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Two Decades of Corporate
Environmental and Sustainability Accounting
– What has been achieved?



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Adams, Carol A

Environmental, Social and Governance (ESG) risk, strategy, corporate reporting and board oversight: interviews with Board Directors

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ABSTRACT

This paper develops a conceptual framework to explain the complex interrelationships which influence the ability of firms to create value for their stakeholders. In doing so it examines the inter-relationships between: Environmental, Social and Governance (ESG) risk; delivering on corporate strategy; non-financial corporate reporting; and, board oversight. The initial framework is developed from prior literature and various forms of engagement work. It is refined through interviews with Board Chairs and Non-Executive Directors of large listed companies on the Johannesburg Stock Exchange (JSE) (where Boards are required to have a Social and Ethics sub-committee and approve mandatory integrated reports) and the Australian Stock Exchange (ASX) (where Board Directors reluctant are to report on strategy due to directors' liability legislation).

The research finds an increasing awareness of the impact of ESG issues and a broader view of value creation emerging. Contemporary (integrated) reporting approaches are found to enhance Board governance and assist organisations in managing complexity and focussing on long term value creation for stakeholders in the face of investor disinterest. A number of avenues of research are suggested to examine the interrelationships identified. The research assists the development of practice and policy by articulating and enhancing our understanding of linkages, which loosely fall under the vague practitioner term 'integrated thinking'. The cross country comparison allows an assessment of the extent to which different national social contexts with differing governance and reporting frameworks lead to different perspectives on value creation.

INTRODUCTION

The fields of practice of Environmental, Social and Governance (ESG) risk management, its incorporation into strategy and accounting and reporting for ESG risks have developed rapidly over the last decade or two demanding review and evolution of theoretical insights and an openness to new theoretical frameworks which structure

researchers' observations of practice and enable scholars to communicate new understandings (Adams and Larrinaga-González, 2007; Adams and McNicholas, 2007; Contrafatto, 2014; O'Sullivan and O'Dwyer, 2015; Parker, 2005; Unerman and Chapman, 2014). This is particularly true as practitioners and scholars grapple with increased interconnectivity between corporate reporting, risk, governance and performance and the complexity that entails. This increased complexity and unpredictability of relationships between relevant phenomena, particularly when moving towards a more multifaceted and interacting approach to social, environmental and economic sustainable development require new theorisations (Unerman and Chapman, 2014).

Prior to the turn of the century theorising in corporate social or sustainability reporting occurred deductively (see Parker, 2005) and, just as corporate sustainability reporting occurred in practice with little interaction with other corporate functions (and hence perhaps little impact), these theories ignored the role of corporate culture, systems and people. Early theorising focussed almost exclusively on linking external reporting with corporate characteristics (such as size and industry grouping) and general contextual factors (such as the social, political and economic context) (Adams, 2002). Further, the accounting and management literatures respectively examined Corporate Social Responsibility (CSR) Reporting and CSR activities with limited connection made between the two (but see Gray *et al.*, 2014). In response Adams (2002) called for more case study work examining internal contextual factors and in recent years a growing body of research has sought to understand the inter linkages between corporate sustainability reporting practices and other organisational functions (see for example Adams and McNicholas, 2007; Correa and Larrinaga, 2015; Cho *et al.*, 2015; Lodhia, 2015; Milne and Gray, 2013; Queen, 2015). Much of this work has drawn on broader management and social science theories to understand (impediments to) particular aspects of the transformation processes.

This paper takes a broad approach in order to increase our understanding of the interplay between

the various elements of the ongoing transformation and identify aspects of it that warrant further research.

A further relevant strand of work examines of the role of social actors or stakeholders in the dynamics of corporate non-financial reporting (see, for example, Adams and Whelan, 2009; Archel *et al.*, 2011). Linked to this Hall *et al.* (2015) argue that including stakeholder voices in reporting enhances value creation. Stakeholder engagement is also increasingly regarded as critical to ESG risk identification and central to the GRI Framework (GRI, 2014).

The literature recognises that aspirational future talk may serve to mobilise organisations to strive to achieve a different future (see, for example, Christensen *et al.*, 2013; Cho *et al.*, 2010). This raises a question as to whether mandatory requirements to report on strategy (such as ASIC, 2013) and encouragement to disclose forward looking information (IIRC, 2013) could influence corporate aspirations themselves. This possibility is reinforced by Cho *et al.* (2015) who suggest that the concepts of organisational façade and organised hypocrisy raise the possibility of individual organisational actors improving an organisation's social and environmental performance. The different future to which these authors refer could include a future where creating value for stakeholders is seen as essential to creating value for shareholders.

Linked to this Hahn *et al.* (2014) present business case and paradoxical frames as being at two ends of a continuum as to how managers conceptualise corporate sustainability. The business case frame is presented as being fully aligned with economic goals and the paradoxical frame as being a combination of interrelated but conflicting social, environmental and economic goals. In the paradoxical frame managers deal with a high level of diversity of attributes and a high level of complexity and diversity of interconnections between the attributes. They scan more broadly considering a wide range of aspects of sustainability issues and consider non-financial information in decision making. Hahn *et al.* hypothesised that, in contrast, managers with a business case frame would only consider sustainability issues that they regarded as having business relevance and information about those issues which is seen as similar to business information i.e. typically quantified. They are also likely to only consider sustainability issues over which they perceive they have a high degree of control.

Hahn *et al.* (2014) is particularly pertinent in understanding organisational dynamics in

developing integrated thinking, a term used by practitioners to denote a way of thinking about the business of an organisation more holistically rather than in silos. How does integrated reporting, which is intended to encourage integrated thinking (IIRC, 2013), influence managers' cognitive frames? The characteristics of the paradoxical frame described above might be considered desirable features of integrated thinking and a broader understanding of value creation. On the other hand any attempt to monetise the non-financial outcomes of the value creation process might encourage a business case frame.

The purpose of this study is to examine the interrelationships between: ESG risk; delivering on corporate strategy; and, corporate reporting, particularly non-financial reporting: from the perspective of Board Directors and insofar as they influence a company's ability to create value for its stakeholders.¹ Informed by Hahn *et al.* (2014) some consideration is also given as to how these interrelationships might influence individual actor cognitive frames.

A conceptual framework is developed and is refined through interviews with sixteen Directors including Board Directors of large listed companies on the Johannesburg Stock Exchange (JSE) and the Australian Stock Exchange (ASX). The interviews sought to gauge: approaches to ESG risk governance; understanding of the nature of ESG risk issues and their relevance to long term strategy; and, the role that corporate reporting has played in forming their views. By nature of their position, the interviewees are amongst the most influential people in the world with respect to aligning business outcomes with outcomes for society. Board Directors, also referred to as Non-Executive Directors (NEDs) of large complex companies are generally required to have held senior management positions, often as Chief Executive Officer (CEO), and hence have an appreciation of the interrelationships between the different factors and actors examined in this paper. Collectively Board Directors are ultimately responsible for corporate risk governance and developing and delivering on strategy. The fact that integrated reporting is mandated for companies listed on the Johannesburg Stock Exchange (JSE)²

¹ For these purposes value creation is defined broadly i.e. beyond the pursuit of profit, as it is in integrated reporting (see IIRC, 2013), but see EY (2013) for a summary of other approaches. It should be noted however, that under the King III Code which was current in South Africa in 2015 when the research was conducted, the notion of value creation is somewhat less organisation-oriented and closer to the notion of Value- Creation Stakeholder Accounting put forward by Mitchell *et al.* (2015).

² The Companies Act no. 71 of 2008 was signed by the President on 8 April 2009 and gazetted in Gazette No. 32121

and discouraged by regulation relating to directors' liability in Australia (see Huggins *et al.*, 2015) makes these two countries particularly interesting to study.

There are a number of factors that, taken together, make this research particularly important: the link between ESG risk, reputational damage and delivering on strategy; investor demand (or lack thereof) for information on ESG risks; the importance of board involvement in integrating environmental and social sustainability into corporate practices; increasing regulatory and stock exchange requirements to disclose both ESG risks and strategy; global discussions on the role of corporate reporting in achieving the Sustainable Development Goals; and, the trend towards integrated reporting.

FINDINGS

The coding scheme and key findings for each specific code arising from the data are summarized in Tables 1 and 2.

(Notice No. 421). The Act replaces the Companies Act, 61 of 1973 and came into effect on 1 May 2011.

Table 1: Summary of South African findings based on thematic coding scheme used

Node codes	Specific codes	Summary of key findings
Social and environmental factors (i.e. Social, environmental drivers for / impediments to change)	Global factors	Megaforces (increase in middle classes, climate change); increased focus on carbon emissions; increase in consumer concern about health and well-being.
	National factors	Social and economic inequity; high unemployment leading to social unrest; energy cuts; young post-apartheid population; retirement of those carrying baggage from the Apartheid era; emigration of racists; poor infrastructure; and, lack of leadership from government and regulators to address these issues.
Institutional factors (i.e. Institutional drivers for / impediments to change)	Role of investors	Gap between Board and investor view of what is important to success. Limited investor concern about longer term/ ESG issues.
	Government intervention in the economy	Minimum wage seen as reason for high unemployment. Government representation on corporate boards (means some discussions take place outside the Board room). Sophisticated regulatory environment.
	Regulation	Integrated reporting as per the King III Code and the Social and Ethics Board subcommittees mandated by the South African Companies Act have led to positive change. A number of significant benefits of mandatory integrated reporting identified.
	Post-apartheid government-business relationships	Improving due to business concern about economic inequity, possible social unrest and business consequences of energy cuts.
Governance and corporate practices (including corporate reporting)	Integrated thinking	Integrated thinking is becoming embedded and evidenced by the changing nature of boardroom discussions.
	ESG risk governance	Focus on ESG issues has increased over last 5-10 years. Board focus on social issues is high and dominates over concern about environmental issues.
	Corporate reporting	Integrated reporting (as per the King III Code) is a useful framework for ensuring that attention is paid to ESG risks.
Implications and outcomes	More informed decision making	Strong positive view of the role of integrated reporting in improving decision making.
	CSR integrated into strategy and core business	Enhanced attitude to Board Diversity - Valuing the holistic thinking of female NEDs. Banks making lending decisions on an integrated basis. CSR initiatives linked to strategy and core business.
	National benefits	Businesses are forging relationships with government to address social issues in recognition of their significance to business success.

