategy deals with how corporate top managements try to establish a direction for the organization and include pre-determined actions and goals, reducing energy use and energy costs using industrial energy management could be one of many goals within such a strategy (Mintzberg, 1987; Hoffman, 2005; Lash and Wellington, 2007).

The issues of energy efficiency or measurement of energy efficiency in industries have risen recently, due to increased concerns about climate change challenges and energy use at local and global level. In particular, rising energy prices, tougher environmental regulations associated with CO2 emission costs, and customer purchasing preferences regarding energy efficient products and services are important drivers for introducing energy efficiency improvements (Bunse et al., 2011).

Energy efficiency improvement is an important source of competitive advantage. Although there are variety of available measurement tools and approaches for energy efficiency improvement, these potentials are not fully achieved, creating the efficiency gap debate. According to Levine et al. (1996), the "efficiency gap' is defined as the "difference between the actual energy used to provide energy services and the level of energy efficiency that can be provided in a cost-effective way for the same services." Then, why does the efficiency gap come into existence? Geller (2003) argued that a wide range of barriers limit the introduction and deployment of the energy efficiency throughout the world. He provided some major barriers of energy efficiency improvement (Table 1).

TABLE 1: MAJOR BARRIERS

Major Barriers to the adoption of Efficiency Improvements	
limited supply infrastructure	purchasing procedure
quality problem	pricing and tax barriers
insufficient information and training	regulatory and utility barriers
misplaced incentives	political obstacles
lack of money or financing	

Source: Geller (2003), p.34.

In energy management, arguably there are economic/market, behavioural, and organizational factors which can yield a positive or negative impact upon energy efficiency implementation (Jaffe and Stavins, 1994; Stern, 1984; Howarth and Andersson, 1993; Sanstad and Howarth, 1994; Stern, 1992; SPRU, 2000; Rohdin and Thollander, 2006; Cogan, 2006; Lee, 2010). Table 2 shows the summary of theoretical framework in this study.

TABLE 2: SUMMARY OF KEY FACTORS

	Key Factors
Economic/Market	● Hidden costs
	● Access to capital
	● Risk
	● Imperfect information
	● Split incentives
	● Principle-agent relationships
Behavioural	● Bounded rationality
	● Form of information
	● Credibility and trust
	● Values
Organizational	● Power
	● Culture

III. RESEARCH METHODS

A survey is employed for this present stud. First, a survey is conducted to empirically identify drivers and barriers of adopting energy efficiency in corporate management practices in Korea's steel industry for reducing carbon emissions in the period June ~ August 2011. The sample for the survey is drawn from the Korea Steel Association which 34 in total companies are registered. The questionnaires were sent to senior executives and managers in strategic planning, operations, energy management, production, and environmental/sustainability management departments. The returned, valid questionnaire is 13 (38.2%).

The steel industry is chosen for the survey because this industry is one of the most energy-intensive industries and major greenhouse gases (GHGs) emitters in Korea. Since the steel industry contributes to serious amounts of carbon emissions in Korea, the Korean government and the public have put considerable pressure on the industry to reduce carbon emissions. Also this industry is under tight environmental regulations and industry-wide standards. A measurement instrument is developed based

on the five point-Likert scale reflecting the level of the firm's adoption and implementation.

IV. FINDINGS

With our survey outcomes, we depict our findings in a graphical format (Fig-1 and Fig-2).

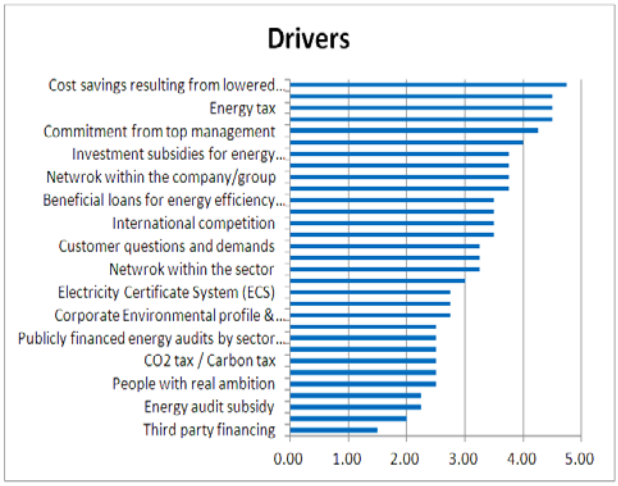

FIGURE 1: DRIVERS FOR ENERGY EFFICIENCY ADOPTION

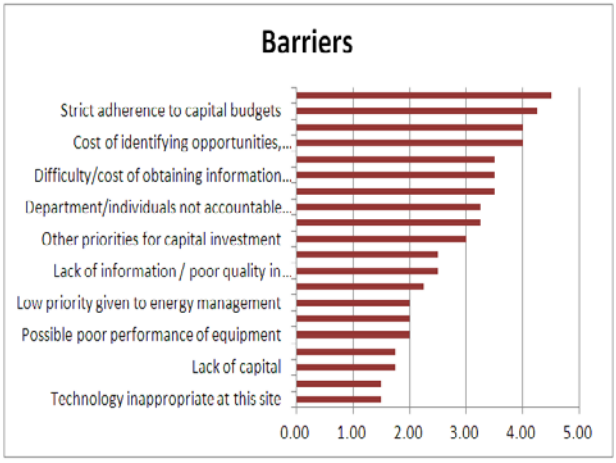

FIGURE 2: BARRIERS FOR ENERGY EFFICIENCY ADOPTION

V. CONCLUSION AND IMPLICATIONS

The results of this empirical study have some important implications for practitioners as well as for policymakers who are responsible for reducing GHG emissions and mitigating climate change. As main drivers for adopting energy efficiency improvements, economic and market factor and organizational factors are major factors for corporate management. That is, cost savings and top management commitments are two main factors. In the meantime, as main barriers for adopting energy efficiency improvements, economic/market factor and behavioural and organizational factors are main factors for hindrance to energy efficiency adoptions. These include capital budgets, opportunity costs and difficulty and cost of obtaining information on the energy management and efficiency. Regulatory factors (carbon tax) didn't affect energy efficiency adoption while economic factors (rising energy price, beneficial loans for energy efficiency investments) and organisational factors (top management commitment, corporate reputation, owner's demand) affect seriously.

This study has some important implications for EMA at organizational level. Although industries and business organizations play a major role in causing and potentially controlling environmental problems, they could also benefit from cost savings and increased productivity through environmental efficiencies, increased resource productivity, and the first-mover advantage (Hart, 1995; Porter and van der Linde, 1995). Environmental and sustainability management accounting (EMA) helps firms to gain those potential benefits (Schaltegger and Burritt, 2000). As part of EMA, eco-control is the application of financial and strategic control approach to corporate sustainability management (Schaltegger and Burritt, 2000). Once energy efficiency is integrated into corporate management system, eco-control can trigger systematic approach to measure, control and improve energy efficiency and energy management at firm level. Since eco-control, as a part of EMA, can be embedded into carbon management, eco-control can contribute to energy efficiency and energy management by providing goal setting and policy formulation, information management, management decision support, control and implementation, and communication under corporate carbon management.

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Glancing into the Applied Tool Box - Surveying Operational Sustainability Accounting Practice

S. Schaltegger, J. Hörisch, and D. Harms
Centre for Sustainability Management (CSM), Leuphana University Lüneburg,
Scharnhorststr. 1, 21335 Lüneburg, Germany
E-mail: hoerisch@uni.leuphana.de

Abstract: **This paper investigates which sustainability accounting tools are applied in corporate practice. Although a multitude of tools can be identified in academic literature and practitioner handbooks, comparatively little is known about which of these sustainability accounting tools are known and applied by companies. The awareness and application of such tools is considered to be inevitable to implement corporate sustainability. Drawing on a comparative survey among large German companies, this paper reveals a growing importance of integrated sustainability accounting tools as well as of specific performance management tools. Based on the survey results, this paper discusses the application of sustainability accounting tools with regard to their function to provide information for managerial decision making and corporate communication. Furthermore, it identifies gaps for future research.**

I. INTRODUCTION

The extant literature describes and evaluates numerous environmental, social and sustainability accounting tools which are applicable in corporate practice (e.g. [1]-[6]). Such tools are developed and provided to tackle the sustainability-related challenges of information needs for processes of decision making and communication ([7]-[10]).

Perrini and Tencati [9] emphasise the importance of the availability of sustainability accounting tools as these tools are useful to monitor and track corporate environmental, social and economic performance. Burritt and Schaltegger's [11] literature review on sustainability accounting moreover portrays the 'critical theory perspective' of sustainability accounting (e.g. [6], [12]) compared to a 'management-oriented perspective'. In line with the second perspective they argue that "corporate sustainability accounting may become a trend if it is accepted that the current tools and methods are the first step in a methodological development process towards sustainability accounting providing useful and high quality information" ([11], p. 833). To map the field of environmental management accounting (EMA) tools, Burritt et al. [3] offer a framework which distinguishes monetary and physical environmental management dimensions according to different decision situations.

So far, however, there is only little research on which of these tools (e.g. eco-efficiency indicators, environmental reports social-cost accounting, sustainability audit) are known and applied in corporate practice (e.g. [13]-[14]), whereas the application of such tools is considered to be supportive or even inevitable to implement corporate sustainability (e.g. [8], [15]).

To overcome the gap between academic considerations and high relevance for corporate practice, this paper discusses the results of a survey depicting which environmental, social and integrated accounting tools sustainability managers are aware of and which are applied in corporate practice. We aim at analysing the companies' interpretation of sustainability accounting and identify areas for future research.

Environmental, social and sustainability accounting tools can help to create information, accountability and transparency as well as support management decisions (e.g. [9], [16]). Our analysis takes a broad view of accounting and considers methods to collect sustainability data (e.g. checklists), to create specific information (e.g. material flow costs) and to manage information with regard to strategy and performance (e.g. sustainability balanced scorecard) as well as sustainability communication (e.g. stakeholder dialogue) and reporting approaches (e.g. sustainability report).

In order to map various tools we suggest a classification referring to the 'dimension of sustainability' which is addressed and to the 'orientation' a tool takes. Whereas the first aspect incorporates the environmental, social, economic as well as the integrative dimension of sustainability accounting tools, the orientation covers whether more specific tools for internal decision making, rather broad internally oriented accounting tools or externally oriented reporting and communication tools are preferred in corporate practice.

II. RESEARCH QUESTIONS

To analyse the companies' interpretation of sustainability accounting and to identify areas for future research, the following research questions are dealt with:

i) Which sustainability accounting tools are known and applied and how has awareness and application developed?

ii) What kind of tools are preferred in corporate practice? Integrated sustainability management tools, which handle all dimensions of sustainability simultaneously, or isolated environmental or social management tools? Tools for internal decision support, performance measurement and management or rather externally oriented communication and reporting approaches? More specific methods or broader, more general approaches?

III. METHODOLOGY

To investigate the awareness and application of sustainability accounting tools, 42 methods which are applicable for sustainability accounting were identified on the

basis of academic literature and practitioner handbooks [1]-[2], [3]-[5], [17].

In a next step, the awareness and application of these tools were tested in two empirical surveys among the 120 largest Germany companies (by revenue) in 2006 and 2010. In 2006 42 and in 2010 31 companies participated in the project (35.0% and 25.8% response rate).

To analyse which kind of tools are preferred in corporate practice, the tools were grouped according to their 'sustainability dimension' and 'orientation'.

The dimension of sustainability encompasses the environmental, social, economic and integrative perspectives of sustainability accounting tools. This categorisation is based on the focus of the tool (social, environmental or economic). Although theoretically not necessary the focus of the tools relates in all analysed practical cases with different units of measurement (e.g. Euro, kg etc.) which the tools use. We identified 5 economically oriented tools with monetary units of economic measurement, 11 environmentally oriented tools with physical environmental measures, 7 socially oriented tools with physical social measures, 12 integrated and 7 partially integrated tools with mixed units of measurement such as Euros per kilogramme (for examples of tools see Table 1).

TABLE 1: TOOLS GROUPED BY DIMENSION OF SUSTAINABILITY

Dimension of sustainability addressed	Examples of tools
Economic (Euro)	Environmental investment appraisal; Environmental shareholder value; Material flow cost accounting; Social cost accounting
Environmental (e.g. kg ; m^3)	Product carbon footprint; Environmental info system; Life Cycle Assessment
Social (count)	Social audit; Human resource (HR) report; Social indicators
Integrated (multiple units of measurement, e.g. Euro/kg)	Sustainability control; Sustainability balanced scorecard; Stakeholder dialogue

With regard to the 'orientation' we distinguish three groups of tools to identify whether more specific internal sustainability accounting tools (instruments), broader internal tools (systems and concepts) or more externally oriented reporting and communication tools are applied in corporate practice. Based on this classification 22 specific accounting tools for internal decision making support, 15 broad internally oriented accounting tools and 6 tools which support external reporting and communication have been identified (for examples of tools see Table 2).

TABLE 2: TOOLS GROUPED BY ORIENTATION

'Orientation'	Examples of tools
Specific sustainability accounting tools for internally decision supporting (instruments)	Environmental investment appraisal; Material and energy flow accounting; Eco Budgeting
Broad internally oriented tools (systems and concepts)	Environmental info system ; Sustainability audit Sustainability audit; Sustainability balanced scorecard
Externally oriented reporting and communication tools	Sustainability report; Stakeholder dialogue; Risk-benefit dialogue

IV. RESULTS

Firstly, the analysis reveals that numerous tools exist of which practitioners are aware of and that the awareness of these tools is still rising. In 2006, 25 sustainability accounting tools were known by at least 50% of the participants, in 2010 this was the case for 32 tools (cf. Figure 1). Simultaneously, the average rate of awareness rose from 53.9% to 58.4%. Furthermore, the number of sustainability accounting tools which were applied increased as well (7 tools applied in the majority of companies in 2006, compared to 12 tools in 2010).

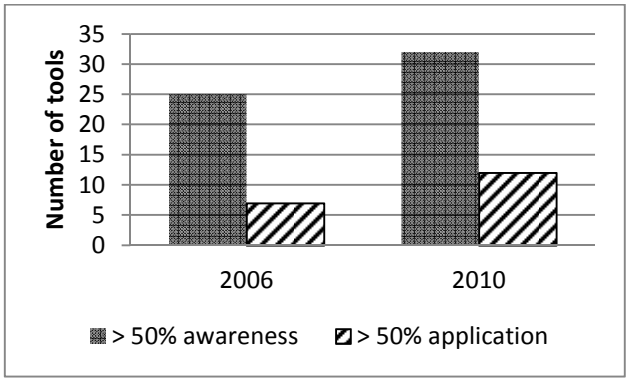

FIGURE 1: CHANGES IN THE NUMBER OF TOOLS WHICH ARE KNOWN BY AT LEAST 50% OF THE PARTICIPATING COMPANIES

Secondly, the overall application increase of tools (+3.6%) is mainly visible as an increase of integrated tools (+10.3%) whereas the application of accounting tools which focus on one dimension of sustainability only (e.g. costs only, environment only, or social only) is more or less constant and in some cases even decreasing. The decreasing application for some tools which solely focus on environmental or social aspects, may be explained by a replacement of these tools (e.g. environmental, social and HR reports) by more integrated tools (e.g. sustainability report) (cf. Figure 2).

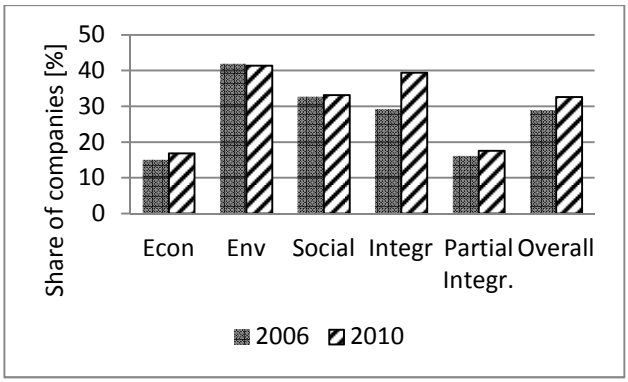

FIGURE 2: CHANGES IN THE APPLICATION OF SUSTAINABILITY ACCOUNTING TOOLS BY DIMENSION OF SUSTAINABILITY

Similar to integrated sustainability accounting tools, the application of specific performance management tools has increased since 2006 (+6.6%). Likewise, broad internally oriented accounting tools (systems and concepts) were applied more often in 2010 than in 2006 (+2.2%). This indicates a growing importance of providing support for decision making and performance management. In contrast, externally oriented reporting and communications tools were applied less in 2010 than in 2006 (-3.2%) (cf. Figure 3).

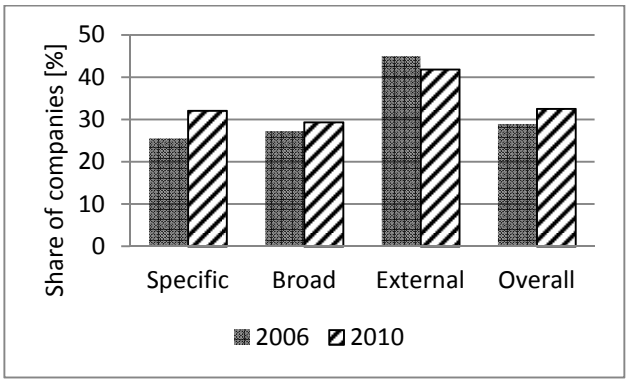

FIGURE 3: CHANGES IN THE APPLICATION OF SUSTAINABILITY ACCOUNTING TOOLS BY ORIENTATION

Summing up these findings, a trend towards integrative tools and specific performance management and sustainability accounting tools can be identified. Although the changes are not very large, this may be interpreted as a change from reporting and communication only to action, or formulated more colloquially an indication for a possible change from "talk" to "walk".

V. DISCUSSION

Our classification of sustainability accounting tools represented on basis of the 'dimension of sustainability' and the 'orientation' is informed by the extant literature which describes a multitude of economic, environmental, social and integrated sustainability accounting tools (e.g. [2], [3]) as well as many tools that are internally (specific or broad) or externally oriented [11], [16].

Firstly, we can expect that companies will start with a limited number of sustainability accounting tools and in the process of a sustainability-oriented organizational development process will *extend the number of applied tools to cover more aspects of managing sustainability information.* As a consequence the number of applied sustainability accounting tools can be expected to increase over time.

Secondly the composition of different kinds of sustainability accounting tools may change over time. Whereas notions like the triple bottom line [18] emphasize that three dimensions (ecological, social and economic) should be considered, much of the sustainability management literature argues that "sustainable development asks for an integrated reflection" ([9], p. 78) of these dimensions. Regarding the *'dimensions of sustainability'* we can therefore conceptually distinguish two consecutive stages to achieve corporate sustainability: the *first stage where economic, environmental or social sustainability accounting tools are predominantly applied separately and independently* from each other to create information for decision support and communication [7]-[10]. In practice a considerable number of such tools support and facilitate particular sustainability efforts such as the environmental investment appraisal (e.g. [19]-[20]), ecological footprint (e.g. [15]) or social audit (e.g. [21]). These sustainability accounting tools are considered to be designed and developed to advance a company's environmental and social performance (e.g. [9]). However, they focus predominantly on just one particular dimension of sustainability and, hence, address only parts of the above mentioned challenges.

As a consequence, companies are also challenged to apply integrated sustainability accounting tools, i.e. tools that address all sustainability dimensions at the same time such as the costs as well as the environmental and social performance of products and production processes. *The second conceptual stage is thus characterized by applying more integrated sustainability accounting tools* and by integrating the information created with more specific social, environmental and economic accounting tools. Taking into account the multitude of sustainability issues and possible corporate goals as well as the associated complexity of information in sustainability accounting it can be rather difficult to apply integrated tools compared to a tool that focuses solely on one dimension of sustainability.

In line with the first expectation of a possible extension of the number of tools, our *findings* show that large German companies have *increased the number of applied sustainability accounting tools* between 2006 and 2010. Concerning the composition of tools, the findings however show that these companies apply *more integrated tools than single focused sustainability accounting tools* in both surveys.

One explanation for this development may be that these companies experience an organizational learning process which includes phases of trial and error as well as, for instance, the opportunity to imitate ([22]-[23]). Once a company has gained experiences in the application of some sustainability accounting tools – irrespectively whether these tools cover one, several or all dimensions of sustainability – the involved actors can be expected to realize deficiencies and to search for more integrated

methods. At the same time these actors may have gained some practical knowledge in sustainability accounting which can be transferred to other, possibly more challenging tools.

A second possible reason for the increased use of integrated tools may be that these companies are increasingly asked to consider all sustainability dimensions at the same time. Both, internal (e.g. management; employees) as well as external stakeholders (e.g. non-governmental organisation (NGOs), media) may more often require information which, for instance, is created in stakeholder dialogues or with a sustainability balanced scorecard (e.g. [9], [11]).

With regard to our *analysis of the 'orientation' of the applied sustainability accounting tools* we distinguish to what extent *specific* (instruments) or *broader* (systems and concepts) internal sustainability accounting tools or *externally oriented* accounting and reporting tools are applied. Whereas internal tools are directed towards supporting management in decision making and in creating internal accountability for sustainable development externally oriented sustainability accounting methods focus on creating transparency and accountability for external stakeholders to evaluate the company's environmental and social impacts. Depending on the management rationale an "inside-out" approach (from an internal logic to external communication) or an "outside-in" approach (from external reporting to internal responsibility management) may guide the organizational development over time whereas the "twin-track approach" tries to combine both development perspectives ([10], [16]). Furthermore, specific sustainability accounting instruments (e.g. eco-budgeting) are in many cases particularly useful on an operational level whilst broader sustainability performance management approaches (e.g. sustainability balanced scorecard) provide higher management with information and facilitate strategic decision making.

The simultaneous increase of the application of specific as well as broad internal tools implies for the analysed time period that sustainability accounting has been developed and implemented in large German companies mainly to support informed decision making on the operational as well as the strategic level whereas external communication has not been of an equivalent development focus.

VI. Conclusions for Future Research

The findings and analysis suggest several areas for further research. Firstly, an in-depth analysis seems useful of why different sustainability accounting tools are applied in a company. In this context, enablers and barriers (e.g. know-how; affectedness by sustainability issues) of the use of these tools may be identified. Secondly, the results provoke the question of how the different sustainability accounting tools should be characterised in terms of, for instance, practicability, flexibility or cost effectiveness (e.g. [24]-[25]) in order to be applied. A third area for further research could investigate possible differences of the awareness and application of tools between large companies and small and medium-sized enterprises or between different countries (e.g. [9], [26]). Fourthly, methodological gaps and whether a need for developing additional sustainability accounting tools exists may be analysed.

VII. Outlook

Our empirical investigation reveals that the number of sustainability accounting tools is increasing. This documents the growing importance for large companies to collect sustainability data, create and manage specific sustainability related information as well as to communicate and report this information. The relatively larger application increases for integrative and specific internal decision support tools indicate that the integrative management of sustainability issues and management decision support have been a priority in the sustainability accounting development in corporate practice.

The relatively large changes during the time span of only four years furthermore stresses that the development of a "set toolbox of sustainability accounting methods" to be applied in corporate practice does not yet exist. Sustainability accounting and its tools are still in development.

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Raising Environmental Accountability: The Impact of Corporate Social Responsibility Framework (CSRF) on Reporting Practices

Haslinda Yusoff, Siti Nurhazwani Kamarudin and Normahiran Yatim
Accounting Research Institute & Faculty of Accountancy, Universiti Teknologi MARA, 40450 Shah Alam, MALAYSIA
E-mail: hasli229@salam.uitm.edu.my

***Abstract*: This study aims to examine the environmental reporting practices of companies in Malaysia, before and after the introduction of Corporate Social Responsibility Framework (CSRF). Specifically, this study examines the level of extensiveness of environmental disclosures and the potential influencing factors comprising of industry sector, ISO certification, size and profitability. The study conducted content analysis on the corporate annual reports of 50 top publicly listed companies. The findings of this study offer evidence that regulatory initiative represents a powerful mechanism in promoting environmental accountability via reporting practices amongst companies in Malaysia.**

Keywords: environmental reporting, accountability, corporate social responsibility framework, influencing factors, Malaysia

I. INTRODUCTION

The development of CSRF marked an important journey for Malaysian companies towards greater CSR (including environmental) accountability i.e. acting responsibly and reporting related information to various interested parties. In relation to that, this study seeks to (1) examine the level of extensiveness of environmental disclosures and (2) identify the potential influencing factors of environmental reporting, before and after the introduction of the CSRF.

II. LITERATURE REVIEW

Mandatory disclosure requirements have great impact on the level and quality of corporate environmental disclosure [1] hence greater environmental accountability. Environmental attitudes within the Asian region are often formulated and shaped more by government policy rather than individual initiatives [2] [3]. With the increased awareness among the Malaysian public on environmental issues as well as the new regulatory requirements imposed, companies are expected to exercise greater environmental disclosure in order to appear more legitimate and to fulfil demands from stakeholders.

III. RESEARCH METHODOLOGY

Content analysis is performed on the annual reports of 50 top public listed companies for the period before (2002 and 2003) and after (2009 and 2010) the introduction of CSRF. A disclosure index score consisting of 24 items of environmental disclosures is used to measure the quantity and quality of the disclosures [4]. Multiple regression analysis is also performed based on the following equation:

$$EnvScore = \beta0 + \beta1(Industry) + \beta2(ISO) + \beta3(MarketCap) + \beta4(TotalAsset) + \beta5(ROA) + \beta6(NetMargin) + \varepsilon$$

IV. MAIN FINDINGS

The results of the study reveal that there is a significant increase in the level of extensiveness of environmental reporting practices between the two periods of study. Refer Figure 1 below.

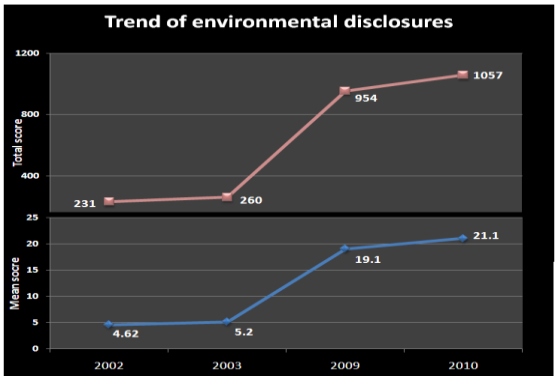

FIGURE 1: TREND OF ENVIRONMENTAL DISCLOSURE FOR THE PERIOD BEFORE AND AFTER THE INTRODUCTION OF CSRF

Based on the mean score, the most disclosed environmental information by public listed companies in Malaysia is found different for the period before and after the introduction of CSRF. Similarly, the analysis suggests the differences in the factors that influence environmental disclosures before and after the introduction of CSRF; i.e. ISO 14001 certification and profitability for the pre-period and only ISO 14001certification for the post-period.

V. CONCLUSION

Overall, it can be concluded that regulatory initiative such as CSRF represents a powerful mechanism in promoting environmental accountability amongst companies in Malaysia.

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Locally identifiable financial environmental items

M. Suutari
Aalto University School of Business, Runeberginkatu 14-16, 00100 Helsinki, Finland
E-mail: Minna.Suutari@aalto.fi

***Abstract*: The aim of this comparative content analysis study was the existence of environmental financial disclosure information longitudinal years 2010 and 2011. The interest was in the locally identifiable financial environmental information, which the environmental items consisted, and the integration with voluntary sustainability reporting. The overview from according to the GRI-framework reporting conglomerates was that the locally or geographically identifiable environmental items were not common in the audited parts of the financial statements and the integration was not common although there already were enterprises using references between reporting types.**

I. INTRODUCTION

Sustainable investing or sustainability-oriented private shareholders have increased their importance as drivers towards longer-term view and environmentally and socially healthier development. The highly diversified ownership portfolios can mean that externalised costs are detrimental to other firms and can end to circulate back to own liability [14] [15]. Awareness of the cross-sectional and universal ownership structures of the enterprises generating e.g. future pensions may enhance the coalitions between different stakeholders and beneficiary views. Management need incentives and support when considering the competition settings and the environmental consequences of the business operations. As the Phopal disaster in 1984 with up to 30,000 casualties indicates; what has been once polluted is not easy to repair:

06/26/2012:
http://www.spiegel.de/international/world/germany-plans-to-dispose-of-bhopal-toxic-waste-a-840791.html

"About two weeks ago, almost 28 years after the accident, a group of cabinet ministers in New Delhi decided to sign over the disposal of the toxic waste …

The 350 tons that we intend to dispose of now are just the tip of the iceberg, says Hans-Hermann Dube, the South Asia director for GIZ International Services, headquartered in the Indian capital. In truth, as Dube points out, the entire former Union Carbide plant is a case for special waste disposal. The problems associated with contaminated ground water, which still affect Bhopal residents today, are another issue altogether."

The incidents do not have to be that serious, for local community minor toxic or biological exposures can cause difficulties. The global, regional and local stakes are estimated to be high. Publicly listed usually multinational companies cause over one-third (35%) of global environmental externalities annually. The largest 3,000 public companies caused over US$ 2.15 trillion of global environmental costs in 2008 [23]. According to the World Economic Forum [27] one of the key barriers to communication between Environmental, Social and Governance (ESG) issues and corporate financial performance is lack of clarity on which ESG factors are financially material and over which time frame.

In the financial reporting context material information refers to a principle that the statements of financial position should include all material and relevant financial implications (e.g. [4] [16] [25] [23]). From the perspective of e.g. large institutional investors the ESG issues are material as they affect the portfolio's value. Global Reporting Initiative (GRI) -voluntary basis sustainability reporting framework defines that material information reflects the organization's significant economic, environmental, and social impacts or would substantively influence the assessments and decisions of stakeholders. E.g. De Villiers & Van Staden ([7] [8]). surveyed individual shareholders in Australia, the UK, the US and South Africa regarding publicly available corporate environmental disclosures. They found support for requirements of more specific, audited environmental information for investment decisions.

An audit is an independent third party revision of the financial statements and of the accounting and governance procedures generating the disclosures. Laws regulating forms of enterprise requires directors to present to the owners' annual general meeting financial statements and other possible reports required by the national laws. Auditors are responsible for auditing in accordance with accounting and auditing laws, regulations or generally accepted standards to give an opinion whether the financial statements give a "true and fair view" (EU wording) or "are presented fairly in all material respects"(U.S. wording). Auditing involves usually sample basis testing of transactions or items with acceptable level of detecting misstatements.

Brennan & Gray [4] examined the relevance of materiality judgments in financial reporting and auditing. Materiality decisions are made by preparers and auditors. Thus judgments of users of financial statements are central to the definition, although the accounting profession as preparers make the judgments. Often definitions of materiality refer to users' ability to utilize information as being reasonable investor/person or average prudent investor. Chiang & Northcott [6] noted that also among the auditor profession a driver of change towards more inclusive environmental accountability, reporting and auditing is increased normative pressure.

The GRI announced in 2010 a goal for convergence of financial reporting and ESG reporting by 2020. In the US incorporated the Sustainability Accounting Standards Board (SASB) in 2011. The purpose of SASB is to establish industry-based sustainability standards for the recognition and disclosure of material ESG-impacts by

companies traded on U.S. exchanges. Material information in context of SASB is defined as information, which represents a substantial likelihood that its disclosure will be viewed by the reasonable investor as significantly altering the total mix of information made available. Decision-useful information provides a basis for action by companies, investors, regulators and the public in addressing environmental, social and governance issues (c.f. [20]). For its part European accountants agreed about the demand for improved information of sustainability performance as well as impacts and interdependencies [11].

Accounting issues and interconnectedness has been seen for a long time as a possible way to advance both enterprises' accountability and practical efforts regarding sustainability (e.g. [12] [21] [9] [2] [19] [1] [5] [25] [2]). The financial annual reporting includes the financial statements and relevant notes, the audit report, management's analysis, and other communications (e.g. International Accounting Standards (IAS 1.10). Reports that are presented outside of the financial statements – including financial reviews by management, environmental reports, and value added statements – are outside the scope of e.g. International Financial Reporting Standards (IFRS).

The EU has adopted the IFRS since 2005. Domestic US stock exchange listed SEC registrants are required to use US GAAP and are not permitted to use IFRSs. Other IFRSs adopted countries are e.g. Canada, Australia, New Zealand, South Korea; South American countries like Argentina, Brazil and Chile as well Middle East countries like Kuwait, Dubai – United Arab Emirates and Israel. Countries considering IFRSs for use of listed companies include e.g. China, India, Japan, Malaysia, Russia, and United States (IAS Plus Deloitte Global Services Limited, Feb 28 2012; PricewaterhouseCoopers LLP, 2011; Cabrera, 2008; [3] [24]). For local use the aggregated financial information can be problematic. As Muyot [22] notes there is demand for also disaggregated publicly available information for local or regional stakeholders, asset managers and investors.

II. OBJECTIVE

The objective of this explorative comparative content analysis study was the existence of environmental financial disclosure information longitudinal from years 2010 and 2011. The interest was in the locally identifiable information that the environmental items consisted and the integration with voluntary sustainability reporting. The aim was to explore how far integrated information the outside shareholders or stakeholders can receive from the public disclosures and what kind of incentives the independently audited mandatory financial disclosures may facilitate enterprises' management.

In this study there were multinational enterprises; reporting voluntarily about their actions according to the Global Reporting Initiative (GRI) framework. The business line was Conglomerates, whose businesses itself consists multisectoral operations.

III. DATA AND METHODOLOGY

The source of empirical data was via the Internet publicly available register of the Global Reporting Initiative Reports List (http://www.globalreporting.org). The financial statements published by Conglomerate sector enterprises at the highest application level A+ and B+ (GRI G3 Guidelines with external assurance) in publishing year 2010 were included (N=18). As comparison data were utilized enterprises' web published GRI Reporting Framework -based reports from the same publishing year as the financial reports. The enterprises, which published financial statements in English language, were included only. Enterprises without web published externally independently audited financial statements were excluded. As follow-up data was considered reports from publishing year 2011 (reports total N=36).

The reports were inspected with the search-function of the Adobe Acrobat Reader. At the beginning the independent auditors' reports were examined to get information of audited sections. This study is limited to directly stated environmental items concerning the effects of enterprises' own production and accounting items in their financial statements. Environmental solution oriented business lines are vital when the enterprises tries to solve the problems of environmental externalities. This study, however, concentrates to the accounting items concerning the enterprises' own production as a reporting unit. Also separately mentioned Green house gas emission related items are not included in this study. All the data collection and analyses were carried out by the author.

As comparison data were utilized enterprises' web published GRI - reports from the same publishing years as annual financial statements. Searched GRI Environmental Performance Indicators were EN28 Monetary value of significant fines and total number of non-monetary sanctions for non-compliance with environmental laws and regulations and EN30 Total environmental protection expenditures and investments by type. These were among the indicators, which could directly be linked to the monetary based financial statements.