Table 2: Summary of Australian findings based on thematic coding scheme used

Social and environmental factors (i.e. Social, environmental drivers for / impediments to change)	Global factors	The global financial crisis (particularly for the banking sector). Digital disruption; housing affordability. Income inequality, ethical sourcing and other global social and environmental issues are a driver to the extent that there is a risk of the corporation being involved in a reputation risk issue.
	National factors	Discussions on the need for long term infrastructure investment and targets to deal with climate change at the G20 summit held in Australia in 2014 got media attention. Shareholder activism; changing customer and employee views; rights of indigenous people.
Institutional factors (i.e. Institutional drivers for / impediments to change)	Role of investors	Belief that investors should (but don't necessarily) want more forward looking information. View that sustainability reporting has limited usefulness in that it does not link ESG issues to value creation. Investor interest and understanding of the impact of ESG issues on long term performance is low.
	Regulation / mandatory requirements	Companies may not be complying with mandatory requirement to disclose forward looking information in the Operating and Financial Review (OFR) due to Directors' liability concerns. Quarterly reporting requirements lead to a short term focus in the absence of compensatory drivers (such as the King III Code in SA).
	Director's liability	Director's liability concerns are a significant barrier to integrated reporting. Directors want to provide information which better meets long term investment needs.
	Other	Emergence of risk management as a profession. Incorporation of ESG issues into Director training.
Governance and corporate practices (including corporate reporting)	Integrated thinking	Integrated thinking expressed in terms of: i) a holistic approach to strategy; and, ii) leadership with respect to culture.
	Redefining value	Boardroom discussions on ESG issues have increased over the last 5-10 years, but generally more from the perspective of reputation risk rather than value creation.
	Board involvement in non-financial reporting	Boards sign off on the sustainability component of annual reports and integrated reports but generally do not sign off on sustainability reports. Some Boards are unaware of what sustainability information is being collected and reported. Many Boards do not have committees dealing explicitly with sustainability issues.
Implications and outcomes	Developing <IR>	Interviewees who had been involved with <IR> had a good understanding of it. The most difficult <IR> concept to put into practice for those with no prior knowledge is the six capitals concept, although boards discuss the capitals in their own terms. The perceived potential for giving away new competitive information is a barrier for those who have not previously reported strategy.
	ESG risks	Governance processes and Board aptitude/capability on ESG risk and opportunity considerations need to be enhanced.

T

The South African interviewees without exception had a high level of awareness of the impact of social issues on long term business success and were broadly in agreement as to what those issues were (see Table 1), how they might impact on their businesses and how they might be resolved. Whilst there was some awareness of environmental issues across all interviewees there were differences in emphasis and understanding of their likely future impact on business. The South African Board Directors raised varying levels of concern about the governance of government. In most cases this level of concern could be described as high. The interview data pointed to exceptional leadership, a concern for the future of their country, the mandatory (by the South African Companies Act) Social and Ethics Board sub-committee and the requirements of the King III Code with respect to integrated reporting being key enabling factors in creating value for shareholders and other stakeholders.

The level of awareness of and responsiveness to ESG issues amongst the Australian interviewees was more varied and was not as natural or engrained. This may reflect the lack of consensus which emerged on both key drivers for change and top ESG issues (see Table 2). Thinking was more traditional or constrained (for example by reporting to short term investors) and, unlike the South African sample, there was no sense of urgency for change from the perspective of pressing issues or of realising benefits. Director's liability legislation was seen as a barrier. Whilst most interviewees could articulate what integrated thinking and a broader view of value creation might mean, there was a sense that, whilst there had been change, the corporate climate was not where it ought to be. A number of Australian interviewees expressed a view that Boards were not sufficiently aware of ESG risk and opportunities or their impact on business (an awareness which is forced upon South African Board directors through the King III Code).

The key findings are further elaborated in the full paper.

DISCUSSION

This section discusses the implications and outcomes of the dynamics discussed in the findings section of the full paper, particularly as they relate to value creation for companies, their shareholders, stakeholders and society more broadly.

A number of examples of a broader view of value creation emerged from the interviews. It was something all of the interviewees had given some thought to albeit to different degrees. One particular interviewee stood out as a leader who had sought, and succeeded in identifying opportunities which served society's interest, decreased negative environmental impact and resulted in business growth. He observed global, as well as national trends. Other examples related to particular initiatives and issues around employees (human capital, to use the term in IIRC, 2013), the environment (natural capital) and relationships with customers, government and other stakeholders (social and relationship capital). This has occurred in the context of increased demand from

customers, employees and even banks for social and environmental responsibility.

The South African interviewees had strong views that business had a role in addressing social issues and they put forward a number of suggestions as to how this might be done whilst simultaneously further enhancing corporate value creation: improving education to increase capability; increasing corporate social investment; and, better collaboration between business and government to make sure regulation makes sense. Thus they espoused a broad view of value creation where ESG issues, particularly national level issues, played an important role. The visibility afforded by the mandatory requirement to prepare an integrated report and consider ESG issues at Board (sub-committee) level was clearly a factor shaping their views (see Burchell *et al.*, 1985; Miller and Power, 2013 regarding implications of making issues visible). Whilst Australian companies had not embraced a broad view of value creation to the same extent, there was evidence that those that had considered integrated reporting linked it with an enhanced awareness of ESG issues albeit starting from a low base,

Contrary to the simplistic mantra of legitimacy theory and the evidence which has been found to support it (see, for example Patten, 1992; Deegan *et al.*, 2002), a number of the interviewees spoke of the importance of transparency: "you'd rather let it hang out there... than come back later to address a shortcoming (SA5); "boards should ask themselves the question all the time: are we being transparent enough?... there's just no reason to be anything other than 100% transparent" (Aus3); "I've never been in any discussion where people have said... it's a risk we don't want to disclose" (Aus9); "we should be disclosing as much as we possibly can" (Aus6). Countering this, a minority of interviewees noted that such views were not shared by some board colleagues.

Whilst as little as a decade ago the possibility of companies contributing to the SDGs and sustainable development would not have been thought possible by this author (see Adams, 2004) (who remains sceptical about the public relations fluff, omissions and untruths in many corporate reports), this research provides evidence that this is happening (notwithstanding the ongoing concerns of Gray, Milne and their co-authors). And initiatives such as those of Stock Exchanges, the IIRC, GRI and UN Global Compact with respect to corporate reporting and governance practices have a part to play.

CONCLUSION

The conclusions are discussed in the full paper.

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Sustainability Performance Measurement & Management using 3E – Planetearth Concept for Sustainable Development

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Extended abstract: Sustainability Performance Measurement & Management would not be integrated unless we ensure that social sciences, technology and innovation progress occurs in harmony with environment, education and economy. Understanding countries current situation and drawing future orientation represents a challenge and deep concern in support of sustainability, as well as, highlighting the advances or failures at different levels and timescales, including an analysis of the efficiency, effectiveness, and financial and technical contributions of the appropriate institutional framework to accelerate the implementation of the Agenda 21 global sustainable development goals.

The 3E-Planetearth Concept for Sustainable Development is a first glance, simple, flexible, practical and innovative approach for problem solutions to the global sustainability challenge; helps saving time and money; demonstrating the scale and ambition of individuals, groups, companies, governments, organisations, societies and all stakeholders to envisage sustainability performance measurement and management and shed light on the journey towards the Agenda 2030 for sustainable development. The concept present good practices in leveraging economic growth, environment, financing, technology, capacity-building, international cooperation and multi-stakeholder partnerships, including adaptation of a long-term, transformative vision and partnership, while operating at widely different, but interacting, geographic and timescales, including different types of knowledge, ranging from peer-reviewed literature and existing international assessments to local and multi-stakeholder knowledge, reflecting the perspectives of scientific interdisciplinary, multidisciplinary and transdisciplinary research around the world.

Key words: sustainability, performance, measurement, management, Planetearth, concept.

INTRODUCTION

Humankind Life and existence is dependent on planet earth. In spite of that, there is no doubt that the impact of human activities on the Earth was huge even if compared to natural disasters. The social, economical, technological and political impacts of these changes, coupled with globalization, urbanization, and unequal patterns of production and consumption, could derail global efforts towards sustainable development. The problems and needs of various countries and world regions are quite different because of differences in economic development, education and capacity building. We need innovative approaches to address issues that are of direct and immediate relevance to society. It's worth mentioning that our increasingly interconnected and interdependent economic, social, cultural and political systems have come to place pressures on the environment that may cause fundamental changes in the Earth system and move us beyond safe natural boundaries [1]- [2].

The World Commission on Environment and Development has defined "sustainability" as "economic development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs". This macroeconomic definition does not provide much guidance on how this sustainability concept should be put into operation at all stakeholder levels. It remains difficult to express it in concrete operational terms. However, sustainability is a very complex multifaceted word, it consists of two words: sustain and ability. This simple clarification represent a good starts to identify, evaluate our abilities and capabilities, and raise our understanding towards sustainability performance measurement and management. The defining Agenda 21 challenge is to safeguard Earth's natural processes, to ensure the well-being of civilization while eradicating poverty in all its forms and dimensions, protect the planet from degradation, reducing conflict over resources, sustainably managing planet natural resources, strengthen universal peace in larger freedom, supporting human and ecosystem health, and revitalized global partnership for Sustainable development.

There is a number of creative thinking techniques, tools, methods, frameworks and concepts in existence for problem solving, but the main difference between the 3E – Planetearth Concept for sustainable development (3E-PECS) and other concepts is the fact that it's a 1st glance, simple, innovative approach that addresses the interlink between the well defined 3 main external institutional dimensions of sustainable development, which are Education, Environment and Economy, and it's 3 internal dynamic drivers, which are Social science, Technology and Innovation.

FUNDAMENTAL IDEA OF 3E-PECS

The 3E - Planetearth Concept for Sustainable Development is an Innovation Approach for Problem Solutions to Global Challenge. It is a scientific methodology for creative thinking and problem solving, invented and developed by Yemeni geo-environmentalist Professor Khalid A Al-Thour in 1995, updated in 2010 and improved in 2012. The Concept is open and not closed; It shows that it is only by working together that we can overcome challenges, barriers and obstacles to change presently practices towards sustainable future. The concept gave us a great chance to think in a broad perspective, develop and deal with various and alternative approaches towards sustainability [1]- [2].