IV. FINDINGS

The findings from the two year longitudinal study of GRI-reporting conglomerates were that few enterprises whose reporting criteria were at the highest application level A+ or B+ (enterprises total N=18; reports N=36) presented extensively environmental details in their audited financial statements. The notes were the most common sections embodying environmental items. One enterprise showed environmental items on Balance Sheets, Income Statement and Cash Flow Statement; four enterprises presented environmental issues on their audited Management or Directors' Report and.

A. Environmental items presented in the Consolidated Balance Sheets, the Statements of Income and the Statements of Cash Flows

Environmental items presented in the Consolidated Balance Sheets:
Mitsubishi Materials Corporation and Consolidated Subsidiaries, March 31 2011 and 2010, page 25.

	Millions		Thousands
…	2011	2010	2011
Reserve for environmental measures …	¥5,235	¥8,170	$62,966
Total long-term liabilities…	¥572,321	¥662,430	$6,883,006

Environmental items presented in the Statements of Income:
Mitsubishi Materials Corporation and Consolidated Subsidiaries, March 31 2011 and 2010, page 26.

	Millions		Thousands
	2011	2010	2010
Net Sales (Note 16)…	¥1,333,992	¥1,119,448	¥1,659,286
Provision for environmental measures …	-	¥ (654)	-

Environmental items presented in the Statements of Cash Flows:
Mitsubishi Materials Corporation and Consolidated Subsidiaries, March 31 2011 and 2010, page 27.

	Millions		Thousands
	2011	2010	2011
(Decrease) increase in provision for environmental measures	¥(2,934)	¥(4,394)	$(35,295)
Net Cash Provided by Operating Activities …	¥115,111	¥45,400	$1,384,387

Environmental items presented in the audited management report:
One A+ level GRI-reporting conglomerate and three B+ level GRI-reporting conglomerates presented information in their audited management report. Items with environmental content included merely qualitative reporting. The information included general information of enterprise's efforts towards sustainability management and integration in the organization; monitoring tools; audits; supply chain management; eco-efficiency analyses; research and development; environmental, safety and risk management; definitions of environmentally sensitive areas, donations for environmental programs; as well strategies and business oriented solutions and possibilities etc. Quantitative financial related environmental items in money terms presented one B+ GRI-reporting conglomerate.

B. Environmental items presented in the notes

The notes to the financial statements were the most common sections embodying environmental items in quantitative money terms. The information reported in the audited parts of annual reports was commonly liability or cost oriented. There were no income related items (solution business unit reporting excluded in this study). Not every enterprise presented environmental issues in the notes for the accounting policies (see Appendix 2).

C. Environmental items with local information presented in the audited financial statements

Three conglomerates reported environmental items with explicitly identifiable local details in the audited management report and four conglomerate presented environmental items in the notes:

Audited management report:

Bayer AG 2011 Page 118 'Apart from our offerings to customers, we are also implementing the ecb program within the Bayer Group itself. At the end of 2010, for example, we completed another Bayer building as part of the ecb Program, this time at Bayer's site in Greater Noida, India.'

Evonik Industries AG, 2011 P. 67 'In 2010 capital expenditures were divided among a large number of smaller measures. For example, a new process control system for the monitoring and treatment of wastewater was installed at the Wesseling site in Germany, while various clean air measures were undertaken at the sites in Lülsdorf, Rheinfelden and Steinau (Germany).

Operating costs for environmental protection in the Chemicals Business Area were €264 million in 2010 (2009: €259 million). This increase was principally due to the inclusion of the site in Tippecanoe (Indiana, USA) …'

Norsk Hydro ASA 2011 Page 12, 'The reduction was mainly due to the closure of the Søderberg lines in Norway and reduced production in Neuss, Germany. In total, we produced 247,191 mt of waste, of which 45 percent was classified as hazardous waste.'

Audited notes:

Locally identifiable environmental items concerning accounting policies were reported by one conglomerate in the notes and liability related three conglomerates:

Mitsui Materials Co. 2011 Page 33 Note 2 Summary of Significant Accounting Policies: '(m) Reserve for Environmental Measures

Reserve for environmental measures is provided for future payments for waste disposal, and to clean up soil contamination at Omiya Environmental Management Center (the Central Research Institute formerly, Saitama, Saitama Prefecture) site, Kaihatsu Board Co., Ltd. ….'

Liability related

L DuPont plc 2011 / Danisco delisted 2011

19. Commitments and contingent liabilities

P. F-28 'Environmental Actions

Of the total accrual, $4 is to fund DuPont's obligations under agreements with the U. S. Environmental Protection Agency (EPA) and the New Jersey Department of Environmental Protection. …'

Suez Environnement S.A. 2011 Page 276, NOTE 26 – LEGAL AND ARBITRATION PROCEEDINGS; '…On October 20, 2008, at the request of the Department of Justice (DOJ) of the State of Indiana, the facilities managed by United Water underwent an inspection with a

view to seeking evidence of possible environmental damage.'

The presentations of environmental solution oriented business units or possible future of these operations did not included in this study.

D. Environmental monetary indicators in GRI–based sustainability reports

The findings from the Conglomerates' GRI - voluntary based reports were that from the outside stakeholder point of view there was difficulties to detect or compare the material environmental information from the pages of the voluntary sustainability reports to the mandatory financial statements or vice versa. It seemed that there was apparent variety between the enterprises' reporting integration patterns (see Appendix 1).

V. CONCLUSION

The aim of this comparative content analysis study was to explore the existence of environmental financial disclosure information longitudinal years 2010 and 2011. The main interest was in the locally identifiable information that the environmental items consisted and the integration with voluntary sustainability reporting. As comparison data were utilized web published voluntary GRI -framework based sustainability reports from the same reporting periods.

The environmental issues seemed not to be always material enough for reporting concerning the enterprises' financial position at the highest application level A+ or B+ (GRI G3 Guidelines). The notes to the financial statements were the most common sections embodying environmental items. The overview was that the locally or geographically identifiable environmental items were not common in the audited parts of the financial reports.

The direct link or reference between the financial reporting and sustainability reporting was not common. As Faux [10] notes issues of materiality are further complicated when expanding reporting function not only to the financial and economic perspectives but also in the point of view of the decision usefulness to assess the environmental sustainability.

The subject is prominent as there are over 75,000 multinational companies with strong global business operations [22]. Investors, societies and local communities may especially in this economic turmoil time call for information about the corporate strategic imperatives and the incentives concerning the environmental issues.

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APPENDIX 1: GRI CONGLOMERATE ENTERPRISES, SUSTAINABILITY REPORTS PUBLISHED IN 2010 A+ AND B+ LEVEL GRI-REPORTING

Name of reporting unit (N=18)	Year	GRI-Level	EN28 Monetary value of significant environmental fines	EN30 Total environmental protection expenditures and investments by type	Relation to the audited sections of financial statements
Bayer AG	2010	A+	Reference to the financial statements	0	Partly identifiable in the notes
	2011	A+	Reference to the financial statements	0	Partly identifiable in the notes
Danisco A/S	2010	A+	1[2]	1	Not separately identifiable in the sections
DuPont plc / Danisco A/S delisted	2011	B	0	2	Not separately identifiable in the sections
Fluidra S.A.	2010	A+	1[2]	2	Identifiable in the notes
	2011		1[2]	2	Identifiable in the notes
ITC Limited	2010	A+	1[2]	0	0
	2011	A+	1[2]	0	0
Larsen & Toubro Ltd	2010	A+	1[2]	0	0
	2011	A+	1[2]	0	0
Mahindra & Mahindra Limited	2010	A+	1[2]	0	0
	2011	A+	1[2]	0	0
Mitsbishi Materials Co	2010	A+	1[2]	2	Not separately identifiable in the audited sections
	2011	A+	1[2]	2	Not separately identifiable in the audited sections
MRCB Malaysian Resources Corporation Berhad	2010	A+	1[2]	0	Not identifiable in the audited sections
	2011	A+	Reference to the financial statements[4]	0	Not identifiable in the audited sections
Pirelli & C. SpA	2010	A+	1[2]	2[3]	Not identifiable in the audited sections
	2011	A+	1[2]	2[3]	Not identifiable in the audited sections
Reliance Industries Ltd	2010	A+	1[2]	2[3]	0
	2011	A+	1[2]	2[3]	0
The Siam Cement Public Company Ltd.	2010	A+	1[2]	2[3]	0
	2011	A+	1[2]	2[3]	0
Efacec Capital S.G.P.S., S.A.	2010	B+	0	0	0
	2011	B+	0	0	0
Evonik Industries AG	2010	B+	0	0	0
	2011	A+	1[5]	0	Not separately identifiable in the audited sections
Georg Fischer Ltd	2010	B+	1[2]	2	Not separately identifiable in the audited sections
	2011				
John Keells Holdings PLC	2010	B+	1[2]	0	0
	2011	B+	1[2]	0	0
Norsk Hydro ASA	2010	B+	0	0	0
	2011	B+	0	Reference to the financial statements	Identifiable in the notes
Suez Environnement S.A.	2010	B+	2	0	Not separately identifiable in the audited sections
	2011	B+	2	0	Not separately identifiable in the audited sections
Trelleborg	2010	B+	2	2	Partly identifiable in the notes
	2011	B+	2	2	Not separately identifiable in the audited sections

[1]Direct reference to Annual report. [2]No significant fines or non-monetary sanctions. [3]Total budjet indentifiable. [4]Reporting towards mentioned target stadards or iniatives. [5]"Not reported." If there are risks arising from litigation and other claims, these are disclosed in the consolidated financial statements in our Annual Report.'

Environmental Management Performance Measurement – Toward a Sustainable Economy

Collins C Ngwakwe
School of Accountancy
University of Limpopo South Africa
Email: collins.ngwakwe@ul.ac.za; ccnijb@hotmail.com

Abstract: **This paper suggests an integration of environmental performance measurement (EPM) into conventional divisional financial performance measures as a catalyst to enhance managers' drive toward cleaner production and sustainable development. The approach is conceptual and normative; and using a hypothetical firm, it suggested a model to integrate environmental performance measure as an ancillary to conventional divisional financial performance measures. Drawing from Vroom's motivation theory and other extant literature; corporate goals are achievable in an environment where managers' efforts are recognised and rewarded. Consequently the paper suggests that environmentally motivated managers are a key to propel corporate sustainability strategy toward desired sustainable economic development. It highlights that managers' environmental motivation may be enhanced if environmental performance is measured. Hence the paper suggests a measure of managers' environmental performance, which this paper refers to as environmental value added (EnVa). Thus this suggested approach modestly adds to existing environmental management accounting (EMA) theory and literature. It is hoped that this paper may provoke scholarly debate and, as well provide an agenda for further research toward a practical application of the suggested method in a firm.**

Key words: environmental management accounting, environmental performance measurement, sustainable economy, environmental accounting, management accounting.

I. INTRODUCTION

Industrial activities are widely believed to contribute to contemporary environmental [1]. In certain instances, firms approach to dealing with pressure for environmental responsibility may be described as environmental politics 2] where firms preferred to lobby against national and international environmental and or climate regulations. However given growing environmental problems with concomitant climate change, societal pressure, regulations and consumer green awareness; firms are beginning to recognise the business implications regarding changing environment and or/climate with attendant impact on corporate competitive positioning [3]. Consequently environmental agenda is fast becoming part of modern corporate strategy [3]. Thus aside from traditional economic profit goal to satisfy shareholders' interest, corporate responsibility has expanded to also include the satisfaction of environmental demands. This expansion in corporate responsibility also means that managers' responsibility has been expanded from divisional profit goal to also include divisional environmental performance. This is important given that a corporate entity may not achieve desired environmental performance without mangers' environmental goal congruence. However, management accounting literature recognises the shortcomings of traditional managerial performance measurement systems as not holistic in capturing actual managerial performance; hence suggestions such as the balanced score card has emanated to improve managerial performance evaluation. However, with the expanded responsibility of the firm toward the environment, environmental management accounting (EMA) literature has been silent on the implication of environmental performance on managers' performance evaluation. This paper seeks to bridge this gap by proposal how managers' environmental performance may be recognised through performance evaluation.

Therefore the question that motivates this paper is: how may managers' environmental performance be integrated into conventional managerial performance measurement systems, and how would such integration affect managers' environmental drive? Consequently the objective of this paper is to suggest a model to integrate managers' environmental performance into conventional performance measurement systems.

This paper is deemed significant given that the journey towards corporate environmental responsibility has not been easy as firms have been accustomed to traditional economic goal; therefore corporate environmental performance has to be driven by managers, and managers' environmental goal congruence may be motivated if environmental performance of managers is

recognised. This is pertinent given that environmental performance is also becoming a critical factor upon which firms are measured by socially responsible [4]. The next section of this paper presents a brief literature; this is followed by a presentation of suggested method; the paper ends with conclusion.

II. RELATED LITERATURE

According to Kaplan and Norton [5] "what you measure is what you get". Although this 1992 research proposition by Kaplan and Norton was centred around balanced score card as a measure that drives performance; nevertheless this assertion has an implicit managerial performance measurement implication toward divisional environmental management. In their study, balanced score card is seen as an amalgam of performance measures (aside profit) that drives corporate competitive strategy such as customer orientation, response time, quality, teamwork, new product development, long term view of corporation and avoidance of sub-optimisation [5]. Concurrently extant literature supports the view that performance evaluation gingers managerial motivation to high effort and goal congruent toward corporate goal. But this would depend on the fairness [6], [7] of performance measures. Achieving consistency, accuracy and justice in performance evaluation is an overwhelming concern to researchers [6], [7]. This disquiet is even more pronounced given growing interest and expansion of corporate strategy toward environmental orientation. Hence it has been suggested that since sustainability is becoming a vital aspect of corporate goal [8], [9]; performance evaluation should be made to recognise divisional environmental and/sustainability management practices [10], [11], [8]. Thus experts believe that accountants' focus on financial profit measure may constitute a setback to the notion of sustainability; but addition of environmental factors is pertinent to propel desired sustainable economic development [12], as non-financial measures may enhance a fairer evaluation of divisional managers [13], and the satisfaction of managers [14]. Consequently scholars have recognised that management control systems impact environmental performance [15], [16]. This paper therefore attempts to suggest how divisional environmental performance may be integrated in performance evaluation to enhance fairness in performance evaluation and to motivate environmental and sustainable business practices of divisional managers.

Theoretical Framework

This paper is rooted on the motivational theory of Vroom [17], which emphasizes that managers' effort is driven by expectations of recognition and reward and that such expectations, if met, promote motivation to higher achievements. Hence motivation, aside from skill is widely recognised in management literature as a factor that drives mangers and/or workers to achieve corporate goal [19], [20]. Consequently this paper reasons that since contemporary corporate objectives includes environmental sustainability, managers environmental goal congruence may be enhanced if divisional managers' environmental efforts are recognised in addition to financial efforts.

III. METHODOLOGY

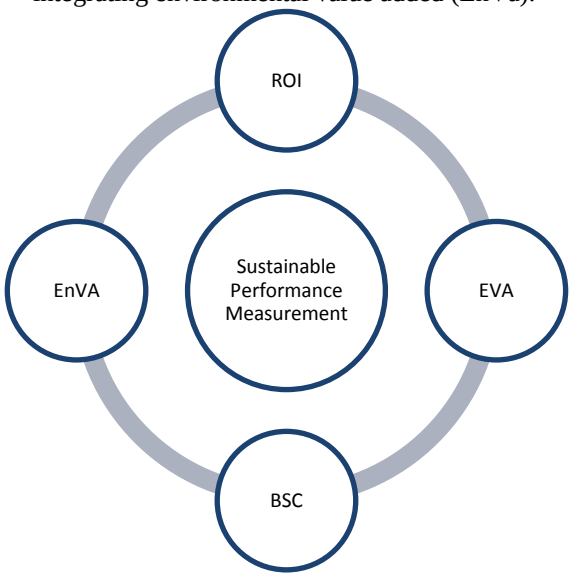
A hypothetical company –Responsible Ltd, is used to suggest how environmental management performance may be integrated into conventional managerial performance measurement systems. This paper does not categorise environmental management performance as this may be relative between firms. It uses environmental expenditure, excluding fines and penalties to represent the extent of divisional manager's environmental initiative.

A. Toward a Model for Integrating the Environment:

Environmental investment committed today has the propensity to yield future positive returns to the firm [21]. Such future environmental values may include *inter alia* expansion in market share – derivable from increase in green consumer patronage; competitive advantage (nationally and internationally); avoidance of environmental regulatory risks; resiliency in the face of climate change impacts. It follows therefore that the more the firm is prepared to invest part of its assets in the environment, the more the firm would expect to benefit from in the near future [21]. Thus if a division is investing in the environment today, it is likely that the divisional current profitability may not be as high as another division that is reluctant to invest in the environment, reason being that assets that could generate current profit is being invested in the environment in the environmentally conscious department. Consequently divisional performance evaluation may be somewhat asymmetry if the environmentally investing division is rated as a less performing division because of current low profit. Divisional performance measure may therefore be more objective and equitable if consideration is given to the amount of environmental investment committed by a division. Thus this paper suggests that, in addition to current divisional financial measures such as ROI and EVA, the ratio of divisional environmental investment to total assets should be considered as an ancillary measure of performance for the environmentally investing division. By

adopting this stance in divisional performance evaluation, an additional index of performance measure which, in this paper, is referred to as environmental value added (EnVa) would be added to existing popular measures of performance (financial and non-financial) – return on investment (ROI), economic value added (EVA) and balanced score card (BSC). This addition may make the overall performance more sustainable, hence the inscription at the centre of figure 1 –sustainable performance measurement. This proposed additional measure unto existing measures is depicted in figure 1 below. EnVa may thus be an additional measure similar to BSC that captures corporate strategic goals.

Figure 1: divisional performance measurement integrating environmental value added (EnVa).



Where:
ROI: return on investment
EVA: economic value added
BSC: balanced score card
EnVA: Environmental Value Added (Suggested additional measure).

EnVA: Environmental Value Added: may therefore be captured in a formula:

$$EnVA = \frac{\text{Environmental Investments (EI)}}{\text{Investment in Total Assets}} \times 100 \quad \ldots.(1)$$

Where: EI = the sum of environmental expenditure in a fiscal year less environmental fines and penalties.
The formula may be rewritten in a shorter version as:

$$EnVa = \frac{IEI}{ITA} \times 100 \quad \ldots\ldots\ldots(2)$$

Note: fines and penalties should be deducted from the total of environmental expenditure as they arise out of environmental negligence.

B. Hypothetical Illustration: Responsibility Ltd (with two divisions –A&B).

Division A: Invested assets: $1 000 000; Cost of capital: 10%; current profit: $200 000; environmental management expenses before profit: $150 000.
Division B: Invested assets: $1 000 000; Cost of capital: 10%; current profit: $300 000.

Table 1 Performance Evaluation Integrating Environmental Management

	Division A	Division B
Invested Asset	$1 000 000	$1 000 000
Current profit	$200 000	$300 000
Cost of capital (10%)	$100 000	$100 000
Environmental management expenses before current profit	$150 000	$ 000
ROI : Profit/Invested Asset	20%	30%
EVA : Profit – Cost of Capital	$100 000	$200 000
EnVa: IEI/IA	15%	0%

Table 1 above shows the performance evaluation of the two divisions in Responsible Ltd using the ROI, EVA and environmental value added (EnVa). The $150 000 environmental expenses in division A shows that the division engaged in environmental management activities during the fiscal year and this contributed to low ROI percentage and less EVA amount compared to division B with zero amount of environmental commitment during the period. Since the environmental commitments of division A would likely generate positive value to the firm in the near future; then the ratio of environmental expenditure on invested assets should be calculated as an ancillary measure of performance which is 15 per cent for division A and zero per cent for division B. This approach would instil fairness and equity in performance evaluation; and would also be environmentally motivational to divisional managers.

IV. Motivational Implication for Environmental Management and Sustainable Economy

Drawing from Vroom's motivational theory [17], divisional managers should expect a recognition of and compensation for their efforts. Therefore in contemporary global drive for environmental and/or sustainable economic development; divisional environmental investment cannot be relegated to the background as a less managerial effort and/or achievement. This is because environmentally committed managers constitute the axis upon which corporate sustainability effort rotates. It follows therefore that without

environmental drive at the divisional level; overall corporate environmental stance may dwindle with attendant negative impact on sustainable economic development. Consequently if divisional managers' environmental or sustainability commitments are recognised, measured and rewarded similar to financial profit achievements; such managers would be motivated to engage more toward the environment and society. The cumulative result would be a sustainable corporation that fosters sustainable economic development.

In contemporary global quest for sustainable economic development, business is an important partner to government for the actualisation of sustainable economic development. Hence according to a 2010 report titled *Business and development: challenges and opportunities in a rapidly changing world* by the World Business Council for Sustainable Development (WBCSD) [21]; the rapid increase in urbanisation is a huge threat to sustainable economic development of the developing nations and emerging economies. This is because increase in population and urbanisation is galvanising pressure on the systems that supply desired energy demand, food, water transportation and healthcare in developing countries [21]. Hence in its report, the WBCSD stresses that transition to a sustainable economic future may be impossible "without business as a committed partner and solution provider" [21]**.** But pragmatic business sustainability initiative relies on environmentally conscious managers; consequently an enabling management control system that recognises, measures and rewards environmental efforts of divisional managers is *sine qua non* to achieving corporate sustainability. A sustainable economic development is thus achievable where managers' economic goal is balanced with environmental demands.

V. CONCLUSION

This paper proposes the integration of environmental management to conventional corporate divisional performance measurement. The objective is to motivate environmental commitment in corporate divisional managers which would promote overall corporate environmental commitment and thus provide enabling business support to sustainable economic development. It suggests how divisional environmental investments might be evaluated and recognised as an ancillary to popular divisional financial measures. Consequently drawing from expectancy theory, the paper asserts that environmentally committed managers should expect that their environmental commitment demand recognition. Thus it becomes apposite that the management accounting system be made to integrate divisional environmental effort and/or investments as another index of performance which this paper refers to as environmental value added (EnVa). Overall implication for sustainable development is emphasized and this rests on the likelihood that such performance recognition would boost the environmental or sustainability penchant of divisional managers. The spine off of environmentally committed corporations therefore would be on sustainable economic development of the host nation. In line with the WBCSD [21] transition to sustainable economic development may not be achievable without the support of corporations; and without the support of sustainable divisional managers, the corporation would continue to operate in an unsustainable and environmentally unfriendly fashion. But management accounting may offer desired boost to managerial incentive to environmental friendliness; this paper suggests that integrating environmental performance to conventional performance measurement may assist in boosting the environmental morale of managers. The hypothetical illustration in this paper may provide an agenda for a field research to apply such environmental performance measurement practically in a firm. It is expected that this would provoke academic and research debate in the field of environmental management accounting.

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Eco-efficiency and urban sustainability

Heidi Tuhkanen[1], Tuula Pohjola, D.Sc.(Tech.)[2]
1. Stockholm Environment Institute Tallinn Centre, Lai Tn. 34, 10133, Tallinn, Estonia
2. CRnet Oy, Punavuorenkatu 2 Aa 37, Helsinki, Finland
E-mail: Heidi.tuhkanen@seit.ee

***Abstract*: As cities are increasingly viewed as places with opportunities for significant climate mitigation, it is important for local authorities to be able to identify the efficient and impactful opportunities for mitigation of CO2 (an important greenhouse gas) emissions. This is especially critical under the current financial pressures facing local authorities. This paper measures eco-efficiency in 9 small and mid-sized Finnish cities. In conclusion, eco-efficiency, provides information which can be used together with other aspects of urban sustainability to inform future development paths in urban areas.**

key words: eco-efficiency, indicator, urban, sustainability

I. INTRODUCTION

As cities are increasingly viewed as places with opportunities for significant climate mitigation, it is important for local authorities to be able to identify the opportunities for mitigation of CO2 (an important greenhouse gas) emissions. In order to know which emissions to decrease, one must know the emission amount and sources through a replicable method of calculation. Since mitigation often calls for investments (or changes in behavior) to improve eco-efficiency, it is crucial to identify either the low hanging fruit, investments in mitigation which have a short payback period, or investments which in addition to mitigating, also provide other co-benefits. The ability to make efficient and impactful investments is especially critical under the current financial pressures facing local authorities.

II. METHODS

This paper calculates the CO2 emissions from sources which have been identified as main drivers in cities: transportation and energy. The eco-efficiency data is based on energy consumption from electricity and heat, as well as transportation (passenger). The study is based on survey of nine Finnish cities: Jyväskylä, Kokkola, Kotka, Kouvola, Kuopio, Mikkeli, Oulu, Tampere, and Turku using the pilot version of the EVE-Index™ developed in 2011.

III. RESULTS / DISCUSSION

This paper looks at the eco-efficiency in 9 small and midsized Finnish cities. Furthermore, the paper explores the links between eco-efficiency and broader sustainability in the context of downtown commercial areas.

IV. CONCLUSION

We conclude that in addition to the CO2 emissions sources calculated, the eco-efficiency index should be broadened to include other sources of emissions, some of which were too difficult to collect data on during the pilot project. Furthermore, since eco-efficiency has interdependencies with other areas of sustainability, we conclude with a discussion on identifying and calculating co-benefits of mitigation as a way to further motivate local authorities to decrease their CO2 emissions. Eco-efficiency, when calculated in a straight-forward and easily reproduced way, provides useful information which can be used together with other aspects of urban sustainability, namely vitality and attractiveness, to inform strategic investment decisions determining future development paths in urban areas, as well as their competitiveness and sustainability.

Development of Water Footprint as an environmental indicator – challenges from company perspective

H. Wessman, M.Ovaskainen, E.Saarivuori and H.Pihkola
VTT Technical Research Centre of Finland, Tekniikantie 2, P.O.Box 1000, 02240 VTT, Finland
E-mail: Helena.Wessman@vtt.fi

***Abstract*: Fresh water is an essential resource for people, for the environment and for the industries. Water scarcity and the availability of fresh water is a global concern and this has led to increased need to measure and communicate the impact of water use in the companies. Collecting and providing more precise information can be challenging for industrial actors. In addition, there are several sector specific and case-specific questions that need to be solved. These include for example definition of the value chain, data availability and geographical locations. The paper presents the available water footprint guidelines and challenges in data collection. Communication of the results will be discussed from industrial perspective.**

I. INTRODUCTION

Freshwater availability and its quality are vital for sustainable development. Although freshwater is a renewable resource, it is highly unevenly distributed and water availability varies widely between, and even within, countries. In the Nordic countries, where water is commonly abundant resource, the water footprint and water use may seem irrelevant. It is important, however, to take part in method development in order to bring out the Nordic and industrial views. These aspects are important especially in technology development, in reducing water consumption and improving water quality.

The water footprint is intended to be used as a multi-use environmental communication tool at both product and organization level. The development of the method has been rapid. Currently there are a variety of approaches and institutions promoting sustainable water management. The aim and scope of the suggested methods are different and it is questionable how comparable they are when calculating the water footprint of products through the value chain. This has created a need for method harmonization at ISO level. As distinct from the product carbon footprint, which describes the global warming potential of a product and where the impact is global, the water footprint is a local indicator. This poses challenges for the calculation and data collection.

Water footprint aims at describing the impact of water use on humans and ecosystems due to changes in water quality and quantity. Water footprint can, ideally, be a tool to guide the development of water saving products and services: the potential mitigation points and critical phases along the supply chain will be revealed.

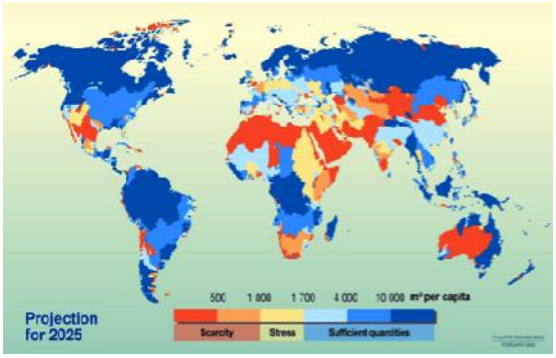

Fig.1 Projection of water availability in 2025[1]

II. METHODS

This article is based on literature surveys, industrial workshops and discussions on Water footprint methodology as well as development work of the on-going ISO 14046 'Water Footprint'. Water footprint methodology has been applied and further developed in the Finnish Forest Cluster project EffFibre (2010-2013) and some of the main findings will be introduced.

III. AVAILABLE WATER FOOTPRINT GUIDELINES AND METHODS

The existing water footprint tools can be broadly categorized into methods for organizational use and tools/methods used for calculating water footprint for products and processes. Global Environmental Management Initiative (GEMI) and Global Water tool (GWT) look at water use at organizational level and can be freely downloaded from the Internet. The European Water Stewardship standard (EWP) that is in preparation, aims to deliver a guideline to assess company's water management. Both EWP and ISO 14046 Standardization work are aiming at greater harmonization of terminology and framework. EMAS and/or Water Ecolabelling may be based on these approaches in the future.

A. Water Footprint Network (WFN)

The Water Footprint Network was the first to launch the idea of the water footprint. The idea behind the concept

was to measure the volumes of freshwater used over the whole supply chain. The method uses the terms green, blue and grey water. Blue water footprint refers to consumption or loss of surface and groundwater resources along the supply chain of a product. The green water footprint refers to consumption of rainwater before it becomes blue water. The grey water footprint is defined as the volume of freshwater that is required to dilute the treated effluent to such an extent that the quality of the effluent corresponds to the existing ambient water quality standards [1].

B. ISO 14046

The ISO standardization work for water footprint was initiated in 2010 and the aim is to finalize the standard in 2014. The following points have been agreed in principle and they represent the state-of-the-art, not the final standard:

1) Water footprint guidelines will cover environmental issues and human health. Social welfare is linked to water availability and water quality.

2) Water footprint is an impact. The inventory result is not a water footprint; the inventory phase is only one stage of the water footprint calculation.

3) Quantity and quality are as important in the water footprint. The water footprint cannot be based solely on consumed water volumes.

4) The water footprint can be a stand-alone indicator or part of the life cycle assessment (LCA). Regional/local impacts are important and they should be taken into account.

5) The water footprint is a tool for products, processes and organizations.

C. European Water Stewardship (EWP)

The European Water Partnership is developing a voluntary certification programme, a Water Stewardship Standard at European level. The first draft of the standard was published in 2010 and has been tested by BASF, Coca-Cola and Holmen Paper. The feedback from the pilot studies was constructive and useful to develop the programme further. The overall opinion was that the evaluation scheme is useful and provides strong support to improve operational water management [3,4]. The overall aim is to publish an international Water Stewardship system that follows the EU Environmental Policy, which will make it easily adapted to environmental management schemes such as EMAS and ISO 14001.

D. Global Water Tool (GWT)

WBSCD continuously updates a Global Water Tool (GWT) that is a free and easy to use tool for companies and organizations to map their water use and assess risks relative to their global operations and supply chains. GWT compares company's or organization's water use with externally validated water and sanitation availability information on a country or watershed basis. GWT can be used to compare consumption data over a period of time to calculate water consumption and efficiency. The tool can also be used to create GRI indicators to ease reporting and management of water use [5].

E. Global Reporting Initiative (GRI)

The Global Reporting Initiative (GRI) is not a water footprint tool as such, but supports company's water management reporting. GRI is an international motion aimed at creating a globally accepted procedure to report an organization's economic, environmental and social performance. GRI is an individual organization that works in accordance with the UNEP (United Nations Environmental Programme), which is one of the active method developers of the water footprint. The latest version of the GRI indicators was published in March 2011. This update is also known by the name G3.1 Guidelines [6].

Tab. 1.The water accounting related GRI indicators [7]

Indicator	**Type**	**Brief description of the indicator**
EN8 - Total water withdrawal by source	core	The total volume of water withdrawn provides an indication of the overall scale of potential impacts and associated risks
EN9 - Water sources significantly affected by withdrawal of water	additional	This indicator measures the scale of impacts associated with the organization's water use
EN10 - Percentage and total volume of water recycled and reused	additional	The rate of reuse and recycling acts as a measure of efficiency and success of the organization in reducing total withdrawals and discharges
EN21 - Total water discharge by quantity and destination	core	The amount and quality of the water discharged by the reporting organization is directly linked to ecological impact and operational costs
EN23 - Total number and volume of significant spills	core	Spills of chemicals, oils and fuels can have significant negative impacts on the surrounding environment, potentially affecting soil, water, air, biodiversity and human health
EN25 - Identity, size, protected status and biodiversity value of water bodies and related habitats significantly affected by the reporting organization's discharges of water and runoff	additional	This Indicator is a qualitative counterpart to quantitative Indicators of water discharge that help to describe the impact of these discharges

F. Other actors

The UNEP/SETAC Life Cycle Initiative has a working group to assess how water use and consumption can be taken into account in LCA. The aim is to have Final Guidance to provide appropriate water accounting schemes and impact assessment methods. UNEP is actively working in the ISO Standardization process stressing the importance of local water availability.

WWF has a global view on water security, setting out key concepts in water management in the context of the need for environmental sustainability. WWF's Global Freshwater Programme concentrates in wetland conservation and issues related to water footprint, water stewardship, and water security.

IV. RESULTS: WATER FOOTPRINT FROM INDUSTRIAL PERSPECTIVE

Based on the studied material, it is clear that sustainable use of water and communicating about it is a topical challenge for the industry. There are social and economic interests in understanding and managing the water use. Stakeholders expect demonstrated commitment for sustainable water use. Water footprinting has brought along a new necessity to study both water use and quality on product, service or company level along the whole supply chain.

Reducing process water use can have net positive effect due to economic savings achieved by lower costs of raw water and lower volumes of waste water to be treated. At some industrial sectors, reduced water consumption can also be linked together with lower energy consumption and increased production efficiency. At sectors, where water is an important processing medium, such as the pulp and paper industry, product quality is linked to the quality of process water, which in turn is related to water consumption in the process. Reducing water use to maximum without sacrificing product quality can thus be a challenge.

Water footprint methodology is unfinished and in order to bring out the typical features of different industrial sectors, it is important that industry is involved in the development work and test the methods to find the most suitable approach. For example in WFN method there are points that should be considered when calculating product water footprint:

The green water definition and data behind it are important for industries using biomass as raw material (bio-energy production, forest products, food products, textiles). Green water use (evapotranspiration) by trees/vegetation forms the largest part of the water footprint in all products that use biomass as raw material, and its relevance in product and company-level water footprinting is questionable [8]. Combining green, blue and grey water does not encourage reduction of blue water use, i.e. by improving water-saving technologies.

The grey water approach is inadequate. It neither provides a sound estimate for the effects of water pollution on water availability nor the impacts on aquatic ecosystems. Thus, in its present format, grey water is not consistent with green or blue water use, which are determined by water budgeting. The quality changes in different environmental parameters are excluded in the volume-based WFN approach, and regional aspects are not included sufficiently.

Water availability and the regional aspects

Fresh water availability varies between countries, regions and seasons. One of the main questions in water footprint is how to define the regional aspects. Commonly the withdrawal-to-availability ratio (WTA), which links the total volume of withdrawals to the volume of renewable water available has been applied. In the latest developed methods also seasonal variations [9] and the impact of water quality changes have been included in to the water footprint methodology [10] [11].

It is important to notice that even though the local issues are essential, they are not enough as such. Process efficiency should be taken into account as well.