The 3E-Planetearth Concept is actually interact and based on the many methods, technologies, concepts,

initiatives and frameworks introduced in the literature, as well as, those developed by UN and its entities, and other institutions. Examples are Triple Bottom Line, KG-Method, Ecotechnie, UN Commission for Sustainable Development Framework, Global Reporting Initiative, Environment Impact Assessment, Wuppertal Sustainability Indicators, Statistical Analysis, the Sustainability Metrics of the Institution of Chemical Engineers, Geographical Information System, Remote Sensing, the UNDP Corporate Human Development Index and the Framework of Sustainable Development Goals Agenda 21 [3]- [4]- [5]- [6].

The Concept summary diagram below can be used as a tool for sustainability performance measurement and management in the short-, medium- and long-terms.

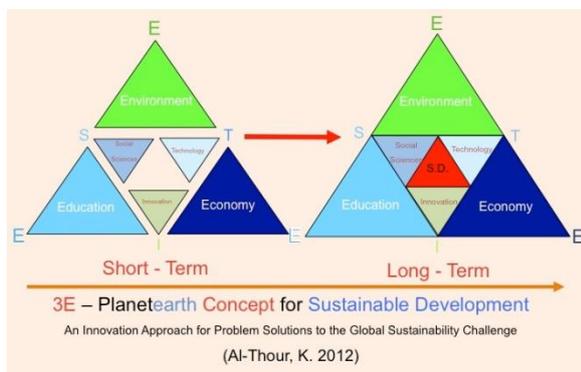


Figure 1: 3E – PLANETEARTH CONCEPT FOR SUSTAINABLE DEVELOPMENT

The concept enables individuals, groups, companies, governments and all stakeholders to develop a framework for sustainability performance assessment of any project, program, plan, strategy which is compatible with all innovative methods or concepts.

IMPROVEMENTS

The 3E-Planetearth Concept reflects the accumulated experience, day-by-day, of Prof. K. Al-Thour in various activities and different business environments in the local, national, regional and international level. The Concept follows the standards basic processes of all innovative methods or concepts taking stakeholders through various stages of problem solving which can include team formulation, problem definition, data collection and analysis, hypothesis generation, implementation strategy, experimentation, evaluation and monitoring; Develop a greater sense of teamwork, cooperation, communication and networking.

Sustainability performance measurement and management is a must. The concept makes this simple and possible via the simultaneous relation between the 3 main external institutional dimensions of sustainable development, which are Education, Environment and Economy, and its 3 internal dynamic drivers, which are Social science, Technology and Innovation. (Figure 2).

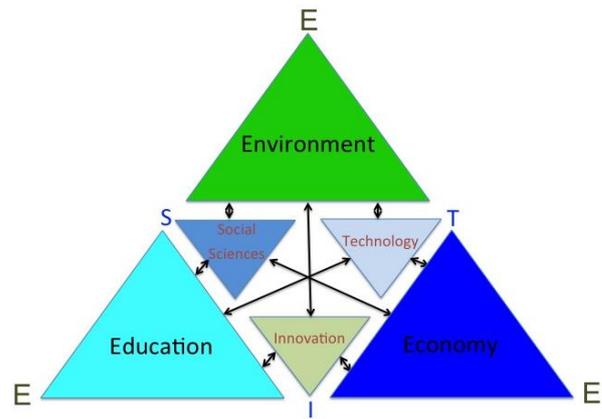


Figure 2: 3E – PLANETEARTH CONCEPT FOR SUSTAINABLE DEVELOPMENT CHAIN

Figure 2 shows that education and environment reflects social science interaction with economy. Economy and environment shows the benefit of interaction between technology and education. While Education and economy reflects innovation impacts to the environment. Sustainability performance measurement and management will depend on the degree and level of the output of such interaction. Agenda 21 Seventeen Sustainable Development Goals and 169 targets can be used to examine the validity of the concept.

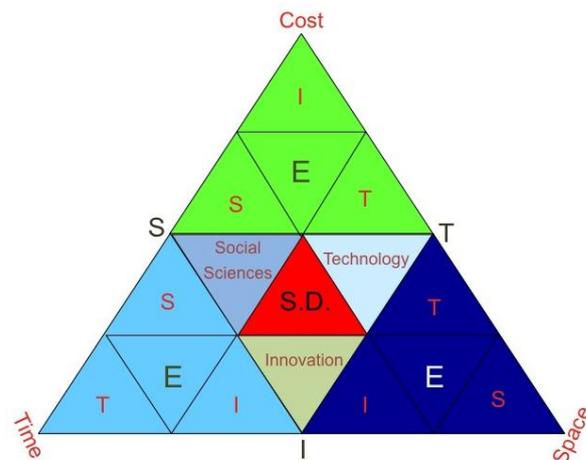


Figure 3: SUSTAINABILITY PERFORMANCE MEASUREMENT AND MANGEMENT USING 3E – PLANETEARTH CONCEPT

On the other hand, figure 3 enables sustainability performance measurement, understanding and evaluation and monitoring the current situation and drawing future orientations towards sustainable development, respecting time and place; and reduce costs (i.e. saving time, energy and money). The interactions between 3 dimensions and drivers turned the concept triangle into16 dimensions diagram, which enables identifying the current status of any project and helps in introducing the appropriate methodology to follow towards sustainable management. It also shows the impacts of any delay and the consequences of such ignorance relating to time, place and cost.

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Water Accounting Research Uptake in Emerging Economies – What Has Been Achieved

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Summary:

This paper provides a maiden discussion on water accounting research uptake in developing countries within the past twenty years. This focus is pertinent given the vulnerability of developing countries to water scarcity and their meagre resources to effectively adapt and mitigate water scarcity. Developing countries have unique water problems but water accounting research in developing countries is still scanty and embryonic. Despite the uniqueness of water problems in developing countries, methodologies used by water accounting researchers have largely been the methods developed in developed countries with little accounting method specifically tailor-made for developing countries water problems. The dominant methods in developing countries' water accounting research include the water footprinting and life cycle methods. The authors identifies a unique future direction for water accounting research in developing countries – the need for virtual water research to enhance an economically and geologically feasible comparative advantage on crop production or importation to save water in water scarce regions. The possible hope for stimulating water accounting research in developing countries would be by integrating water accounting research into the curriculum of academic institutions and the introduction of a specialisation on water accounting preferably at the postgraduate level. This maiden discussion is not exhaustive due to space and time limitations, further inclusive review is encouraged to consider other developing countries' water accounting researches.

Keywords: water accounting, water footprint, virtual water, developing countries, water scarcity

INTRODUCTION

This paper adopts a slightly different stance from others and focusses water accounting research uptake in developing countries. As water resources are progressively being utilized for different purposes, the pertinent question that has attracted the attention of researchers within the past twenty years is an efficient accounting framework to depict, measure and characterize water use in a locality, be it a catchment, a water basin or a nation (Tilmant, Marques, and Mohamed 2015). The main water accounting research occurring in developing nations within the past twenty years has concentrated on the physical asset, attempting to depict the status of water asset use and outcomes of water-resources related activities (Molden 1997). Water accounting methodology has been enhanced by a method amenable to both micro and macro level applications. The popularised method is referred to as the

connecting water use to significant profitability indicators (Molden and Sakthivadivel 1999) to provide water managers vital data on water distribution in a region.

At the global level, water accounting research has largely been done within the context of developed countries' water resources apparently because major water accounting methodologies were developed in developed countries (Buckley, Friedrich, and Blottnitz 2011). However, the majority of water problems exist in developing countries (UNEP 2010), and water resource problems are relatively different in developing countries. Hence, water footprint accounting and life cycle assessment accounting methods have dominated water accounting researcher methods commonly applied in developing countries (Buckley et al 2011). The two major questions that has underpinned water accounting researchers in developing countries has been on how the burden of water could be shared (burden sharing or burden shifting) and on how to measure the quantity of water used up from the green, blue and grey water categorisations (Buckley, et al. 2011). These key questions are indeed pertinent for developing countries' water accounting given their much vulnerability to water scarcity and heavy financial burden involved in the provision of water (Gadgil 1998; Yang and Zehnder (2002; Vairavamorthy, Gorantiwar and Pathirana 2008).

In the past twenty years, 1996 to 1997 in particular, water information or data on the effectiveness and/or productivity of irrigation schemes were uncommon and, in some instances of apparent availability, the underlying technique was not clearly presented (Molden, 1997; Barker, Dawe, Tuong, Bhuiyan, & Guerra 1999). However, Molden (1997) and Molden and Sakthivadivel (1999) broke the seeming dearth of water accounting methodology in developing countries within those years. Hence, the first publication that has attracted much quotations in the developing countries' water research in the past twenty years seem to be the seminal work of Molden (1997) which was applied again in Molden and Sakthivadivel (1999). In his research, Molden (1997) developed a water accounting approach for analysing the throughput of water resources at a farm, a system or at the basin level, it was therefore one of the first water accounting research that offered

water balance – a (a foot print genre). It accounts for water inflows, outflows and internal usage – showing at a

glance the depleted quantity of water and the amount remaining for further usage over a classified region and this was first applied in India and Sri Lanka (Barker at al 1999) and later applied in Egypt's Nile Basin (Molden and Sakthivadivel 1999). The Molden (1997) approach, was developed further by Peranginangin, Sakthivadivel, Scott, Kendy and Steenhuis (2004), the adapted method was applied in Singkarak–Ombilin River basin, Indonesia.

SCHOOL OF THOUGHT & KEY RESEARCH FINDINGS

This section presents a highlight of a randomly selected publication themes and the essential contribution within the past twenty years from developing and/or emerging economies.

Theme: “The economic benefits of surface water quality improvements in developing countries: a case study of Davao, Philippines” (Choe, Whittington & Lauria 1996, 519). **Essential Contribution:** the research derived the economic worth, which people attach to improvements in water quality and thus highlights economic justification in accounting for and improving water quality.

Theme: “Economic policies for sustainable water use in Thailand” (Kumar & Young 1996). **Essential Contribution:** the research refined the Social Accounting Matrix approach to trace the demand, supply and pricing of water in Thailand.

Theme: “An approach to sustainable water management in Southern Africa using natural resource accounts” (Lange, 1998, 299). **Essential contribution:** Lange's research depicts the utilization of water in the Namibian economy and the linkage with client charges, distribution expenses and the monetary commitment of water in various parts of the economy to provide a primary step towards evaluating the opportunity cost inherent in water resource (Lange, 1998).

Theme: “Water accounting to assess use and productivity of water” in Egypt and Sri Lanka. (Molden & Sakthivadivel 1999, 55). **Essential Contribution:** the research arranged surges from a water balance area into different classifications to give an account of the amount of water drained by different uses, and the balance accessible for further utilization

Theme: “Grid-cell-based crop water accounting for the famine early warning system” (Verdin & Klaver, 2002, 1617). **Essential Contribution:** the a grid-cell-based formulation for the water requirement satisfaction index (WRSI) was applied in maize farms in Southern Africa and using a remote sensing data gathering, the research provided an early account of potential famine arising from water scarcity, and hence providing data often scarcely made available from conventional methods.

Theme: “Water accounting for conjunctive groundwater/surface water management: case of the Singkarak–Ombilin River basin, Indonesia”(Peranginangin et al 2004). **Essential Contribution:** Molden and Sakthivadivel are recognised for advancing a water accounting technique, which is applied in the analysis of water usage patterns and trade-offs between users; but this technique suffers a disadvantage in that it lumps groundwater and surface water in a single domain of analysis. However, Peranginangin et al (2004) adapted and advanced this procedure to account for groundwater and surface water components separately, and they applied the adapted procedure to the Singkarak–Ombilin River basin, Indonesia. Furthermore, Peranginangin et al (2004) applied the modified water accounting procedure to evaluate previous water usage.

Theme: “Water accounting for the Orange River Basin: An economic perspective on managing a transboundary resource” (Lange, Mungatana & Hassan 2007). **Essential Contribution:** paper presents a novel application of water accounting to a transnational river basin – the Orange River in Southern Africa; the research ushered in a pecuniary approach for a regional water management.

Theme: “Integrated ecological economics accounting approach to evaluation of inter-basin water transfers: An application to the Lesotho Highlands Water Project” (Matete & Hassan 2006, 246). **Essential Contribution:** This research contributed by developing and using a multi-nation environmental social accounting framework for Lesotho and South Africa to assess the biological ramifications of the Lesotho Highlands Water Project and their subsequent monetary expenses and advantages for the two nations. The concentrate further utilized the created multipliers to investigate the effect of lost environmental administrations on the downstream of the Lesotho Highlands Water Project dams on the wellbeing of families specifically influenced by the undertaking in Lesotho and the general economies of Lesotho and South Africa (Matete & Hassan, 2006).

Theme: “a new and integrated hydro-economic accounting and analytical framework for water resources: a case study for North China.” (Guan & Hubacek 2008, 1300). **Essential Contribution:** previous studies on water accounting have devoted attention on the quantity of water withdrawal and less attention on water quality; however, this research undertook a slightly different bearing and contributes to water accounting research by using a nuance approach to account for a combination of quantity and quality of water input and output in a hydrological system.

Theme: Financing water services, (Ambe, 2008) addresses financing issues of water and sanitation provision in South Africa. **Essential Contribution:** Addressing the demand and supply of water financing, actions to enhance financing of water infrastructure,

operational and maintenance cost, cost recovery and other capital investments options are recommended.

Theme: “*Water valuation at basin scale with application to western India*” (Pande, van den Boom, Savenije, & Gosain, 2011, 2416). **Essential Contribution:** the research provides details about the benefit augmentation issue of different operators in a water basin, each distinguishing a sub-basin, that work inside of the limits of a spatially express model that depicts the prevailing hydrological forms.

Theme: Water Efficiency Practices in Service Sector (Ganda & Ngwakwe, 2014). **Essential Contribution:** Setting up green divisions, auditing water consumption, utilizing water efficiency benchmarks will improve water efficiency and environmental performance of firms.

Theme: “Greenhouse gas inventory of a state water and wastewater utility in Northeast Brazil”(Santos, Andrade, Marinho, Noyola, & Gueereca, 2015). **Essential contribution:** the research revealed new insight on water related emission with the findings that sewage water treatment accounts for the largest form of carbon emission in wastewater management industry.

Theme: “Green and blue water accounting in the Ganges and Nile basins: Implications for food and agricultural policy” (Sulser, Ringler, Zhu, Msangi, Bryan, & Rosegrant, 2010). **Essential Contribution:** paper highlights that conventional water accounting relies heavily on irrigation water and pays less attention on precipitation, which is termed the green water. Accordingly, the paper proceeded to introduce a nuance on the water accounting approach that combines the green water and the blue water to account for the quantity of water needed to sustain crop productivity using the Nile Basin scenario.

Theme: “*A dynamic water accounting framework based on marginal resource opportunity cost*” (Tilmant, Marques, & Mohamed, 2015, 1457). **Essential Contribution:** this paper relied on Hydro-economic modeling and introduced an alternative dynamic water accounting method that treats the whole river basin as a value chain with diverse services, which includes production and storage. The research expanded the optimization-based, hydro-economic modeling to derive “marginal resource opportunity costs” (Tilmant et al 2015, 145).

Theme: “*A complete soil hydraulic model accounting for capillary and adsorptive water retention, capillary and film conductivity, and hysteresis*” (Sakai, van Genuchten, Alazba, Setiawan, and Minasny, 2015). **Essential Contribution:** The model was acquired by fusing the hysteresis model of Parker and Lenhard into the water-powered model of Peters-Durner-Iden (PDI) for the van Genuchten (VG) maintenance mathematical statement. The model incorporates the accompanying procedures: slender hysteresis accounting for air entanglement

Theme: “Increasing efficiency in ethanol production: Water footprint and economic productivity of sugarcane ethanol under nine different water regimes in north-eastern Brazil” Chico, Santiago, & Garrido, (2015, 1203).

Essential Contribution: This study accounted for water expended in ethanol generation from sugarcane in a Brazilian region utilizing the water footprint (WF) indicator and supplementing it with an assessment of the water apparent productivity (WAP). With this fusion of methods, the researchers could give a measure of a crop's physical and financial water efficiency utilizing, separately, the WF and WAP ideas.

Theme: “Water footprint analysis of second-generation bioethanol in Taiwan” Chiu, Shiang, Lin, Wang, & Chang, (2015, 271). **Essential Contribution:** Using a case study of bioethanol plant in Taiwan, the water footprint accounting study by Chiu et al demonstrated a practical, economic and sustainability insight that “Using nonfood crops as raw materials for bioethanol can reduce water consumption” (Chiu et a, 2015, 271).

METHODS AND TOOLS

This section provides a brief highlight of the methods and tools that were applied in the research themes identified in the preceding section. Molden & Sakthivadivel (1999), adopted a water balance sustainability accounting method and this has been praised for being amenable to micro and macro level sustainable water accounting and analysis. Choe et al (1996), applied the contingent valuation and travel cost models to account for the value, which people attached to improved water quality. Guan & Hubacek (2008), introduced a new water accounting method by creating a fusion of economic input-output modelling with a mass-adjusted hydrological model to account for both water consumption and pollution in a hydrological system. In the Orange regional water basin, Lange et al (2007) linked supply and demand tables to economic data to account for industrial and countrywide use and production of water. Lange (1998), used the Natural Resource Accounting methodology to isolate the opportunity cost of water in Namibia. In another water accounting research in the Western Indian Water Basin, Pande (2011), applied a parsimonious hydro-financial model for dryland territory with no financial information for water. It highlights a basin-level decentralized water portion system, which is adjusted to a practical water use and to take care of the externalities from upstream–downstream linkages. In another related water basin study, Matete & Hassan (2006), applied an integrated ecological economic accounting model, a variant of Social Accounting Matrix (SAM), to evaluate the monetary implication of inter-basin water transfers between Lesotho and South Africa. The Social Accounting Matrix (SAM) seem to have received attention in water accounting research in emerging and developing economies; for instance, aside from the Lesotho Highlands Water Project study by Matete & Hassan (2006), SAM tool has been applied in China (Pan 2000) and in Thailand by Kumar & Young (1996). Whilst the preceding water accounting research from developing countries have been silent about the GHG Protocol

method, the water emission accounting research by Santos et al (2015) in Brazil applied the GHG protocol method of the WBCSD and WRI.

In their accounting for surface and underground water research, Peranganing et al (2004) applied an adjusted Molden and Sakthivadivel (M–S) water accounting procedure for evaluating configurations of water usage and the associated trade-offs between users. The Sulser et al (2010) green and blue water accounting research in the Nile Basin applied the International Model for Policy Analysis of agricultural commodities and Trade (IMPACT). The model facilitates accounting for the price and supply/demand for agricultural commodities. Despite the emerging pertinence for the application of IMPACT to account for green water, emphasis still centres on the application of IMPACT on conventional blue water accounting, hence research that applies IMPACT method on green water accounting are uncommon in accounting in emerging/developing economies.

In another methodological application, Tilmant et al (2015) expanded the Optimization-based hydro-economic model to derive a proposed water accounting framework for deriving the “marginal resource opportunity costs” in water-basin value chain during fluctuations. A contrasting method was applied in in a soil water accounting research; Sakai et al (2015) developed a soil hydraulic model that considers fine hysteretic and adsorptive water maintenance and in addition fine and

film conductivity covering the complete soil dampness range. Thus, soil the hydraulic accounting model provides estimates of soil dampness for water strategic planning.

Chico et al (2015) and Chiu et al, (2015) made a varied application of the water footprint method in Brazil and Taiwan respectively. Chico et al (2015) study in Brazil applied a fusion of water footprint (WF) indicator and the water apparent productivity (WAP); however Chiu et al, (2015) applied the water footprint to account in a comparative sense the consumption of water in bioethanol between a food crop and non-food crop in Taiwan. These varied applications of water footprint method demonstrated the flexibility inherent in water footprint, both as a surrogate water method capable of being merged with another method and as comparative method for comparing two scenarios.