Water footprint data collection

Data collection includes the definition of the type and volume of water used (intake and release), the water availability in the geographical area, and the quality of the water. The water inventory must cover and quantify all life cycle stages. Production sites typically collect data on process water and effluent volumes, and waste water quality (direct water use), but data on the upstream or downstream water within the value chain is lacking (indirect water use). Calculation of water footprint thus imposes new, resource intensive challenges for environmental data gathering for companies. Figure 2 presents the framework for process data collection taking into account the indirect water use.

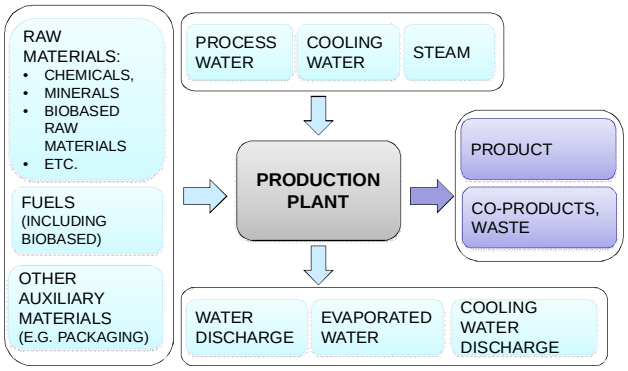

Fig 2. Framework for process data collection.

From the life-cycle assessment (LCA) perspective, the existing and publicly available life cycle inventory (LCI) databases have not included complete data on input and output water balances. The widely used EcoInvent LCI database has however recently updated its process water data for different supply chains [12]. Still, the generic LCI databases mostly contain limited information on water use. There are inconsistencies in categorization, terminology, and reporting output flows between different databases [e.g. 13].

Required water balance information for the water footprint analysis could also be sourced from modelling tools or process simulators that are often standard tools in industry. In an ideal case, and mainly for bigger sites, such mass balances already exist providing the required information, including water quality parameters for the calculations. The modelling tools can even further be applied to estimate the changes in process water footprint: what-if- type of studies could be performed to e.g. estimate the link between water and energy consumption, and what are the implications to the site emissions.

Environmental communication

Once the water inventory has been carried out and the impacts are identified, the results can be used to support environmental communication, such as corporate reports or other customer oriented communication. Easy to communicate indicators are needed, because in addition to calling for sustainable water management, stakeholders ask for water footprint calculation results.

There are challenges in communication of the results with a single aggregated value. Water footprint results calculated with different methods, scopes, or system boundaries are not suitable for comparative claims i.e. the results cannot directly be used to identify products that have smaller water footprints.

The entity matters, one “stand alone” indicator such as water footprint does not sufficiently represent environmental impacts but a toolkit of methods should be used. Important aspects to consider are e.g. material and energy efficiency, carbon footprint, land use, and waste re-use.

V. DISCUSSION

Data availability and data quality are the current restricting factors of transparent and comprehensive water footprinting. Sometimes parts of the most developed water footprint methods must be omitted due to a lack of data or incomplete understanding of the issue, which will make it difficult to collect the correct data. Depending on the industrial sector, the challenges regarding data collection differs.

Water footprinting should encourage the industry to reduce process water use and increase the waste water quality. From a wider perspective, water footprint needs to be developed to a direction where it becomes part of the larger sustainability toolkit. Instead of taking a volume based approach, the impacts of water use should be studied as a consequential approach. Relevant indicators and description of mechanisms and processes behind them should be further developed, together with critical evaluation whether the impacts are relevant or not.

Based on discussions with industry the importance of environmental communication has been emphasised. Communication on water should tell about positive and negative impacts of industrial processes along the value chain. Environmental indicators such as water footprint should be clearly based on scientific results. Also linking water into certification systems has been considered important in environmental management.

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Biotechnology and Sustainable Development: Mapping the Field by Means of a Systematic Review of Life Cycle Assessments Conducted on Biotechnological Products and Processes

Jan Endrikat[i], Edeltraud Guenther

Technische Universitaet Dresden, Faculty of Economics,
Chair of Environmental Management and Accounting
Muenchner Platz 1/3, 01062 Dresden/ Germany
E-mail: ema@mailbox.tu-dresden.de

***Abstract*:** Biotechnology is gaining momentum throughout the world and has resulted in a wide range of applications in different sectors. Biotechnological products and processes are deemed to provide several advantages in terms of environmental sustainability when compared to conventional alternatives. However, recent studies showed that biotechnological applications cannot be considered a priori superior with regard to environmental impacts.
We conducted a systematic literature review of published Life Cycle Assessment (LCA) studies in order to provide an overview of the current state-of-the art of LCA in the field of biotechnology.

Keywords: biotechnology, life cycle assessment (LCA)

I. INTRODUCTION

Sustainable development, considered as meeting the needs of present generations without compromising the ability of future generations to meet their needs, is deemed the key concept for facing the World's challenges in the 21st century. Consequently, supranational and international institutions such as the United Nations, the Organization for Economic Cooperation and Development, or the European Union have mainstreamed this concept into several strategies and policy frameworks. Within these strategies and policies biotechnology is considered one of the key technologies that may contribute significantly to a more sustainable economy [1].
Biotechnology, is defined as "the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services" [2]. Biotechnological processes provide alternatives for conventional production systems and are capable of reducing environmental impacts by decreasing the consumption of resources, diminishing the utilization of toxic materials, reducing hazardous waste, maintaining biodiversity, or providing renewable energy. Consequently, biotechnology is gaining momentum across a wide range of applications in several industrial sectors (e.g., energy sector, food industry, chemical industry) and already contributes about €2 trillion to the EU economy [3]. However, recent research questioned the widely held view of a priori superiority of biotechnology with regard to sustainability issues [4]-[7]. For example, there are concerns with regard to land use change due to the cultivation of biomaterial feedstocks [5]. Moreover, biotechnological production routes have been shown to use large amounts of water [6]. Finally, biomaterial feedstocks require significant amounts of fertilizer and pesticides being harmful to humans and environment [7].
Therefore, reliable statements concerning the advantageousness of biotechnological products and processes have to be grounded on sound examination of environmental impacts that takes into account the entire life cycle. Life Cycle Assessment (LCA), as a tool of Environmental Management Accounting (EMA), constitutes such an approach. Thus, LCA has become a standard tool for evaluating the environmental impacts of products or processes. According to the ISO standard [8], LCA is the compilation and evaluation of the inputs, outputs, and potential environmental impacts of a product system throughout its life cycle. LCA comprises four main steps: goal and scope definition, inventory analysis, impact assessment, and interpretation (see Figure 1).

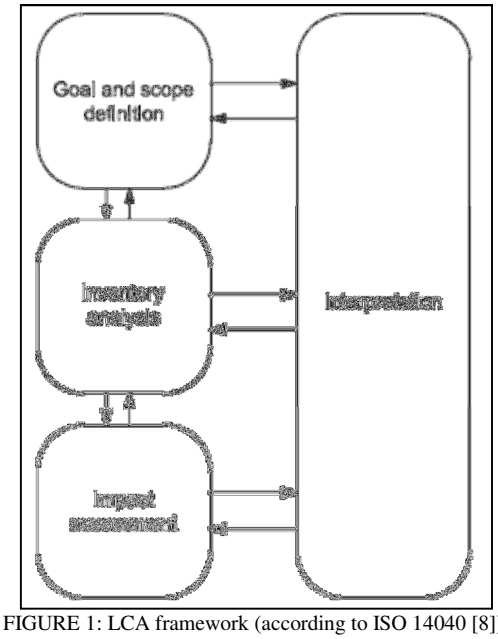

FIGURE 1: LCA framework (according to ISO 14040 [8]).

While recently several LCA studies on biotechnological products and processes have been conducted, these publications reflect the complexity and diversity of biotechnology itself. That is, LCA studies in the field of biotechnology differ considerably with regard to their general object of study as well as in

terms of goal and scope, system boundaries, underlying functional unit, and applied impact assessment procedure.

Therefore, this study seeks to provide a critical and systematic literature review [9] of existing LCA studies covering biotechnological products and processes. Thereby, we provide an overview of the state of LCA methodology applied in different fields of biotechnology.

Our study proceeds as follows. First, we briefly outline the methodology used for the systematic literature review. Second, we present the results. Thereby, our primary focus is on the key methodological issues such as the type of LCA methodology, data source, boundaries, the considered impact categories, or the used approaches to treat uncertainties. Third, we end up with a concluding discussion and outline implications for further research.

II. METHODOLOGY OF THE REVIEW

We followed the four steps for a systematic review as proposed by Fink (2010) [9]. First, we selected our research question and determined our search strategy for identifying relevant LCA studies. Second, we applied practical review criteria for the inclusion or exclusion of studies. Third, we developed and applied methodological screening criteria. Fourth, we synthesized our findings.

A. *Research question and search strategy*

Biotechnology constitutes a broad field comprising several distinct applications across various sectors. Due the complexity and diversity of the issue of interest our research question is: "What is the state of LCA methodology applied in different fields of biotechnology?"

To search the literature we employed the following key words: "life cycle assessment" OR "life cycle analys*" OR "life cycle inventory analysis" AND "biotech*". We searched the following databases: Web of Science, Academic Search Complete, ScienceDirect, Wiley Online Library, and Polymer Library. Additionally, we conducted manual searches in the International Journal of Life Cycle Assessment and in the Journal of Industrial Ecology. Finally, we cross-checked the reference lists of the found studies.

B. *Practical review criteria*

We included LCA studies concerned with biotechnological products, processes, or sub-processes that have been published in scientific journals (i.e., we excluded working papers or governmental reports). In total, 48 LCA studies were included in the review (see Table A1 in the Appendix). Since biotechnology involves a wide range of disciplines concerned with, biotechnology LCA studies are likely to be published across a large pool of different journals .

Therefore, we do not claim that our sample of studies represent the complete literature. However, we argue that it does provide a representative cross-section of studies conducted so far.

C. *Methodological screening criteria*

We developed a review protocol comprising different categories for the content analysis of the LCA studies. For setting up the categories and the coding items we consulted several published reviews of LCA studies [10]-[12] as well as the checklist for LCA studies provided by Zumsteg et al. (2012) [13]. The following categories were applied to the LCA studies: *publication date, journal, researcher affiliation, subject area, object of study, type of LCA methodology, applied software, reference to the ISO standard, comparative assertion, data source, functional unit, boundaries, impact categories, consideration of economic or social aspects, treatment of uncertainties*.

The fourth step of the systematic review (i.e., the synthesis of the findings) is discussed in the next section.

III. RESULTS

The LCA studies under review can be categorized into five rather broad subject areas with a majority of studies focusing on biofuels/bioenergy (see Figure 2). In addition, the studies considered bio-based materials (especially bio-plastics), bio-based chemicals, or enzyme production systems.

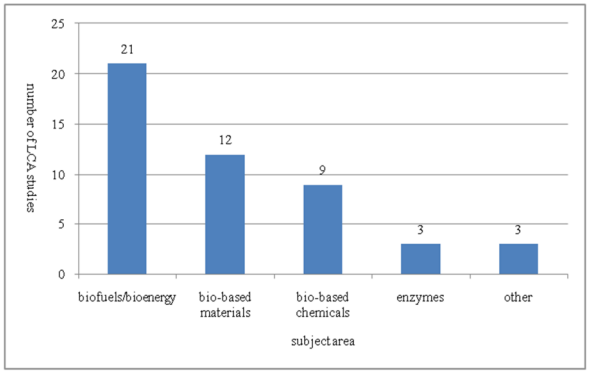

FIGURE 2: SUBJECT AREAS OF THE LCA STUDIES

The majority of the studies are published after the year 2000, while three studies are published in 1999. In general, there is a large spread regarding the journals in which the studies have been published. This corresponds with the interdisciplinary nature of biotechnology. However, one journal sticks out: 19 of the 48 studies have been published in the *International Journal of Life Cycle Assessment*.

Table 2 summarizes the key issues of the reviewed LCA studies.

47 of the 48 studies are 'Process LCA' studies, while one study [5] uses a hybrid methodology combining 'Process LCA' with an "Input Output' approach. In 'Process LCA' studies the data used is based on parameters of known, physically utilized components and is added together to provide the total emissions for the focal product or process [5], [13]. 'Input Output' LCA apply an emissions factor to economy-wide economic data to provide average emissions per unit (in monetary value) spent by each sector of the corresponding economy [5]. Hybrid LCAs combine both approaches and thus provide a more holistic assessment [14].

Key issues of the LCA studies	Number of studies applying*
Researcher affiliation	
Academic	45 (94%)
Corporate	10 (21%)
LCA technique	
'Process LCA'	47 (98%)
'Input Output'	0
'Hybrid LCA'	1
Reference to ISO 14040 standard	24 (50%)
Comparative assertion	45 (94%)
Biotechnology vs. non-biotechnology	35 (73%)
Data source	
Primary data	
Measurement	15 (31%)
Calculation	16 (33%)
Estimation	22 (46%)
Secondary data	
Database	30 (63%)
Literature	36 (75%)
Functional unit	
Mass based	28 (58%)
Energy based	10 (21%)
Other	10 (21%)
System boundaries	
Cradle-to-grave	9 (19%)
Transportation processes included	36 (75%)
Infrastructure included	9 (19%)
Impact assessment	
Mid-point approach	27 (56%)
End-point approach	4 (8%)
Only life cycle inventory	18 (38%)
Impact categories	
Global warming potential	31 (65%)
Acidification	27 (56%)
Eutrophication	24 (50%)
Ozone depletion	13 (27%)
Photo-oxidant formation	5 (10%)
Photo-chemical oxidation	15 (31%)
Radiation	1
Abiotic depletion	6 (13%)
Ecotoxicity	8 (17%)
Human toxicity	10 (21%)
Land use	11 (23%)
Consideration of economic aspects	4 (8%)
Consideration of social aspects	1
Treatment of uncertainty	
Monte-Carlo-Simulation	2 (4%)
Different scenarios	29 (60%)
Sensitivity analysis	18 (38%)
Applied software	
SimaPro	10 (21%)
Umberto	2 (4%)
GaBi	3 (6%)
TEAM	3 (6%)
SuperProDesigner	2 (4%)
Other	2 (4%)

TABLE 1: KEY ISSUES OF THE LCA STUDIES
* Percentages may sum up to more than 100% due to multiple categorizations.

Regarding the research objectives it can be observed that most of the studies (94%) seek to compare different products or processes. Thereby, 35 studies (73%) compare biotechnological products or processes with conventional alternatives. For example, the production and/or the use of biofuels are compared with fossil-based gasoline. Or bio-plastics (based on polyhydroxyalkanoates or based on polylactic acid) are compared with conventional plastics (e.g., based on polyethylene).

The majority of the studies apply secondary data derived from databases (63%) or literature (75%). When primary data is used the studies mostly rely on estimated information (46%) which constitutes the least reliable data type [15].

The functional unit is a concept which is used in LCA to enable comparisons of alternative products and services [8]; it is a quantitative description of the service provided by the production system [11]. The functional units used in the LCA studies differ considerably due to the diversity of the products or processes examined. However, two main categories can be identified: (1) mass based functional units, and (2) energy based functional units [11]. While in the former case the environmental impacts are related to a specific amount or volume of output, in the latter case the impacts are related to a specific amount of energy.

With regard to the system boundaries only nine studies (19%) consider the entire life cycle by adopting a cradle-to-grave perspective. Transportation processes are included in 75% of the studies, while the infrastructure is considered in only 9 studies (19%).

The impact assessment phase of LCA involves the selection of impact categories and the assignment of the life cycle inventory date to the selected categories. Two main methods of life cycle impact assessment can be distinguished: (1) mid-point approaches, relating the impacts to well known environmental problems (e.g., global warming or acidification), and (2) end-point approaches aggregating all the effects to specific areas of protection (e.g., human health or ecosystem quality) [16]. Most of the reviewed studies apply a mid-point approach (56%). 18 Studies (38%) merely provide life cycle inventory data and do not conduct any impact assessment. With regard to the considered impact categories, the most frequently applied category is global warming potential (65%), which may be due to the broad public discussion on climate change. In addition, acidification (56%) and eutrophication (50%) are frequently considered impact categories. Notable is the small number of studies including land use impacts (23%).

As sustainability consensually involves three dimensions, or pillars, namely, environmental, social, and economic sustainability (e.g., [17]), several authors prompt to extend the environmental life cycle view to the economic and social dimension (e.g., [18]). Nevertheless, in the studies under review there is an obvious negligence of economic and social aspects. Only four studies consider economic aspects; and only one is including an examination of social issues.

LCA is subject to several sources of uncertainty (e.g., data measurement uncertainty, modeling uncertainty, or variability due to natural fluctuations of values) [19]. Accordingly, several approaches for dealing with uncertainty have been proposed, with Monte-Carlo-Simulation (a sampling method) and scenario analysis as well as sensitivity analysis (as parameter variation methods) [20] being the most widely used ones. Most of the review studies use scenario analysis (60%) or sensitivity analysis (38%); only 2 studies conduct a Monte-Carlo-Simulation.

Especially complex LCA studies require the use of LCA software. Therefore, a large number of LCA software tools are available. The majority of LCA studies included in the review used SimaPro, which is commonly used software for LCA across a wide range of applications. Surprisingly, SuperProDesigner, that is rather specific software for biotechnology has been used only by two studies.

CONCLUDING DISCUSSION

Taken together, the reviewed studies differ considerably with regard to the methodological key issues. On the one hand, this reflects the fact that biotechnology is an umbrella term covering broad diversity of biotechnological applications [21]. On the other hand, it shows that LCA in the field of biotechnology has to be considered being in a premature state involving several fruitful avenues for further research. In the following we briefly outline some suggestions for future LCA studies.