Generally, though not conclusive at this stage, but the preceding overview of water accounting models applied in developing countries suggests that water footprint accounting method seem to have gained more attention in developing countries’ water accounting research. There are variants and scantily scattered application of life cycle accounting, WBCSD Protocol accounting tool and the GEMI water sustainability tool. A brief summary of advantages and disadvantages of these four main water accounting methods is adapted from UNEP (2010) and presented in Table 1

Table 1 COMMON WATER ACCOUNTING METHODS USED BY RESEARCHERS IN EMERGING/DEVELOPING COUNTRIES

Methods →	Water footprint	Life Cycle Assessment	WBCSD Global Water Tool	GEMI Water Sustainability Tool
Strengths	Easily understandable and suitable for water use accounting	Useful in water quality impact accounting	Cheap and requires no expertise and simple for compiling water data	Cheap and does not require expertise. Most suitable for companies at the primary stage of water accounting and conservation
Weaknesses	Generic lumping of data on blue-green-grey water foot-printing is misleading	Absence of accepted method for water use impact and results is not easily understandable for non-technical users	Fails to recognise water quality and impact risks, and provides only a rough risk estimation	Lack of quantitative result and deals with a basic risk assessment
Assessment of water related business risks	Links water source with water use data and identifies risk through green/blue water foot-printing distinction	Identifies strategic spots (product & technical design) to save water	Benchmarks company facilities with external water and sanitation data	Overall company water-related risks are easily identified
Responding to water use and quality impacts	Conducts water impact accounting through the green/blue/grey water classification	Water impacts is measured against sustainability bench marks; water usage is mapped against water stress and impacts	Does not account for corporate water usage and impacts and does not account for quality	Gathers information to understand impacts but fails to quantify the impacts.
Providing water information to users	Conveys water usage data and awareness to to the public and water resource managers	Creates an asymmetry of water data between business and the public. Provides effective information to eco-label initiatives	Instant accounting of water-related indices for CSR disclosures	Not popularly used water communication tool

Adapted from UNEP (2010) corporate water accounting an analysis of methods and tools for measuring water use and its impacts. Available at: http://www.pacinst.org/wp-content/uploads/sites/21/2013/02/corporate_water_accounting_analysis3.pdf [accessed April 2 2016]

RELEVANCE TO PRACTICE

This section provides a summary of the practical and/or policy relevance of the preceding water accounting researches from developing countries. This practical summary is sequentially presented in their order of appearance in section 11.

The water balance approach by Molden & Sakthivadivel (1999) provides a practical relevance for household water analysis and for larger analysis such as in water basins. It also provides a well-defined indicators that may provide information on water resource efficiency. Choe et al (1996) can be used to derive the practical economic value that people attach to improvements in water quality around the river basin community. The Guan & Hubacek (2008), hydrological-monetary accounting and investigation method permits the tracing of water utilization on the data input frame, water contamination escaping the financial framework and water streams going through the hydrological framework accounting which accordingly empowers managers to manage water assets of various qualities concurrently. The Lange et al (2007) Southern Africa Orange River Basin research provided an avenue for regional authorities of water to envision incongruences in water production and this approach provides a vital information for water development initiatives, pricing and allocation of water amongst regional member states. Lange (1998), analysis of opportunity cost of water in Namibia provides a practical relevance for water resource policy making for effective sectorial allocation and subsidization policies for developing economies. The Pande et al (2011), Western India Water Basin research presents a practical approach for financial valuation of drying and draining options in sub-basins located in a dry land. It also shows how this approach may lead to an ideal water valuation with related water pricing and incentives scheme in sub-basins.

The Matete & Hassan (2006), Lesotho and South Africa river basin study initiated a practical generalised analytical framework that can be applied in coordinating natural water sustainability issues into financial improvement strategies on account of misusing water assets in inter-basin water transfers. Besides, the research offers a practical approach for analysing the social and economic impact of transferring water from the Lesotho Highlands on households and socio-economic groups in Lesotho and South Africa. The Kumar & Young (1996) research in Thailand refined Social Accounting Matrix to show a practical application of SAM in deriving effective pricing for supply and demand of water and for linking the accounting matrix to user costs and to the Computable General Equilibrium.

The sanitation industry water emission accounting research by Santos et al (2015) provides a practical insight to company water emission accounting decisions. Since the findings of Santos et al (2015) reveals that wastewater treatment triggers the largest source of carbon

in the sanitation industry, it thus provides a fresh idea to enhance the sanitation industries' strategic and operational planning regarding the effective integration of carbon reduction initiatives in strategic planning and disclosures. Furthermore, Santos et al (2015) findings about the emission quantity from waste water treatment plant also has a practical potential to transform overhead cost allocation practice and associated performance evaluation processes in the sanitation industry.

The Peranginangin et al (2004) application of Molden and Sakthivadivel (M-S) water accounting technique demonstrated a valuable approach for evaluating water use designs and recognizing prospects for enhancing water administration in water basin areas. The Molden and Sakthivadivel water-accounting method delivers physically grounded water accounting measurements. By looking at water-accounting measurements, one can undoubtedly survey relative water use either in a territory or between territories, which is essential for distinguishing future or imminent potentials for enhancing water administration, particularly when all water supplies are completely used. Sulser et al (2010) green and blue water accounting approach offers a practical implication for intensifying agricultural productivity through improved yield on an agricultural area rather than emphasis on land expansion. The integrated green and blue water accounting strategy also offers a practical climate-change adaptation strategy for its ability to forecast and account for proper harvesting of green water for crop production as a supplement to blue water. The paper highlighted that green water accounting should present an alternative policy options for improving crop productivity in water scarce areas.

Tilmant et al (2015) water accounting framework, brings a practical analysis that could derive the contribution from the water storage services in a water basin value-chain using the Blue Nile as a case study. The soil hydraulic accounting model by Sakai et al (2015) was found to precisely depict observed hysteretic water maintenance and conductivity information for a sand dune. The model permits estimations of the pressure-driven conductivity from immersion until thorough dryness. Chico et al (2015) water footprint study in Brazil provides a financial and water management implication. The financial examination demonstrates the benefits of expanding the water administration, and the expanded productivity (per item and monetary) of changing from rainfed frameworks to water administrations in which higher watering system layers are connected.

CONCLUSIONS AND OUTLOOK

This paper focussed on a review of water accounting research in developing countries; the reason is that these countries are beset with the most pressing water related problems more than the developed countries (UNEP 2010). Despite this though, it seems evident from the literature that water accounting research in developing and/or emerging economies is embryonic with negligible significant inroad to effectual impact on national and regional water policies and practice for sustainable water use and conservation.

Water accounting research in emerging economies should move toward the direction of applying to the local context, the four major developed water accounting tools as presented in Table 1 to effect a sustainable policy and practical change. In addition to the popular methodologies, researchers in emerging and developing economies may also begin to engage in virtual water accounting research to highlight any potential comparative advantage between water usage and crop production and food import and scarce water conservation (Hoekstra 2010).

The possible hope for stimulating water accounting research in emerging economies would be made possible by integrating water accounting research into the curriculum of academic or research institutes in emerging and developing economies. In order for this idea to be effective, the call for creating accounting niche that may be called engineering accounting becomes even more apposite to arm students with necessary science/engineering based tools to fuse with accounting tools to confront the growing sustainability challenges in which water has become a vital component. The developing countries water accounting imperative may need prodding mostly in the agricultural sector since about 87 percent of water in the developing countries is consumed by the agricultural sector, however with the growth in non-agricultural demand for water in developing countries, it is estimated that available water for agriculture in developing countries would decline to 73 percent. Furthermore, it is estimated that industrial and municipal water demand in developing countries might exceed the current agricultural consumption of water by 2020 and beyond (Rosegrant, Ringler & Gerpacio 1997). This seeming gloomy picture for future water availability in developing countries heightens the imperative for water accounting (mostly from the demand side) in developing and emerging countries. This maiden discussion on water accounting in developing countries is by no means exhaustive; the authors therefore encourage further inclusive review to consider numerous other developing countries' accounting research, which the authors offer apology for not including due to space and time.

Chiu et al (2015) water accounting in a second-generation bioethanol in Taiwan demonstrated a practical significance that shows the application of feedstock to the production of second generation bioethanol which are

non-food crop and domestic waste and proves that these could produce biofuels at lowest levels of water consumption compared to high water consuming production of biofuels when food crops are used.

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Corporate Sustainability Indicators: A Turkish Banking Case Study

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Summary: The main purpose of this study is to measure corporate sustainability performance using main indicators of economic, environmental, social and administrative dimensions of sustainability in Turkish Banking Sector. Data set is obtained from the sustainability reports issued by Garanti Bank between the years 2010 and 2014. Qualitative and quantitative data analysis techniques considering the Content Analysis and Multi-Criteria Decision Making (MCDA) are both used for measuring the corporate sustainability performance. Based on the results, the main indicators of Garanti Bank's corporate sustainability has been determined, as well as the superior aspects and differences of the bank's corporate sustainability are demonstrated.

INTRODUCTION

Sustainability issues are gaining importance within business organizations, and are increasingly impacting the banking sector. Bank's steady growth is the assurance of effectiveness of the real economy at the same time. Moreover, one of the main reasons behind the 2008 global crises, was the short-term economic goals of the banks and the manager's risk taking considerations. This movement directly affected the financial system and the global economy. At the same time, investments and other financial products made via credit extended by the banks affect directly and indirectly to the environment, economy and social life.

In recent years, the main corporate sustainability indicators of economic, social and environmental factors seem to be insufficient for the sustainability practices of the firms. Along with these indicators; a good administrative structure, stability, soundness of corporate governance are seen as complementary factors for ensuring corporate sustainability. Therefore, all factors should be evaluated as a whole to measure the sustainability performance of companies.

In Turkey, 93 companies published sustainability reports between the years 2004-2016. There are 232 reports and 176 of them are GRI reports. Furthermore, Borsa Istanbul Sustainability Index has been established for providing a benchmark for listed companies with high performance on corporate sustainability and to increase the awareness, knowledge and practice on sustainability in Turkey. As of the end of June 2016, 29 companies are listed in BIST Sustainability Index and 9 of them belong to banking sector.

The main objective of this case is to measure corporate sustainability performance along with the main indicators of economic, social and environmental taking into consideration of the administrative factors. The methodology part of the study includes both qualitative and quantitative data analysis methods considering the Content Analysis and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

BRIEF LITERATURE REVIEW

The concept of sustainable development was used for the first time in 1987 in "Our Common Future" report released by World Commission on Environment and Development (WCED). This report, known as the Brundtland Report defines the sustainable development as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987) [1]. With this definition, sustainable development can be performed creating a balance between environment, economic and social sustainability indicators in the long term.

International standardization efforts have resulted in sustainability reporting indexes such as the Global Reporting Initiative (GRI), the World Business Council for Sustainable Development (WBCSD) and the Organization for Economic Co-operation and Development (OECD) are now internationally recognized and widely adopted. Sustainability risks and opportunities have become a global imperative and hot topic trend for business (Aras and Crowther, 2009) [2]. Since sustainability gains greater importance in business, companies are adapting the sustainability indicators of economic, social and environmental factors to their organizations and decision-making activities for creating value for all stakeholders.

Corporate sustainability performance measurement has been the subject of a growing amount of research since the 1990s. Although a significant amount of research focused on determining sustainability indicators including economic, social and environmental dimensions (Ranganatan, 1998 [3]; Fricker 1998 [4]; Keeble, Topial and Berkeley, 2002) [5], there is a lack of empirical research on measurement of corporate sustainability performance [5]. Moreover, previous studies including Dyllick and Hockerts (2002) [6], Marrewijk and Werre (2002) [7], Marrewijk (2003) [8]

contributed to development of corporate sustainability concept, while Moneva et al. (2007) [9] focused on determining the quality of companies' sustainability reports.

Sobhani (2012) [10] describe the status of disclosure practices of corporate sustainability in the annual reports and corporate websites of the banking industry in Bangladesh while a current study belongs to Weber (2016) [11] analyzed sustainability performance of Chinese banks through assessing data from annual financial and non-financial reports. The relation between corporate sustainability performance and financial performance was also investigated in Weber's study.

Prior researches conducted in Turkey, including Erol and Ozmen (2007) [12], Es (2008) [13], Ozcelik and Ozturk (2014) [14] used Multi-Criteria Decision Making techniques for measuring corporate sustainability performance. Erol and Ozmen (2007) used AHP and TOPSIS techniques for measuring sustainability performance while Es (2008) used Entropy, Electre and TOPSIS. Ozcelik and Ozturk (2014) measured selected banks' corporate sustainability performance using Grey Relational Analysis technique.

METHODOLOGY

Garanti Bank has been established in 1946 and is Turkey's second largest private bank with consolidated assets of USD 96.2 billion as of December 31, 2015 [15]. Garanti Bank is the only Turkish company to be selected for the Dow Jones Sustainability Emerging Markets Index and the first bank in Turkey to sign the United Nations Global Compact's (UNGC) Business Leadership Criteria on Carbon Leadership. Besides this, it is the only Turkish company that was included in the CDP Global Leaders Report by being selected to the highest performance band (A) and was awarded with the CDP 2015 Climate Performance Leadership award [16].

In this case, according to the dimensions (economic, environmental, social and administrative) of corporate sustainability, content analysis and TOPSIS are utilized with a total of 4 sustainability report published by Garanti Bank within the period of 2010-2014.

First, Content analysis is used to determine the number of disclosures in the sustainability reports of the bank. Content analysis is an attractive method for understanding social phenomena. It is a scientific tool and is also a research technique for making replicable and valid inferences from texts to the contexts of their use [18]. As a research technique, content analysis provides new insights, increases a researcher understands of particular phenomena, or informs practical actions. In this case, the number of the sentences disclosed in the bank's corporate sustainability reports is the unit of analysis and composes the dimensions. These dimensions are selected based on global sustainability reporting guidelines including the GRI framework, UNEP Finance Initiative and ACCA guidelines comprising with a total of approximately 130 criteria [17] under four dimensions and six sub-dimensions listed below.

1st Dimension: Economic Sustainability Disclosure
2nd Dimension: Environmental Sustainability Disclosure
2.1 Disclosure of Energy Consumptions and Savings
2.2 Disclosure of Natural Environment
3rd Dimension: Social Sustainability Disclosure
3.1 Disclosure of Contribution to Community
3.2 Human Resource Development Disclosure
3.3 Human Rights Disclosure
3.4 Product Responsibility Disclosure
4rd Dimension: Administrative Disclosure

Many items of the instrument are incorporated through the pilot survey and the opinion of the executive managers is considered in this regard and Nvivo 11 is used as software.

Second, to evaluate sustainability performance of the bank between the years 2010 and 2014, TOPSIS method is employed. TOPSIS method is one of the multi-criteria decision making techniques and is commonly used. It is developed by Yoon and Hwang and is based on the concept that the chosen alternative (years) should have the shortest distance from the positive ideal solution and the farthest from the negative-ideal solution The positive ideal solution is a solution that maximizes the benefit criteria and minimizes the cost criteria, whereas negative-ideal solution maximizes the cost criteria and minimizes the benefit criteria. TOPSIS method doesn't assume that each criteria has equal importance therefore it requires a set of weights from the decision-maker [19]. It has six steps consecutively and these are as follows:

Step1: Decision matrix is normalized
Step2: Weighted normalized decision matrix is constructed.
Step3: Positive ideal solution and negative-ideal solution are determined.
Step4: The distance of each alternative from positive ideal solution and negative-ideal solution is calculated.
Step5: The closeness coefficient of each alternative is calculated.
Step6: The ranking of alternatives is determined by comparing closeness coefficient values.

TOPSIS method produces a performance score that lies between 0 and 1 is obtained for each year. According to this, alternatives (years) are ranked.

Before employing TOPSIS method, Entropy method is used for evaluating the weights of the criteria objectively. In this way, relative importance of each criteria is obtained. Entropy has a useful meaning in information theory, where it measures the expected information content of a certain message [20]. In this study, Based on the entropy method results, the main indicators of corporate sustainability can be determined, as well as the superior aspects and differences of the bank's corporate sustainability are demonstrated.

Lastly, to determine sustainability performance of the bank during 2010-2014 period, performance scores are compared in the light of knowledge about Turkish Banking System.

CONCLUSION

This study provides the main indicators of corporate sustainability throughout superior and inferior aspects of the one of the leading bank incorporated in Turkey. According to results of Entropy method, in economic dimension, “Comparative financial growth with previous years”, “information concerning credit portfolio”, “information concerning economic contribution”, and “information concerning remittance collection” are the leading disclosures while in environmental dimension disclosures that contain “information about energy consumptions and savings” are leading disclosures. There are four sub-dimension that are called as “contribution to community”, “human resource development”, “human rights” and “product responsibility” in social dimension. Among these, disclosures related with human rights have the highest weight in social dimension. Lastly, “directors’ profile”, “stake holder engagement/view exchange programmes” with “corporate perceptions on CSR and sustainability conceptions” and “disclosure process of CSR/sustainability performance” are the leading disclosures in administrative dimension.

After employing Entropy method, sustainability performance of the Garanti Bank is measured by using TOPSIS method during 2010-2014 period. Based on these results, the bank has 0.4449, 0.4860, 0.4896, 0.6018 total performance scores respectively. In line with results it has been seen that sustainability performance of Garanti Bank tends to be increased between the years 2010 and 2014.

In addition to this, when the dimensions are examined separately, the bank has the best performance in economic dimension while the worst performance in administrative dimension.

Consequently, the number of banks accepting corporate sustainability approach is increasing in Turkey. Understanding and implementing sustainability issues into business strategy is a hard task to accomplish. This change process may take a lot of effort and a long time, however by adopting corporate sustainability approach banks will certainly have competitive advantage over their rivals.

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A Sustainability evaluation system based on a new multicriteria sorting method: VikorSort

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Abstract: Recent years environmental, social, and economic responsibilities of the firms have been discussed intensely. The firms are investing on environmental, social and economic responsibility issues for corporate sustainability. In this paper, a new sorting method based on Vikor methodology is proposed to evaluate the companies' sustainability performances and sort them into the predefined ordered classes. The proposed methodology helps decision makers in evaluating the overall sustainability performance of the companies, in monitoring relative performance of the companies within each class and in determining the corrective actions to improve companies' sustainability performances.

INTRODUCTION

The sustainability performance of the firm is very important for being competitive as customers and legal authorities are more sensitive to sustainability concept. Higher sustainability performance is becoming a hallmark for global competitive market. Therefore the evaluation of sustainability is one of the key research areas on both academic literature and practice. Many researchers have paid great attention to evaluate the sustainability performance of the companies ([1]-[3]), while many of them analyze the relationship some factors on the sustainability performance[4-6].

As both market requirements and legal authorities force the companies to improve sustainability performances, an effective tool is required to sort companies based on their performances with the ability of continually monitoring and evaluating the their sustainability performances. Although many studies have been performed for evaluation of companies' sustainability performance, most of them try to rank the companies from the best to the worst. Furthermore, comparison of the sustainability performance of companies and identification of the potential reasons for differences have not been fully explored. Because of the multicriteria nature of the problem, it is thought that a multicriteria sorting methodology can be helpful in classifying the companies into ordered sustainability classes and in identifying the differences in sustainability performance of both classes and individual companies.

On the basis of this thought, an integrated MCDM methodology is proposed to sort companies based on their sustainability performances. The corporate sustainability performances are measured in terms of their environmental, social and economic responsibility activities. The sustainability performance of the companies are evaluated with the help of different criteria. As there is more than one criteria in order to evaluate the sustainability performance of the companies, multicriteria based methods should be used. For that reason, a novel multicriteria sorting methodology based

on Vikor Method is proposed to sort the sustainability performance of the companies.

Based on this consideration, in this paper, a multicriteria sorting methodology will firstly be used in evaluating sustainability performance of companies and a new sorting methodology will also be introduced in the literature.

THE PROPOSED METHODOLOGY

Initially, the determination of performance evaluation criteria should be performed. Then, the sustainability performance of the companies are evaluated using VIKOR methodology. In order to assign the companies to predefined ordered classes (i.e. the best sustainability performers, the worst sustainability performers etc.) the proposed sorting methodology is then used. The assignment of a company to a predefined class is performed by using the profiles which defines the limits of classes and the reference companies in consecutive steps of the proposed sorting methodology.

Assume having m alternatives should be ranked, which are denoted as A_1, A_2, \dots, A_m and having n criteria, which are denoted as C_1, C_2, \dots, C_n . For alternative A_i , the value of the j th criteria is denoted by f_{ij} . VIKOR method includes the following steps [7, 8]:

Step 1: Determine the best and the worst values of all criterion functions $j = 1, 2, \dots, n$.

$$f_j^* = \max_i f_{ij}, \quad f_j^- = \min_i f_{ij} \quad (1)$$

where the j th function represents a benefit.