- Several studies merely provide Life Cycle Inventories without a kind of impact assessment. However, in order to characterize the overall environmental burden of a system with regard to specific environmental issues an impact assessment is indispensable. Therefore, future studies should include an impact assessment phase, which is also a mandatory element of LCA according to the ISO standard [8].
- Most of the studies exclude the infrastructure used for the biotechnological processes. Therefore, more efforts should be made to examine the infrastructure contributions to the life cycle impacts of biotechnology.
- Given the low amount of studies applying a cradle-to-grave perspective, we urge researchers to take a greater account of the whole life cycle of products and processes. Especially with regard to bio-plastics several studies have shown that the choice of the end of life scenarios has significant effects on the overall results [5], [22].
- Regarding the used impact categories the results of our review highlight a preference for the global warming potential dimension. While climate change indeed is a very important topic, other impact categories should not be neglected. Especially, land use changes have not been considered sufficiently, given the extensive land use due to the cultivation of biomaterial feedstocks [5].
- In view of the great proportion of estimated data, the small number of studies applying more complex forms of uncertainty analysis (i.e., Monte-Carlo-Simulation) constitutes a critical issue. Since Monte-Carlo-Simulation has become standard in most of the LCA software tools [20], it should be feasible for future studies to more carefully examine uncertainty.
- Finally, we call for an increasing examination of social aspects within LCA studies on biotechnology. For example, the use of genetic modified material is an issue of high relevance to stakeholders and society and should be taken into account when biotechnological processes and products are evaluated.

By reviewing published LCA studies conducted on biotechnological products or processes, our study brings together two fundamental issues strongly related to sustainable development. It gives a broad overview of the status quo of the application of LCA as an essential tool for quantifying the environmental impacts of products and processes; and it does so using the case of biotechnology, which is suggested to play a key role in the quest for sustainability [23].

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APPENDIX

Author(s)	**Year**	**Journal**
Andersson & Ohlsson	1999	International Journal of Life Cycle Assessment
Akiyama et al.	2003	Polymer Degradation and Stability
Bai et al.	2010	International Journal of Life Cycle Assessment
Berglund & Börjesson	2006	Biomass and Bioenergy
Brehmer & Sanders	2009	Biotechnology and Bioengineering
Brinkmann et al.	2010	Chemical Engineering and Technology
Cherubini & Jungmeier	2010	International Journal of Life Cycle Assessment
Dowaki & Genchi	2009	International Journal of Life Cycle Assessment
Fahd et al.	2012	Energy
Fu et al.	2003	International Journal of Life Cycle Assessment
Gerngross	1999	Nature Biotechnology
Gironi & Piemonte	2010	Environmental Progress and Sustainable Energy
Glew et al.	2012	Journal of Cleaner Production
Gonzales-Garcia et al.	2010	Renewable and Sustainable Energy Reviews
Gustafsson & Börjesson	2007	International Journal of Life Cycle Assessment
Häkkinen & Vares	2010	Journal of Cleaner Production
Harding et al.	2007	Journal of Cleaner Production
Henderson et al.	2008	Industrial Biotechnology
Hermann et al.	2007	Environmental Science and Technology
Hermann et al.	2011	Polymer Degradation and Stability
Hospido et al.	2005	International Journal of Life Cycle Assessment
Jödicke et al.	1999	Journal of Cleaner Production
Jungmeier & Spitzer	2001	Nutrient Cycling in Agroecosystems
Jury et al.	2010	Biomass and Bioenergy
Kadam	2002	Energy Policy
Khoo et al. (part1)	2010	International Journal of Life Cycle Assessment
Khoo et al. (part2)	2010	International Journal of Life Cycle Assessment
Kim & Dale	2005	International Journal of Life Cycle Assessment
Kumar & Murthy	2012	International Journal of Life Cycle Assessment
Kurdikar et al.	2000	Journal of Industrial Ecology
Lardon et al.	2009	Environmental Science and Technology
Luo et al.	2009	Renewable and Sustainable Energy Reviews
Luz et al.	2010	Resources, Conservation and Recycling
MacLean & Spatari	2009	Environmental Research Letters
Madival et al.	2009	Journal of Cleaner Production
Nguyen & Gheewala	2008	International Journal of Life Cycle Assessment
Nielsen & Wenzel	2007	International Journal of Life Cycle Assessment
Nielsen et al.	2007	International Journal of Life Cycle Assessment
Panichelli et al.	2009	International Journal of Life Cycle Assessment
Piemonte & Gironi	2010	Environmental Progress and Sustainable Energy
Sander & Murthy	2010	International Journal of Life Cycle Assessment
Sheehan et al.	2003	Journal of Industrial Ecology
Skals et al.	2008	International Journal of Life Cycle Assessment
Spatari et al.	2010	Bioresource Technology
Strauss & Wiedemann	2000	International Journal of Life Cycle Assessment
van Duuren et al.	2011	International Journal of Life Cycle Assessment
Vink et al.	2003	Polymer Degradation and Stability
Vink et al.	2010	Industrial Biotechnology

TABLE A1: LCA STUDIES INCLUDED IN THE REVIEW

[i] The first author acknowledges financial support from the European Social Fund (ESF).

The Connections between Green Economy and Biomimicry

Jenni H. Koho, Ilpo S. Penttinen
Turku University of Applied Sciences, Sepänkatu 1, 20700 Turku, Finland
E-mail: jh.koho@gmail.com

Abstract: The study presented in the following article was made as part of bachelor's thesis in Turku University of Applied Sciences, in the department of Sustainable Development. The aim of the study was to show connections between green economy and biomimicry and to point out applicability of the method in greening economic activities. The study was conducted as a theoretical research and it is based on data, which consists of literature and articles written on biomimicry and economy.

Keywords: biomimicry, green business, green economy, sustainability

I. INTRODUCTION

Market economy has brought us wealth but not without consequences. Irresponsible and short-sighted economic activities have resulted in varieties of different environmental problems and ecological scarcities.

Extraction of raw materials, manufacturing and transportation are causing the lion's share of the most severe impacts of economic activities. Nonrenewable resources are depleted; renewable resources like forests and fish reserves are being used faster than they can regenerate themselves; water, air, and soil are being polluted; landfills are expanding.

These examples show that the way we conduct business in today's world is far from the goals of sustainable development, the kind of development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" [1]. To achieve these goals something needs to be done to our current economic model.

Green economy is presented to be an answer to balance the shaken relationship of human economy and natural world. There are no specific guidelines defined how to carry out green economy. This gives countries and businesses freedom to implement green economy in the way that best suits their aspirations and operations. UNEP (United Nations Environment Program) defines green economy as "a system of economic activities related to the production, distribution and consumption of goods and services that result in improved human well-being over the long term, while not exposing future generations to significant environmental risks or ecological scarcities." [2].

Adopting strategies and policies to promote a shift into green economy has positive effects on trade flows and trading opportunities. Associated with a green economy, greening of markets may open up opportunities to export goods and services which have low environmental impacts. This is a good opportunity especially for developing countries. Green economy improves global trade governance but also domestic trade environment and at the same time ensuring that the trade is sustainable and eradicates poverty [3].

Biomimicry is a method to consider in implementing green economy since it coincides with the definition of green economy very well. Biomimicry is an innovation method seeking for sustainable solutions for problems we humans face by imitating nature's patterns and strategies that have formed during thousands of centuries. The method seeks to create earth-friendly products, processes, and policies that are sustainable in the long run. To get to this target biomimicry provides also an ideology. Nature is seen as a source of ideas, not as a source of resources [4].

II. THE MAIN ASPECTS OF THE STUDY

In this paper the concepts of biomimicry and green economy and business are presented and the connections between them are discussed. The aim is to point out applicability of the method (biomimicry) in greening economic activities. From the sustainability point of view the aspects of ecological and economical sustainability are strongly emphasized.

III. THEORETICAL FRAMEWORK AND RESEARCH METHOD

The theoretical framework of the study consists of literature and articles written on biomimicry and both on current and green economy. Sustainability and economy are the basis of the study and viewpoints for biomimicry.

The research method of the study was a qualitative mapping research, and the analyzing method used was context analysis. In context analysis the research data is examined by condensing, itemizing, and finding similarities and differences. Context analysis is text analysis in which already existing written data is analyzed [5].

IV. GREEN BUSINESS

There is no clear and universal definition for green business. This means that in the end defining green business is in the eye of the beholder. It's about companies defining themselves what they believe is "good enough" for their customers, employees, communities, and the natural environment [6].

Green businesses are striving for making their policies, practices, and principles more sustainable and as a result there is a positive outcome to the environment. The reasons don't matter: businesses can try to solve environmental or societal problems or just attempt to produce products with smaller footprint [7].

Green image is a reply for green consumerism. In addition to customers, according to some surveys, environmental image is important when choosing an employer. To be authentically pro-environmental, a company needs to get the best employees, the ones who think that being green business really matters [8].

If the true costs of environmental impacts are taken into account, a company saves money. These costs include transportation, waste management and all other hidden costs, energy and water consumption for example. Being green also means that a company is not depleting natural resources it needs for manufacturing processes. Obviously this means that businesses from the same sector commit themselves to this principle as well. Especially big, multinational corporations should acknowledge their responsibility.

The limits of natural world could constrain business operations and realign markets. Also growing concern of stakeholders is setting new kind of pressures to companies. Surprisingly banks and insurance companies are new arrivals on the environmental scene. Traditional elements of competitive advantage, such as access to cheaper raw materials and lower cost of capital, are starting to lose their place. In the new world of business going green offers an important new path to innovation and to creating enduring value and competitive advantage [9].

V. The Principles and Levels of Biomimicry

According to Janine Benyus, the founder of the Biomimicry guild and Biomimicry Institute and the author of the book Biomimicry – Innovation inspired by nature, there are three principles that can be distinguished in biomimicry: nature as a model, nature as a measure and nature as a mentor.

A. Nature as a model

Nature as a model means that we would be taking our cue from natural processes using sun as energy source and simple compounds to produce goods. Our farms would be like prairies, self-fertilizing and pest-resistant with perennial and diverse varieties. We would also consult animals and insects to find new drugs or crops. Even computing, which at first sight seems to be as far from nature as possible, could take lessons from nature, since after all, computers are made to mimic the function of the brain [10]. So far living things have done everything we have done and what we only can dream of doing, without fossil fuel, polluting the planet or mortgaging their future – sustainably. Could there be better models? [11].

B. Nature as a measure

Nature provides the model but it also functions as a measure. Human innovations would be cross-checked against nature's standards. Innovations should be life promoting, they should fit in and they should last, these are the rules that apply in nature [10].

C. Nature as a mentor

Perhaps the most important thing that biomimicry could offer is the way we place nature. Starting to see nature as a mentor, a source of ideas instead of source of raw materials, we would be shifting from extracting to learning. We would be obedient students rather than savages who "torture nature for its secrets". Viewing nature as a source of ideas instead of goods, protecting biodiversity and conserving resources becomes more and more reasonable [10]. Jonathon Porritt describes biomimicry as philosophical and visionary approach bringing together humankind's model of progress and growth and nature's systems and processes [12].

D. The three levels of biomimicry – from shallow to deep

Biomimicry can be implemented in three different levels. The first and shallowest level is mimicking natural form. Copying nature's design is only the tip of the iceberg. For achieving deeper biomimicry, one must mimic natural process, the way the thing at issue is made. The third and the deepest level is fulfilled by mimicking natural ecosystems [10].

Organisms evolve and learn through genetic information over long periods of time. People do too, but there is another much faster way to learn: communication and technology. People speak, read and write and transfer knowledge between individuals, communities, nations, business life etc. We can use our wit and technology, man-made capabilities, to copy nature's designs and processes. While some nature's functions can be copied in detail, others are better serving as an inspiration for more sustainable activities. At least until the technology needed is available. Combining all these levels together with the principles of biomimicry our actions will gradually start to be life promoting instead of destructive to life.

VI. CONNECTIONS FOUND

Biomimicry is a versatile method and it can be used in different sectors of economy. What is especially good about this method is that it can be applied exactly in those sectors of green economy which have most export potential: in primary (agriculture e.g.) and secondary industry (manufacturing) and in energy sector. Since biomimicry is about innovating new sustainable technologies it goes hand in hand with green economy which stresses the importance of technology transfer to developing countries. Implementing green economy will mean a large-scale transfer of technologies and acquirement of technological capabilities in developing countries [3]. Biomimetic technology transfer could be implemented in a way that expensive investments and prototypes are developed in richest countries and solutions are taken into developing countries after becoming established.

In biological ecosystems localization and specialization are important [11]. Every organism have their role to play, they are not doing what they are not supposed to do. Since there are vast differences in natural, human and economic resources between countries the rule applies also in green economy: it is important to realize and accept the boundaries of production in a specific country. Products manufactured and energy produced depends on the circumstances of the country. Extraction of raw-materials and manufacturing should happen in the same place wherever possible to avoid unnecessary transportation. By studying and mimicking mature natural ecosystems, the living and non-living environment which function in harmony, current human economy can take steps towards greener economy.

Since nature's processes are cyclical (continuous cycle of nutrients and minerals) waste doesn't actually exist. The only thing that is taken from outside the system is energy from the sun [11]. Our current economic systems on the other hand are mostly linear open input-output – systems in which energy (renewable or non-renewable) and raw materials are put into the system and the output results in goods but also in wastes and emissions that are led back into the nature. In human economy the problem is that consumers don't consume, they dispose. By mimicking the cycle of life, companies can learn to close the loops and make the word waste disappear. This means that the production residue is utilized again and again in the manufacturing processes and the goods that are disposed of by consumers can efficiently be collected and re-used or recycled. Entropy, which means that matter disperses during time, creates its own challenge to closed-looped manufacturing.

From environmental point of view consumerism can be considered as the curse of our time and one of the greatest reasons for depletion of natural resources. If we can change our mindsets concerning consumption it would help in transition from overconsumption to appropriate consumption, in shifting from maximizing to optimizing (one of the great lessons of nature). The change in our mindset gives room for sustainable design, i.e. design for durability, which can be realized with the help of biomimicry.

Green business can be defined in various different ways. If it is defined as a combination of green practices and values (Table 1), biomimicry fits in the picture astonishingly well due to the coverage of the method and ideology it has to offer. Genuinely green products and technologies have markets in the future, and therefore biomimicry brings competitive advantage to companies. This said, using biomimicry as a method for sustainability practices, businesses can implement not only ecological sustainability but economical sustainability as well.

TABLE 1: GREEN BUSINESS AND BIOMIMICRY

Green business	Biomimicry
Green practises • product design • manufacturing processes	Design inspired by nature • fitting form to function • mimicking natural processes
Green values • policies • principles • investments	Nature as mentor • mimicking natural ecosystems • nature as source of ideas, not raw materials

Of course there are downsides in using the method as well. For biomimicry to really help any organization requires a substantial investment in both time and money. The larger the organization is the bigger investments can be made. This raises an important question: is design innovated by nature only for those companies that can afford to experiment new ways of doing their business? Using biomimicry, like any other design method, includes a risk of not reaching the desired market success. Nike for example had to face this with Goatek shoes, which were designed after the hoof of a goat. Shoes didn't sell and manufacturing had to be stopped [13].

Without an ideology biomimicry could end up being only a technological tool for solving environmental problems. The approach is therefore technocratic and doesn't really go into the heart of the problems. It is like medicine that takes away the pain but not the illness itself.

VII. CONCLUSIONS

After analyzing the data it can be concluded that there are clear connections between biomimicry and green economy (Figure 1). Connections can be found only by defining these two concepts. Biomimicry can be used in adopting green economy and also used as a tool for making business greener. In the best case biomimicry could contribute to green the economy in a global level. Not necessary alone, but as part of expansive reform.

Biomimicry reduces energy and material consumption and transportation need and improves recyclability of products and materials. Therefore eco-efficiency is one essential form of biomimicry. There are also a number of studies which show that preventing environmental problems is more cost-effective than trying to fix the damage done. Studies on climate change and its costs, the Stern report e.g., are good examples of this.

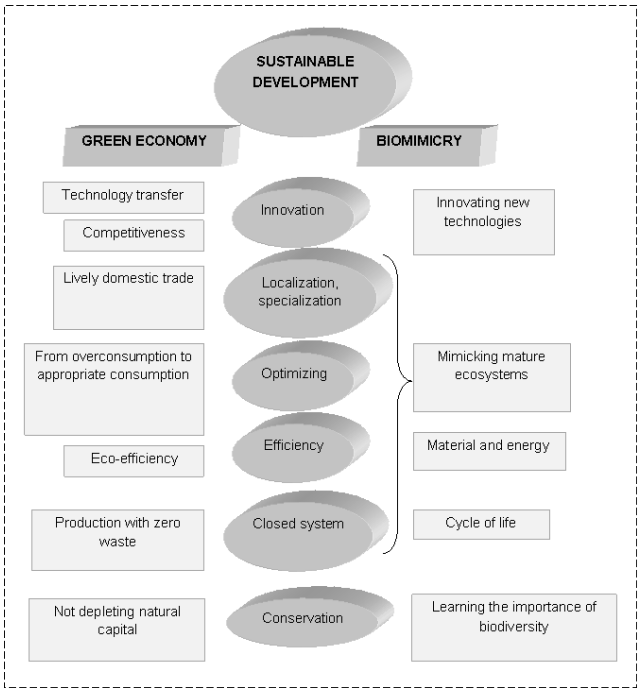

FIGURE 1: CONNECTIONS BETWEEN GREEN ECONOMY AND BIOMIMICRY.