Step 2: Compute the values S_i and R_i ; $i = 1, 2, \dots, m$, by the following equations,

$$S_i = \sum_{j=1}^n w_j (f_j^* - f_{ij}) / (f_j^* - f_j^-) \quad (2)$$

$$R_i = \max_j w_j (f_j^* - f_{ij}) / (f_j^* - f_j^-) \quad (3)$$

where w_j are the weights of criteria, expressing their relative importance

Step 3: Compute the values Q_i ; $i = 1, 2, \dots, m$, by the following equations,

$$Q_i = v(S_i - S^*) / (S^- - S^*) + (1 - v)(R_i - R^*) / (R^- - R^*) \quad (4)$$

$$S^* = \min_i S_i, S^- = \max_i S_i \quad (5)$$

$$R^* = \min_i R_i, R^- = \max_i R_i \quad (6)$$

where v is the weight of the strategy of "the majority of criteria", which takes values between 0 and 1.

Step 4: Obtain three ranking lists by ranking the alternatives considering the values S, R and Q in increasing order (the least to the best).

Step 5: The alternative A' which has the minimum Q value is selected as the compromise solution, if the following two conditions are satisfied:

C1. Acceptable advantage: $Q(A') - Q(A'') \geq DQ$ where A'' is the second best alternative according to the increasing order ranking list by Q; $DQ = 1/(m - 1)$; m is the number of alternatives.

C2. Acceptable stability in decision making: Alternative A' must also be the best alternative according to the increasing order ranking lists by S or/and R.

If one of the conditions is not satisfied, then a set of compromise solutions should be selected.

Vikor method was originally developed to deal with ranking and selection problems like other multicriteria decision making methods. Up to date, any sorting methodology based on Vikor method has not yet been proposed.

The proposed sorting methodology, VikorSort assigns the companies to different sustainability classes as follows:

- a) Calculating Q,S and R values (including dummy profile companies also) using traditional Vikor steps.
- b) Constructing preference relations by comparing profile limits and alternative companies using Acceptable advantage and acceptable stability criteria in Vikor steps.
- c) Using preference relations obtained to assign the companies into different sustainability classes except the companies which do not satisfy the preference conditions of Vikor
- d) Assigning the companies which do not satisfy the preference conditions of Vikor based on pairwise comparison.

APPLICATION

The sample of the study consists of the companies that take place in Sustainability Index of Istanbul Stock Exchange (BIST) for 2016. For 2016 year 29 firms exist in Sustainability Index. These firms are Aksa Energy, Anadolu Efes, Arçelik, Aselsan, Brisa, Coco Cola Drink, Doğuş Automotive, Ereğli Base Metal Goods, Ford Automotive, Garanti Bank, İŞ Bank, Koç Holding, Migros, Otokar, Petkim, Sabancı Holding, Saf Real Asset Trust Company, Turk Industrial and Development Bank, Tav Aiport, Tofaş Automotive, Turkcell Communication, Tüpraş, Turkish Airlines, Turk Telekom, Ülker Biscuit, Vakıflar Bank, Vestel Electronics and Yapı ve Kredi Bank. These companies are selected as a sample because the data needed for sustainability performance is just available for the companies. Data will be gathered from sustainability and corporate social responsibility reports of these companies.

The criteria are divided in three parts; economic, social and environmental [9-10].

1. Economic criteria:

- Producing qualified and trustable products
- Designing products that increase customer

satisfaction

- Giving prompt reactions to customer needs
- Increasing service quality for customer satisfaction.

These criteria are scores as 1 if the company meet these criteria if the company does not meet these criteria the company gets 0.

2. Social criteria:

- Giving education opportunities for workers
- Education expenses will be taken for scoring the company
- Providing safe working environment
- Determining fair working conditions and reward system

These criteria are scores as 1 if the company meet these criteria if the company does not meet these criteria the company gets 0.

3. Environmental criteria:

- Disclosure of pollution: if the company disclosure its pollution the company will get 1 score if the company does not disclosure then the company will get 0.
- Material expenses: This criteria will be taken from balance sheet of the company. The lower the material expense the higher the environmental performance.
- Energy expenses: It is also taken from the balance sheet of the company. Energy expenses will be low if the environmental performance is better.

In the application, 29 companies that take place in Sustainability Index of Istanbul Stock Exchange (BIST) for 2016 are sorted into three categories. The results of classification are also compared with those of Carbon Disclosure Project (CDP) reports. The performances of the companies assigned to different classes are also compared with the average class performances.

CONCLUSION

The evaluation of the sustainability performance of companies is a difficult task because of its multicriteria nature. In this study, an integrated MCDM methodology which ranks and sorts companies into predefined ordered classes based on their sustainability performances is proposed. In order to show the usability, 29 companies that take place in Sustainability Index of Istanbul Stock Exchange (BIST) for 2016 are sorted into three categories. The results show that the multicriteria sorting methods can help decision makers in evaluating the overall sustainability performance of companies, in monitoring relative performance of companies within each class and in determining the corrective actions to improve companies' sustainability performances.

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The Economic Consequences Associated with Integrated Report Quality: Early Evidence from a Mandatory Setting

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Abstract: We examine whether integrated report quality (IRQ) is associated with stock liquidity, firm value, expected future cash flow, and cost of capital. Our study is motivated by the recent focus on sustainable capitalism and the global interest shown by firms, investors, and regulators in the work of the International Integrated Reporting Council (IIRC). We use data from South Africa because it is the only country where integrated reporting is mandated. We use a measure of IRQ based on proprietary data from EY who rates these reports as part of its Excellence in Integrated Reporting Awards. We find that IRQ is positively associated with both stock liquidity (measured using bid-ask spreads) and firm value (measured using Tobin's Q). Our results are consistent whether we analyze levels or changes. When we decompose the firm value into an expected future cash flow effect and a cost of capital effect, we find that the positive association between IRQ and firm value is driven mainly by the cash flow effect, consistent with investors revising their estimates of future cash flows upward as a result of a better understanding of the firm's capitals and strategy or future cash flows increasing because of improved internal decision making by managers. We provide evidence on these two explanations and find that it is more likely that our results are attributable to improved decision making by managers than to analysts forecasting future cash flows more accurately.

Keywords: Integrated reporting, corporate social responsibility, firm value, cost of capital, stock liquidity, South Africa

The International Integrated Reporting Council (IIRC) defines an integrated report as a “concise communication about how an organization's strategy, governance, performance and prospects lead to the creation of value over the short, medium and long term” [1]. In a 2011 *Wall Street Journal* article, former US Vice President Al Gore and David Blood identified mandating integrated reporting as one of five steps needed to support a “sustainable capitalism” where businesses focus on long-term value creation. They argue that integrated reports allow investors to make better resource-allocation decisions by providing a more comprehensive view of the firm, and they call for stock exchanges and securities regulators to mandate integrated reporting to “ensure swift and broad adoption” [2]. More recently, in April 2016, the Securities and

Exchange Commission (SEC) in the U.S. issued for public comment a *Concept Release* on proposed changes to mandatory business and financial disclosures in terms of Regulation S-K. One question the SEC [3] is seeking feedback on is: “How important to investors is integrated reporting, as opposed to separate financial and sustainability reporting?” Our study sheds light on this question. Specifically, we use data from South Africa, where integrated reporting is mandated, to examine the effects of integrated report quality (IRQ) on stock liquidity, firm value, expected future cash flows, and cost of equity capital.

Although there is a growing literature on integrated reporting (see [4] for a review), these studies are mainly qualitative. Empirical evidence of the benefits of integrated reports is scarce (e.g., [5]), and we contribute to this emerging line of research by examining the capital market effects of IRQ. Our investigation is relevant because there is uncertainty regarding the economic benefits of integrated reporting. For example, Bob Laux [6], senior director of financial accounting and reporting at the Microsoft Corporation, argues that the IIRC needs to do more work articulating how investors benefit from integrated reporting and that this should include academic research.

A second motivation of our study is to extend the academic literature on the implications of new accounting frameworks. For example, there is a sizeable literature on the effects of mandatory adoption of IFRS (e.g., [7]-[9]). We add to this literature by examining the effects associated with the mandatory adoption of a new reporting model rather than a new set of accounting standards. While IFRS affects the production of financial information, integrated reporting emphasizes non-financial information and how it is disclosed. We are not aware of another setting where a country has mandated a new reporting model. As our models include controls for accounting quality, the issuance of a standalone corporate social responsibility (CSR) report, and overall disclosure quality, we provide evidence on whether integrated reports are associated with benefits that are incremental to existing corporate reports.

A third motivation is to provide evidence on disclosure and reporting regulation outside the U.S. Leuz and Wysocki [10] contend that examining

non-U.S. settings can provide a richer understanding of regulatory effects, and they encourage researchers to exploit settings outside the U.S. to document “novel effects”, especially related to “nontraditional disclosure and reporting settings”. The South African setting provides a unique natural laboratory to examine the economic consequences of an alternative reporting regime, and thus our findings may be of interest to investors, firms, and regulators outside South Africa who are interested in mandating an expanded set of disclosures.

To measure IRQ, we use proprietary data from EY who rates the quality of the integrated reports of the top 100 firms listed on the Johannesburg Stock Exchange (JSE) each year. We have access to each firm’s quality category, which is released publicly, and the underlying scores for each quality dimension, which are not publicly available. According to the chair of the EY panel that rates the reports, the ratings focus on the quality of the disclosure, e.g., whether the integrated report gives readers a sense of the firm’s strategy and value creation process. Thus, our measure of IRQ is not simply a disclosure index that captures the presence or absence of particular items.

We find that IRQ is negatively associated with the bid-ask spread, our inverse measure of stock liquidity, after controlling for corporate governance, CSR performance, accounting quality, firm complexity, overall disclosure quality, and other factors. To provide a stronger link between IRQ and the bid-ask spread, and to reduce the likelihood of correlated omitted variables, we run a changes model and find that firms with larger year-to-year increases in IRQ have larger decreases in their bid-ask spreads.

We also find a positive relation between IRQ and firm value measured by Tobin’s Q. We focus on Tobin’s Q because it measures the excess of the market value of assets over their book values. This excess is likely related to capitals that should be discussed in the integrated report (i.e., intellectual, human, environmental, and social and relationship, and natural capital), which are only partially or not reflected in the book value of assets. Our use of Tobin’s Q is also consistent with the IIRC Framework that states that the primary purpose of an integrated report is to explain to investors how an organization creates value over time. We find that IRQ is positively related to Tobin’s Q whether we use levels or changes.