As mentioned earlier, biomimicry requires big investments. Nevertheless, if the innovation succeeds, investments turn out to be profitable in the long run. Especially savings in energy costs are remarkable. A good example of this is the Eastgate building in Harare Zimbabwe. Eastgate is designed and built using biomimicry principles innovatively to construct a

sustainable building. The building has no conventional air-conditioning or heating, instead it uses technology adopted from the self-cooling mounds of African termites. Eastgate uses 90% less energy than a conventional building of its size. 3.5 million dollars alone has been saved because there wasn't no need to implement separate air-conditioning system [14].

It is obvious that biomimicry cannot be used solving every problem we humans face, but it still has a lot of potential in serving as a bridge between current and future economy (Figure 2). Knowledge on biology increases all the time and technology advances with giant leaps. Citing Achim Steiner, UN Under-Secretary-General and UNEP Executive Director, "Biomimicry is a field whose time has come."

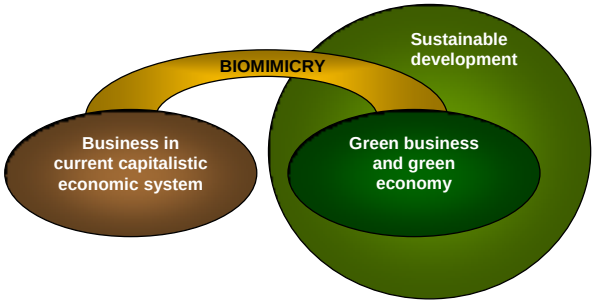

FIGURE 2: BIOMIMICRY CONNECTING CURRENT AND FUTURE ECONOMIC MODEL.

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Material Flow Cost Accounting Change in Japan: Reconstruction by Consultants

Tatsumasa Tennojiya
Doctoral Candidate in Graduate School of Business Administration Kobe University, 1-1 Rokodai-cho, Nada-ku, Kobe-city, 657-8501, Japan
E-mail: tentatsu713@gmail.com

***Abstract*: This paper addresses the issue of Material Flow Cost Accounting (MFCA) change in Japan. Employing the concept of "translation" (Latour, 2005), this paper trace how MFCA was changed by consultant's translation. Consultants reconstructed MFCA form management accounting tool to manufacturing renovation tool. This change will be the driver of mobilizing the people on the manufacturing line to MFCA network.**

***Keywords*: Material Flow Cost Accounting, Management Accounting Tool, Manufacturing Renovation Tool, Consultant**

I. INTRODUCTION

The purpose of this paper is to trace how MFCA is changed by consultant's translation, and to argue that activities of people on the manufacturing line are reflected in this change. They are important because this is them that improve productive activity.

II. THE VIEW OF ACCOUNTING CHANGE

This paper considers accounting as network around accounting not as accounting itself, so considers accounting change as network change. This is because this paper wants to avoid the problem regarding dichotomy between sociology and technology. This dichotomy determines the role of management accounting *a priori*. But in reality, the role of management accounting is determined in relation to actor around management accounting. Therefore to employ Latour's concept "translation" is going with this paper.

III. RESEARCH OBJECT

The object of this paper is MFCA which is environmental management accounting tool embedded in ISO 14000 series. MFCA is developed as innovative management accounting tool by management accounting researchers, because it is management accounting tool not only leading cost reduction but that could also result in environmental load decrease. On another front, MFCA also has been identified as an effective manufacturing renovation tool, but this fact is not yet recognized in many of Japanese company. Against this background, MFCA Forum Japan formed the working group named "MFCA as new manufacturing renovation tool". The leading members of this working group are consultants who have rich experience in implementing MFCA in company's structure, and the main topic of their discussion has been how to recognize MFCA as manufacturing renovation tool. In this working group, there are some consultant's translations, and this paper covered this working group discussion.

IV. ANALYSIS

MFCA's role has been determined in relation to traditional cost accounting, environmental management accounting in the network management accounting researchers has main role in (see Fig.1). On another front, in the network consultants has main role in, MFCA's role is determined in relation to manufacturing renovation tool such as IE, TPM (see Fig. 2).

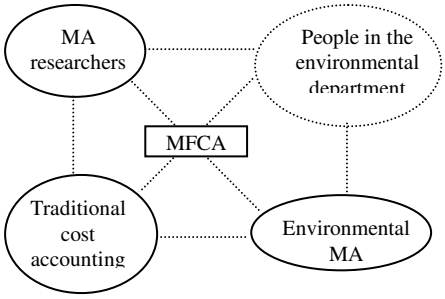

FIGURE 1: MFCA NETWORK BY MANAGEMENT ACCOUNTING RESEARCHERS.

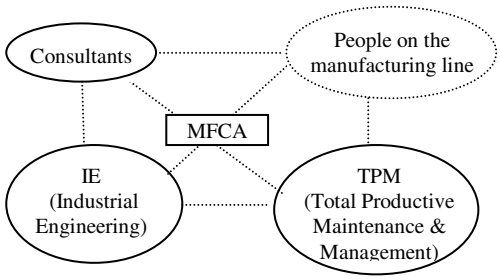

FIGURE 2: MFCA NETWORK BY CONSULTANTS

V. CONCLUSION

MFCA reconstructed as manufacturing renovation tool not innovative management accounting tool by consultants would reflect the activities of people on the manufacturing line. To mobilize them is very important for implementing MFCA successful. This reconstruction will be driver for diffusion of MFCA.

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Defining the pros and cons of sustainable development – a case study in the Finnish furniture industry

Katri Valkokari, Tiina Valjakka, Heidi Korhonen and Tapio Koivisto
VTT (The Technical Research Centre of Finland), Tekniikankatu 1, 33101 Tampere, Finland
E-mail: katri.valkokari@vtt.fi

***Abstract*: The purpose of this study is to explore business potential and risks related to sustainable development in the Finnish furniture industry. Our study contributes to the current discussion about sustainability with a practical case example of a multilevel approach. The multilevel approach is required in order to achieve systemic change towards sustainability within a networked manufacturing industry.**

I. INTRODUCTION

Increasing demands for sustainability have created new challenges and emerging opportunities for society and for business. A concrete way of exploiting these opportunities is the development and implementation of new sustainability-based industrial models and concepts. On the other hand, the current manufacturing paradigm of collaborative networks challenges traditional supply-chain management with system thinking and highlights shared purposes and co-development.

However, the previous studies of sustainability within the manufacturing industry have been focusing mainly on green issues in supply-chain management or corporate-level governance models and reporting practices. This paper aims to form a broader view on sustainability and recognises business and its development as part of the solution. Thus, we argue that a multilevel approach is required in order to define the pros and cons of sustainability from the viewpoints of all the actors involved and thereby ensure their commitment to change.

II. LITERATURE REVIEW

Sustainable development and its key aspects within the manufacturing industry are the main concepts related to the multilevel approach of sustainability in the Finnish furniture industry.

A. *Sustainable development*

The most widely quoted definition of sustainability (in other words sustainable development) is that provided by the Brundtland Commission:

> *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*[1].

Furthermore, just like the majority of researchers, we use the 'triple bottom line' approach proposed by Elkington [2]. Thus, three aspects of sustainable development – economic, social and environmental – have been considered in this study (Figure 1). Figure 1 summarizes the key factors of sustainability.

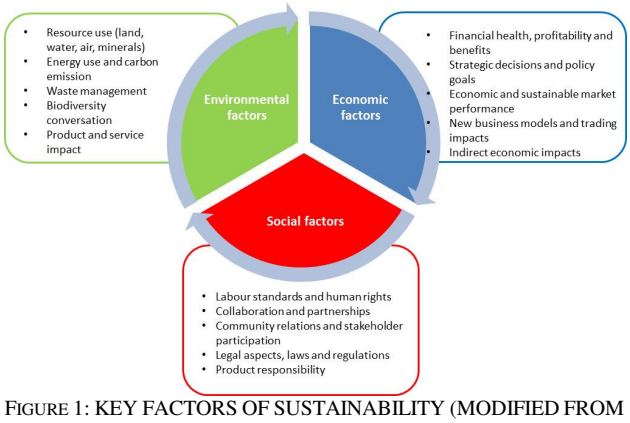

FIGURE 1: KEY FACTORS OF SUSTAINABILITY (MODIFIED FROM RANA 2011 [3])

Integrating these factors of sustainability into strategic decision-making is an essential pre-requisite for moving towards sustainable development. At the level of a manufacturing company, products and services must be:

- safe and ecologically sound throughout their lifecycle;
- appropriate, designed to be durable, repairable, readily recycled, compostable, or easily biodegradable;
- produced and packaged using minimal amounts of the most environmentally friendly materials and energy;
- transported, stored, delivered, and commissioned for use in an eco-efficient, economic, and socially responsible manner.

B. *Sustainability in the manufacturing industry*

The new manufacturing paradigm in the networked economy is based on collaborative, value-adding networks [4]. In addition, globalisation has activated a different industrial revolution, leading to a new world distribution of production and markets. Driven by increasing product complexity and lower barriers for international trade and cooperation, enterprise-led value creation has transformed into network-based manufacturing operations over time.

Thus, Supply Chain Management (SCM) has been approached, for a very long time, not as unifying but as coordinating the operations of (a) independently managed entities (b) who seek to maximize profits (only) individually [5]. This point of view is a major obstacle to achieving sustainability in supply-chain operations and more broadly in manufacturing industry. For sustainability, supply chains and other manufacturing operations must be designed and managed as an integrated system. In other words, all actors within the supply chain must be involved in co-development, e.g. working together in order to achieve shared targets. In addition to the supply-chain members, other stakeholders

can also have an impact and should therefore be involved in development work.

C. Multilevel approach of sustainability in the Finnish furniture industry

Sustainable development is a directional process of change by which a system improves through time in a sustainable way. The transformation can occur through either system innovations, as in the emergence of new subsystems that are more sustainable, or managed improvements of the current system. Therefore, given their differing needs and interests, all stakeholders have their own perceptions of development and improvements, in terms of what changes bring better, more sustainable circumstances.

For us to understand and envision such development requiring systemic change, a multilevel approach is required [6], [7], [8]. Figure 2 illustrates the different viewpoints at the three levels of change. Pros and cons regarding sustainable development should be defined from the viewpoints of several stakeholders: end customers, shopkeepers, a product company and its manufacturing network. In addition to these actors, there are also other stakeholders such as company employees and the local business community, who may influence sustainability development in the Finnish furniture industry. However, the viewpoints of these other actors are not covered in this paper.

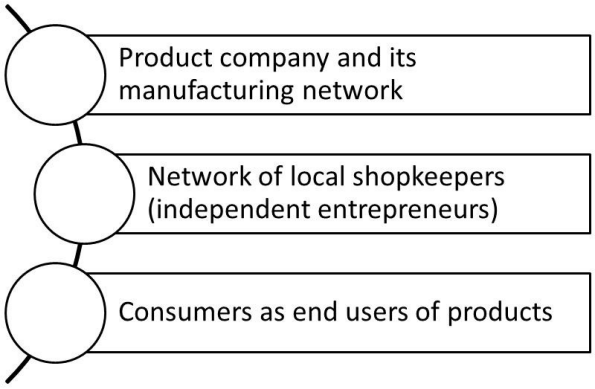

FIGURE 2: MULTILEVEL APPROACH TO SUSTAINABILITY

The main challenges of the Finnish furniture industry are related to better understanding of end-user needs, new product concepts, renewal of distribution chains and internationalisation [9]. The small size of companies within the furniture sector is one of the key challenges limiting its further growth. Entrepreneurs and family businesses have limited resources to invest in product development, marketing and production machinery, and at the same time, the furniture-chain purchasing requirements are more rigorous.

III. CASE RESEARCH

The research methodology employed in this paper is a qualitative case study. The case study was chosen as a method because it is a suitable method for situations that include complex and multiple variables and processes. The case study is also expressed as a distinctive strategy when 'how' or 'why' questions are being asked about a contemporary set of events over which the investigator has little or no control. [10] In accordance with the above views of Yin, the main research question concerns how to achieve networked sustainable development in the Finnish furniture industry.

Our case data is based on action research with different actors from the Finnish furniture industry. Pros and cons regarding sustainable development have been defined from the viewpoints of several stakeholders: consumers (end users of products), shopkeepers, a product company, and its manufacturing network. The case data is collected from multiple sources: interviews and workshops with the company representatives (both the product company and four shopkeepers). Table 1 summarizes the data sources.

TABLE 1: DATA COLLECTION

Stakeholders	Interviews	Workshops
Product company	2	3 internal + 1 with shopkeepers
Shopkeepers	-	1 (five participants from four shops)

Furthermore, the research work is in progress, and the viewpoints of consumers will be collected via a large survey during the summer of 2012.

IV. FINDINGS

According to our study, it is important to understand the different interests of all stakeholders as well as the impacts of different regional perspectives or national cultures and values. Sustainability means different pros and cons to different actors (Table 2). Pros and cons were identified within all three aspects of sustainability and from the viewpoints of all stakeholders involved. Hence, they were also in accordance with the viewpoints presented in earlier literature (see Figure 1 for summary).

TABLE 2: PROS AND CONS OF SUSTAINABLITY

Viewpoints of different stakeholders		
Product company	Shopkeepers	Consumers
Economic aspects		
The product company is able to improve its brand as a sustainable producer. Profitability of the business can be improved. On the other hand, sustainable products may increase production costs (e.g. component costs may be higher).	Shopkeepers find new business opportunities (e.g. services related to products). However, the main objective of shopkeepers is increasing their local market share and sales.	Consumers can base their decisions on a deeper and broader understanding of sustainability and be more satisfied with their decisions. At the moment, sustainability does not typically feature among major decision criteria.
Social aspects		
The product company facilitates participation of different stakeholders (such as consumers, local business communities, new partners and NGOs). Social media improve the connection between end users (consumers) and the product company.	Shopkeepers form partnerships with each other or with other actors (e.g. reusers, recyclers and local business community members). New alternative solutions increase local diversity in the furniture industry. Furthermore, face-to-face personal service is important.	Through new tools and the on-line community, consumers share the feeling of community, and have opportunities to interact, influence and engage with each other.
Environmental aspects		
The product company has lower costs (logistics, warehouse, design) due to more transparent supply and distribution chains.	Shopkeepers are able to consider and improve the environmental impacts of their products and gain energy-efficiency due to virtual product presentations and improved logistics.	Consumers are able to find new, more sustainable products, which are more convenient due to their usage and have a long life-cycle.

Firstly, both the independent shopkeepers and the representatives of the product company highlighted that business needs and benefits should be considered as a starting point. According to their view, consumers are not willing to pay extra for sustainable products within the furniture industry, but consumers set great store by a longer product life-cycle. However, new business opportunities for shop keepers may be found from the service sector related to furnishing, assembly of furniture, and its recycling or reuse. These new opportunities strengthen the competiveness of independent entrepreneurs and may even increase the diversity of local business communities.

Secondly, social aspects, such as standards of labour, are appropriately taken care of, as is quite typical for western production companies and networks. The case results indicated that involvement of different stakeholders could be facilitated through social media, such as furnishings blogs and on-line communities. These new communication tools can enhance collaboration between parties and support them in aligning interests. Furthermore, companies may improve their brand as sustainable producers and retailers. However, the shopkeepers also pointed out that for some of their customers, neighbourhood, familiarity, personal service, and proximity are important social criteria.

Thirdly, environmental benefits were strongly linked to energy and resource efficiency in manufacturing and distribution chains, e.g. improved logistics, and decrease of warehousing and packaging material. On the other hand, both the independent shopkeepers and the representatives of the product company emphasized that the use of recycled materials was not typically valued or desired by Finnish consumers. This may be related to the high value of wood in Finnish culture.

The results of the study highlight the need for collateral, horizontal relationships and a joint-development process among stakeholders, as has been emphasized by earlier literature too [5], [7], [8]. Furthermore, the various network levels (local, regional, sub-national, national or global) and types of relationship arrangements between a diverse set of stakeholders are recognised as important factors to be considered in the systemic change process of sustainable development.

V. CONCLUSION

The purpose of this study was to figure out how to gain networked sustainable development in the Finnish furniture industry. With regards to this question, the study explores what sustainability can offer to the main actors in the Finnish furniture industry.

Our study contributes to the current discussion about sustainability with a practical case example of a multilevel approach. This kind of approach is required in order to figure out how to guide the network actors at different network levels towards sustainability, e.g. how to align self-interests and business models of the actors involved with the public good (including the needs of future generations) at each level.

One of the key success factors identified in this study is that sustainability should be integrated into companies' as well as networks' core strategies. Thus, the shaping of

new sustainable markets is possible only through systemic change and a multilevel approach.

ACKNOWLEDGEMENTS

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Quality Cost Calculation using MFCA

Jaroslava Hyršlová, Gabriela Rajdlová, Miroslav Hájek
College of Economics and Management, Nárožní 2600/9a, CZ-158 00 Prague 5, Czech Republic
Czech University of Life Sciences Prague, Kamýcká 129, CZ-165 21, Prague 6, Czech Republic
E-mail: jaroslava.hyrslova@vsem.cz, hajekmir@volny.cz, g.rajdlova@seznam.cz

Abstract: **The costs of quality pay an important role in the management system, as they indicate the level of management in relation to quality, reveal potential possibilities for savings and help to raise the effectiveness of the decision-making in the area of quality management. The paper presents the pilot project of the quality costs monitoring system in the production plant of a company that produces ceramic tiling. The company is the largest manufacturer of ceramic tiles and paving in the Czech Republic and one of the biggest European manufacturers of tiling materials. The quality costs monitoring system in the selected production plant has the aim of providing information about major cost items that the company's management will be using to support its decision-making process. The proposal within the pilot project is based on the PAF model. Quality costs are sorted into prevention costs, control costs and the costs of internal and external defects. The basic source of the relevant data is the management accounting system and the ERP system. The calculation of the costs of internal defects is based on the data from the MFCA.**

I. INTRODUCTION

Quality costs are perceived in various ways (with regard to historic development, authors' approach and the requirements of company management). Nenadál speaks about quality costs as financial measurements in quality management systems. In his approach, the quality costs are all financial resources that the supplier or customer has to spend on the processes of the securing and/or improving of the quality of its products [1]. The definition provided by Wong corresponds to this approach: The costs of quality are all costs spent by the company to ensure that the overall concept of the product provided to the customer really meets their requirements [2]. On the other hand, Crowley states that the costs of quality are the difference between the current revenues and the revenues at the moment when all customers are always satisfied [3]. The essence and importance of the monitoring of the costs of quality as a management tool (and not just quantification of value) was captured by Atkinson, who regards quality costs as the link between quality management and financial targets and company targets [4].

The content of quality costs – i.e. their internal structure (see e.g. [5]-[7]) - is also perceived differently. As a rule, the formulation of the structure of quality costs is based on the following prerequisites [3], [6]:

- Low quality costs the company money, while good quality earns money for the company.
- It is usually cheaper to provide high quality products. The costs of improvement are spent only once, while the costs of the removal of insufficiencies and/or defects are spent repeatedly.
- Each flaw (defect) has its cause; these causes may be removed – flaws (defects) may be prevented. Prevention is always cheaper.
- The cost incurred by the customer may be substantially higher than the cost of the rectification of the defect; to satisfy the customer's requirements, it is not sufficient to monitor the company's costs and revenues, but the costs that the customer will have to spend on the product over its entire life cycle must be monitored as well.

In order to be able to play the role of a management tool (to provide information that supports decision-making), the cost monitoring system has to cover all substantial costs related to the quality management system in the company, the costs of internal and external defects (i.e. costs of non-quality), as well as the costs incurred by the users of the product. The system set in this way forms an important part of the quality management (and management in general). It enables the setting of an optimal quality management system, contributes towards the elimination of costs related to low quality production and helps to identify the possibilities for improvement and to optimise company activities (processes). In order for the cost monitoring system to be of benefit for the company, significant cost items must be identified and relevant responsibilities must be defined, with the aim of using the acquired data for the improvement of individual corporate processes [3], [6], [8].

The company may use various models within the quality costs monitoring system (see e.g. [1]):

- PAF (Prevention, Appraisal, Failure) model. This model focuses on the monitoring of the costs of internal defects, the costs of external defects, control costs and prevention costs.
- COPQ (Cost of Poor Quality) model. The model is based on the prerequisite that the failure to meet the requirements causes substantial economic losses to producers; the model recommends monitoring the costs of internal defects, the costs of external defects, the costs of wasted investments and environment damages (the costs incurred in relation to the non-compliance with environment protection laws and its return to the original condition; these include also the costs of the treatment of job-related illnesses etc.).
- Process costs model. The model works with the costs of compliance (i.e. real cots for the transformation of inputs into outputs in the most effective manner) and the costs of non-compliance (wasted time, material and capacities – related to the creation of non-compliances within processes).
- Lifecycle costs model. This model focuses also on the costs incurred by the user; this model makes sense only by a limited group of products with foreseen usage period of more than a year, where the costs of

assembly, operation and maintenance are not negligible in comparison to the acquisition price of the product).

The entire quality costs monitoring system is useful only if the acquired information is evaluated and used by the management to support the decision-making processes in the company.

The following text focuses on the quality costs calculation in a company that produces ceramic tiles. The paper presents the pilot project of quality cost monitoring in one of the company's production plants.

II. CHARACTERISTICS OF THE PRODUCTION PROCESS, QUALITY MANAGEMENT AND COST MONITORING SYSTEM

LASSELSBERGER is a family company owned by Austrian group LASSELSBERGER GmbH Pöchlarn, which does business in the production of ceramic tiles, as well as the mining and adaptation of raw materials and production of building materials. LASSELSBERGER is currently the largest manufacturer and supplier of ceramic tiles on the Czech market. Europe remains the traditional export market – Germany, Austria, France, as well as the Netherlands and Scandinavian countries. The company's aim is to maximise the effort at satisfying the growing customer requirements.

The quality management system in LASSELSBERGER complies with the requirements of the ČSN EN ISO 9001:2009 norm. The company has created, documents, applies and adheres to a quality management system and is continually improving its effectiveness. The company has defined processes that secure the activities of the quality management system, defined how they are applied, and introduced their monitoring, if and where these processes may be measured and analysed.

Systematic monitoring of quality costs is non-existent in the company. Only the costs of complaints proceedings are regularly monitored and reported in the company (they are included in the Quality Information Summary). The complaints are sorted into complaints related to production flaws and complaints related to shipment, i.e. logistic complaints (shortages, product exchanges, break-ups etc.) The complaints are monitored acc. to period, plant, claim admittance, type of defect, country, warehouse (by logistic complaints) and customers. The information is quantified in the amount of defects, m^2 as well as CZK. The report is discussed on management meetings.

One of the company's production plants was selected for the pilot project of quality costs monitoring. The production process in the plant consists of the following steps:

1. Ensuring of input raw materials and their storage.
2. Wet milling in mills – homogenisation of raw materials. From the mills, the homogenised liquid mass is drained into reservoirs, from which it is transported through pipes for further processing.
3. Drying in a spray drier. Granulate with water content of cca 5.5 % is created. This granulate is then taken from the drier into a reservoir.
4. Press moulding. Granulate is transformed into a tile. The semi-finished products are transported via conveyors from the pressing machines for further processing.
5. Preparation of engobes and glazes. Engobes and glazes are readied in a separate production step. The amount of the waste created within the preparation of the glazes is not known and/or controlled. It is estimated that the waste amounts to cca 9.5 % of the glazes and engobes put into the mills and subsequently 5 % of the suspensions produced in the glaze preparation facility.
6. Glazing on glazing lines. Here the engobe, glaze and print are applied to the tile semi-finished product. All in all, the waste rate for the pressing and glazing production steps is reported to be 2 % of the total production. The production is monitored in the company in m^2 and in tons.
7. Firing in gas furnaces. The firing process takes 40-50 minutes.
8. Product control and sorting. The products are divided into three categories, which correspond to EN CSN 14411 (1^{st} class, 2^{nd} class and waste). The loss from the quality check amounts to 5 % of the total size of the surface of the production output.
9. Packing and subsequent dispatch to product warehouse.

The non-existence of waste in the classic sense of the word is a specific feature of ceramic production. All non-quality (defective) products (semi-finished or finished products) are recycled and put back into the first production phase.

The entire production process is monitored through 18 checkpoints (locations), where the product parameters are monitored and recorded and low-quality (defective) products are excluded. The nineteenth checkpoint (location) is the company laboratory.

The monitoring of the flow of the material through the production is currently done through ERP (Enterprise Resource Planning) within the SAP system. According to the existing corporate management accounting system, the production plant is divided into three cost centres: mass (raw materials) preparation (includes raw material warehouse, milling and drying), glaze preparation and production (includes pressing, glazing, firing, quality check and sorting and packing).

III. IDENTIFICATION OF MAJOR QUALITY COSTS AND PROPOSAL OF THEIR INTERNAL STRUCTURE

Given the nature of the production, the PAF model was selected for the monitoring of the costs; the costs are sorted in classification to prevention costs, control costs, costs of internal defects and costs of external defects. The content of individual quality costs categories (incl. the characteristics of activities falling within individual areas) is apparent from Table 1.

The proposed system collects and registers data about individual cost categories, monitors the development of total quality costs, as well as individual cost items, in the monitored period, and compares the share of individual cost groups on total costs. The system provides information supporting decision-making, with the aim of improving production and other company processes.

TABLE 1: QUALITY COSTS STRUCTURE [9]

Prevention	Control	Internal defects	External defects
Quality information system and documentation maintenance	Input, inter-operational and output control	Irreparable rejects minus utilisable waste	Irreparable external rejects
Quality management section	Laboratory tests	Internal rejects reparable (reworking and adjustments)	External rejects reparable (reworking and adjustments)
Training and educational programs	Metrology	Deficits and damages	Damage liability
Development of new control and test methods	Expert opinions	Discounts on non-compliant products	Complaints solution
	Procurement of services from external testrooms and laboratories	Removal of irreparable defective products	Minus accepted compensations from employees, suppliers, sales agents, insurers
	Production of samples for destruction tests	Minus accepted compensations from employees, suppliers, sales agents	

IV. CALCULATION OF INDIVIDUAL QUALITY COST ITEMS AND TOTAL QUALITY COSTS

A. *Prevention costs*

The costs of the quality information system and the maintenance of the documentation and the costs of the quality management section were determined by an expert estimate; this is a portion of the cots of the relevant company sections the carry out the monitored activities for all production plants of the company.

The costs of the quality management section include also the cots of the training and education programs and the costs of the development of new control and test methods.

B. *Control costs*

The costs of the input, inter-operational and output control are a part of the costs of the technologies centre. This centre carries out the technological aspects of the production preparation; it prepares e.g. the technological documents (bills of material, work procedures) for the given production lines or the production processes, cooperates on the setting of the production equipment, tests and evaluates the production samples, cooperates on the selection and assessment of input raw materials.

The laboratory tests are carried out in laboratories which perform this activity for all production plants in the company (they are a separate cost centre). The costs of the laboratory tests allocated to the monitored production plant were determined by estimation (acc. to the plant production/total company production volume ratio).

The costs of laboratory tests include also the costs of metrology, expert opinions and purchased external services (external test rooms and laboratories).

No products are produced specifically for destruction tests. Destruction tests, as well as other tests, are performed on finished products in the laboratories (the used amount is negligible). The losses on finished products due to tests are a part of the total losses of finished products and the cots of these losses are part of the cost item Irreparable rejects (see costs of internal defects).

C. *Costs of internal defects*

Certain losses are incurred in each production degree of the tile production. Four types of defective products were identified within the entire production process, all of them return back into production (as input raw materials); the flows are depicted in Figure 1 with a dashed line. Flow 1 (between the glazing and pressing processes) consists of pressed, wet and unglazed defective tiles. Flow 2 consists of defective tiles with a glaze layer. Flows 1 and 2 are created through the sorting of non-quality products on the belt, or they are tiles that were used for the purpose of quality control. Flow 3 consists of finished fired tiles that do not comply with the rigidity parameters. Flow 4 consists of completed fired tiles that were excluded due to low quality. The costs related to these flows are classified as so-called costs of internal defects.

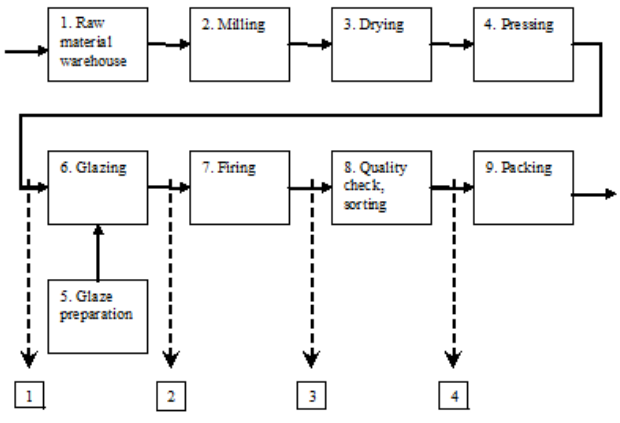

FIGURE 1: CREATION OF NON-QUALITY PRODUCTS [9].

The calculation of the costs of internal defects must be based on the data from the cost centres that monitor the production process. The MFCA method can be used with an advantage (see [10]).

The MFCA method has been applied to the complete manufacturing process of the plant. The whole manufacturing process was subdivided into four quantity centers:

- Preparation of materials. This quantity center corresponds to the cost center preparation of materials. Almost all material losses consist of water evaporated during the drying process.
- Preparation of glazes. This center, similarly as the previous quantity center, also fully corresponds to the cost center preparation of glazes.
- Pressing and glazing. This quantity center does not correspond to the cost centers created within the existing management accounting. The reason for its formation is the need to acquire a more realistic view of the material flow corresponding to the assessment of arising material losses.
- Burning, sorting, and packaging. The reason for the formation of this quantity center is the need to specify the monitoring of material flows. The only material loss of the burning process is the water evaporated from the pressings; other material losses result from the sorting process on sorting lines.

During the data collection process, it was necessary to perform the reconstruction of material flows by individual quantity centers (weight units). Some data required for the MFCA method had to be calculated based on the knowledge of the manufacturing process and using the company formulas. The knowledge of the material flows and the prices of raw/other materials were used to determine the material costs of products and material losses – i.e. the prices of materials, which leave for other quantity centers (or to customers) as part of products or as part of material losses – waste flows. It applies than the material costs of products equal to the material costs of products produced in the last quantity center. The material costs of material losses were obtained as the sum of costs of material losses throughout the whole manufacturing process (i.e. for all quantity centers). It was also necessary to identify and determine energy and system costs incurred by individual quantity centers. During next stage, it was necessary to allocate the material, energy, and system costs to products and material losses, and to determine the total costs associated with individual material flows. The allocation must be performed within each quantity center based on the material distribution percentage. Based on the use of the above procedure were determined total costs of products and material losses. Calculation of costs of internal defects come out of total costs of material losses calculation. The costs of internal defects include the energy and system costs of material losses. The costs of internal defects do not include the material costs of material losses, as non-quality products are returned back into the production process (as input raw materials).

Deficits and damages are monitored directly in the accounting system.

1st and 2nd class tiles, as well as non-quality products, are created within the production of tiles (see above). As the plant's aim is to produce 1st class products, the discounts on 2nd class products are included into the costs of internal defects (2nd class products are sold for half the price of 1st class products).

D. Costs of external defects

The calculations of the costs of external defects (costs related to complaints) were taken over from the intracompany quality report.

E. Total quality costs

Within the pilot projects, the quality costs in the selected part of the company (selected production plant) for 2008 and 2009 were calculated using the methodology described above (see Table 2).

TABLE 2: QUALITY COSTS IN 2008 AND 2009 (THOUSANDS OF CZK) [9]

Cost item	Year 2008	Year 2009
Prevention costs	3 091.4	2 294.8
Control costs	3 340.1	4 052.1
Costs of internal defects	76 636.5	57 342.9
Costs of external defects	556.3	522.9
Total quality costs	83 624.3	64 212.7
Production volume (in mln m^2)	6.6	6.1

The total quality costs dropped by almost CZK 19.4 mln between the years of 2008 and 2009; the production in the same period decreased as well, though (from 6.6 million m^2 to 6.1 million m^2 – i.e. almost by 8 %). It is apparent from the Table 2 that the structure of the costs has changed. The share of the costs of internal defects has decreased, while the control costs on total quality costs has increased. The collected data clearly indicate that the most significant cost item is the costs of internal defects, which account for cca 90 % of total quality costs. In order to be able to cut the costs, one must focus on individual production operations (input raw materials, production recipes, tuning and setting of production equipment). The lowest cost item is the cost of external defects.

Based on the MFCA calculation, it is possible to recommend to the company to mainly concentrate on the processes taking place within the preparation of materials, which produced the majority of material losses. Material losses mainly occur during the manufacturing process of drying, and they result from the method of processing raw materials at the beginning of the material flow. Even though the non-quality products are recycled within the company, the energy and system costs incurred in connection with their production are irrecoverably lost. The manufacturing of ceramic tiles represents a traditional production with a familiar manufacturing process. In general, it is very difficult to propose any improvements for these technologies, because they tend to be very sophisticated from the perspective of technology. The MFCA method could contribute to the development of new technologies, which would eliminate

or mitigate deficiencies of traditional technological processes. It is apparent that it is not possible, for various reasons, to completely prevent the production of material losses. However, it is useful to try reducing the value of material losses as much as possible while preserving the product quality desired by customers.

V. CONCLUSION

The quality management system is an essential part of the management of every company. The article focused on the monitoring of quality costs, which forms an integral part of quality management and may represent a very effective management tool.

The main advantage of the quality costs monitoring system is the fact that the level of quality of company activities, products and services (incl. quality management) is quantified in monetary units. As a rule, each operation that is not carried out in appropriate quality leads to the creation of a non-quality product (material losses); the system quantifies the economic losses incurred by the company. This may contribute to a change in the perception of the errors within the company processes by the company's management, and primarily employees. Thanks to the obtained information, the places where the biggest economic losses are incurred may be identified, and, on this basis, rectifying measures may be proposed and implemented – their efficiency may be defined very precisely. The aim of the measure is to improve individual company processes, and thus also the company's economic results. The implemented measures are systemic and systematic.

For a successful implementation of the quality costs monitoring system, the system must be supported by the company's top management, the implementation must be handled by a professional interdisciplinary team, the system must gradually be expanded to the entire company and, in many cases, adjustments to the company's information system are required. It should also be noted that the system in itself does not solve the problems with the quality, does not offer specific solution and does not eliminate the company' costs.

When applying the MFCA method within a plant manufacturing ceramic tiles of different sizes, colors, and glazes, the reconstruction of material flows was mainly based on the detailed knowledge of the manufacturing process and its individual stages. At the same time, data from the company information system and company formulas were used. In spite of this, the identification of the material flows in physical units did not present a simple task, especially in those manufacturing stages, which use materials already preprocessed in other centers. The application of the MFCA method revealed that the quality of information output is mainly affected by the selection of quantity centers. For this reason, it is necessary to specify an optimum size of each quantity center, in order to prevent losses of important data and time/money-consuming collection of the relevant data. Furthermore, the quality of obtained data is greatly affected by an identification of energy and system costs and, above all, their correct allocation to individual quantity centers.

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