In our next analyses, we decompose firm value into a numerator effect (expected future cash flows) and a denominator effect (discount rate) to examine the channel(s) through which IRQ is associated with higher firm value. Similar to Plumlee, Brown, Hays, and Marshall [11], we use analysts’ estimates of future stock prices (target

prices) as a proxy for expected future cash flows. We find a positive and significant association between IRQ and expected future cash flows. We estimate cost of capital based on the average of four proxies commonly used in the literature. We find no evidence of a relation between IRQ and the cost of capital. Thus, we conclude that IRQ is associated with firm value mainly through expected future cash flows.

We probe our finding of a positive association between IRQ and expected future cash flows further. Proponents of integrated reporting argue that IRQ can allow investors to better appreciate a firm’s strategy and business model, leading to improved estimates of future cash flows. Further, integrated reporting may affect the thought processes of management – often referred to as “integrated thinking” – leading to improved operating and investing decisions that generate higher cash flows. We test these two possible explanations of our expected future cash flow results by examining the association between IRQ and target price accuracy and *ex post* operating cash flows, respectively. We find a positive association between IRQ and *ex post* operating cash flows, consistent with improved decision making by managers. However, we find no association between IRQ and target price accuracy, which suggests that better IRQ is not associated with more accurate cash flow forecasting by analysts.

Finally, we repeat our main analyses by decomposing IRQ into individual components linked to the IIRC’s integrated reporting framework. We find that the components related to connectivity, stakeholder relationships, materiality, and conciseness are the most important drivers of our main results. Overall, our study suggests higher quality integrated reports are associated with more positive economic consequences.

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The Reporting Exchange: a collaborative knowledge platform bringing coherence to the reporting landscape

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The Reporting Exchange is a new knowledge platform developed by the World Business Council for Sustainable Development designed to bring coherence to the sustainability reporting landscape. This paper outlines the approach taken in developing a framework to describe components of the reporting landscape and the outcomes from a recent pilot of the platform.

INTRODUCTION

As the consequences for business of resource scarcity, climate change, social inequality, corruption and other risks have emerged, expectations of corporate performance and transparency have changed. Interest in sustainable development and the contributions of business has led to the introduction of numerous environmental, social and governance disclosure schemes related to corporate performance, prospects and strategy [1; 2].

Although welcome activity, this has created a confused sustainability “reporting landscape” where variation between requirements has made it increasingly difficult for business to respond effectively and efficiently [3]. Apart from specific structured legal requirements, companies can report through self-selection, on a flexible basis, in different places, according to different approaches. The resulting variability in the quality, quantity and relevance of disclosure prevents the effective use of information by markets and stakeholders [4; 5; 6]. The absence of agreed, standard terminology for describing and defining the components of the reporting landscape contributes to this confusion and complexity [7].

The World Business Council for Sustainable Development, recognizing these challenges and the role of effective corporate reporting in integrating sustainability into wider strategic decision making, is developing the Reporting Exchange, a freely available, global knowledge platform which will help business navigate and understand the landscape of reporting provisions [8]. The Reporting Exchange proposes terminology and a structure that describes the components of the landscape, and seeks to identify similarities and differences, providing the evidence base to support the harmonization of non-financial corporate reporting requirements.

METHOD

To define the components and terminology that characterise the reporting landscape a detailed review of over 50 reporting provisions³ was conducted. These provisions covered a broad range of legislation, guidance, and standards across environmental, social and governance subjects. This review facilitated the development of a framework (

TABLE 1) to classify reporting requirements and supporting resources, enabling comparison and the identification of similarities and differences.

TABLE 1 REPORTING EXCHANGE CATEGORIZATION FRAMEWORK

Provision type	Including regulation, standards, codes, principles, tools and guidance that set out what an organization should report, how it should prepare information or that inform management practice.
Obligation	The obligation of a provision. Often dependent on conditions.
Conditions	Conditions influence the applicability, relevance and obligation. May include sector/industry, size of the company, environmental and financial metrics.
Principles	The principles identified and applied in determining, preparing and presenting information.
Subjects	A 3-tier environmental, social and governance subject framework e.g. Social – Employment conditions, policies and practices – Training and development
Channel	The channels through which companies publish information.
Characteristics	Identifying whether requirements include specific definitions, indicators and guidance related to scope, accounting, compilation and presentation.
Indicators	The metrics and indicators outlined in the reporting requirement.
Content	The type of information requested or identified. May include: risks, opportunities, management, measurement, dependencies, impacts, policy, strategy, target, performance and outlook.
Related provisions	Reference – an explicit cross reference between reporting requirements, or reporting requirements and supporting resources. Associated - identified by the Reporting Exchange community as resources that support companies responding to reporting requirements.

For the first pilot of the Reporting Exchange, 6

³ The collective term used to describe the regulations, standards, codes and guidance which ask business to disclose or support the disclosure of sustainability information.

countries were selected – United Kingdom, United States, Brazil, South Africa, Peru, and Singapore. Research was conducted, with in-country support from WBCSD Global Network partners, into the state of the reporting landscape and reporting provisions were categorized according to the pre-defined framework.

The pilot platform was targeted at WBCSD members and Global Network partners from CEDBS (Brazil), Peru2021 (Peru), NBI (South Africa) and US BCSD. Engagement was selective based on those who had already expressed an interest in WBCSD’s reporting work. Prior to accessing the pilot platform, participants completed a short questionnaire to understand their experiences of the reporting landscape. After accessing the pilot platform, participants were asked to complete a questionnaire on their experience of the Reporting Exchange platform and invited to semi-structured interviews which were conducted by telephone. The interviews were not recorded but themes arising in each interview were noted for future action.

RESULTS

The pilot research though not a complete exhaustive study revealed 230 reporting provisions that influence non-financial sustainability reporting in the 6 pilot countries, and 130 international provisions that set requirements or support the disclosure of sustainability information. Between our pilot countries, marked differences were observed in the number of requirements and resources and the focus of legislation, standards, codes and guidance. The UK government has introduced requirements and guidance for companies to report environmental matters and greenhouse gas emissions in the annual report through Climate Change Act 2008, the Companies Act (Strategic Report and Directors' Report) Regulations 2013 and Defra Environmental Reporting Guidelines, with specific requirements related to intensity metrics, methodologies and omissions. In Brazil, only companies from certain sectors (public electric utilities) are required to prepare social and environmental responsibility reports, according to the ANEEL Requirements for Annual Sustainability Reporting (Despacho 3034/2006). BM&FBOVESPA stock exchange does however recommend that listed companies state whether they publish a regular sustainability or integrated report and where it is available, or if not explain why.

TABLE 2 – OVERVIEW OF PROVISIONS IN PILOT COUNTRIES

Country	Summary
Brazil	20 Provisions – 14 Reporting Requirements – 10 Mandatory – including the Brazilian Accounting Norm (NBC) T 3.7
Peru	5 Provisions – 3 related to Corporate Governance – including Principles of Good Governance for Peruvian Companies
Singapore	9 Provisions – 4 Reporting Requirements - including SGX’s sustainability reporting requirement
US	140 Provisions – including 80 industry specific voluntary standards from SASB -
UK	30 Provisions – 16 Reporting Resources – including guidance from the Financial Reporting Council on Strategic and Narrative Reporting
South Africa	15 Provisions – including the King III Code of Governance which introduces a requirement for companies to develop an Integrated Report

There are also significant similarities. In the UK, the Large and Medium-sized Companies and Groups (Accounts and Reports) Regulations introduces specific requirements related to employee engagement, diversity, welfare, recruitment & retention and training & development. In South Africa the Employment Equity Act, Broad-Based Black Economic Empowerment Act and Skills Development Act introduces similar requirements.

TABLE 2 provides a summary of observed similarities and differences between countries.

The pilot was held between 29th February and 27th March 2016. There were 72 participants predominantly representing businesses (74%) with operations in more than 44 countries globally. 89% of participants were directly involved in non-financial (sustainability) reporting with the majority having a management or strategic decision making role (80%). 48% were focussed on voluntary reporting only, 50% on both voluntary and mandatory (compliance) reporting. When asked about their experience of the current landscape, 100% agreed that the number of organisations asking business to disclose has increased significantly in recent years, and 73% agreed that this had made it difficult to understand the mandatory and voluntary reporting requirements that are applicable to their business. Participants also agreed (97%) that there is the need to develop common language and definitions of key terms to bring clarity to the reporting landscape.

100% of the participants that completed the follow-up survey stated that the Reporting Exchange and

the associated categorisation framework for classifying reporting provisions had improved or partially improved their understanding of the reporting landscape. 92% also stated that they would use the Reporting Exchange again. In addition, 79% stated they would contribute information about reporting provisions to help others better understand the reporting landscape. Feedback was also received on improvements to the platform, common requests were to tailor processes for academic, business, investor users, reference indicators and metrics, and clarify the relationships between reporting requirements and supporting resources.

A further 10 participants were interviewed on four topic areas: the categorization approach, overall design of the platform, user experience and opportunities. Four major themes arose from the interviews. These included the need for a highly advanced search engine, similar to those users are familiar with on other web applications. Secondly, approximate two-thirds of interviewees described how they would value the opportunity to share and review best practice examples across the user community. Thirdly, with refinement, the categorization framework provides logical and coherent description of the reporting landscape. Finally, was the need to consider top-down design based on, for example, the stage of the reporting journey or what the reporter is trying to achieve was highlighted as key to future success.

CONCLUSION

The findings from the Reporting Exchange pilot suggest that, with refinement, the proposed categorisation framework can bring a level of coherence to the reporting landscape and that there is appetite amongst business and academics for a collaborative platform that enables those working in the corporate reporting space to share developments and best practice. As the Reporting Exchange develops there will be further opportunities to analyse the regional approaches, explore similarities and identify opportunities for alignment and harmonization. In the longer term, this may enable us to understand the effectiveness of different provisions in supporting sustainable development objectives.

It is also apparent that the Reporting Exchange may serve as a valuable engagement tool helping dialogue between industry groups, business associations and governments.

Moving forward, the geographical coverage of the Reporting Exchange platform will expand to 40 countries by the end of 2016 ahead of a second pilot. Collaborative tools will be introduced to allow registered users to contribute relevant

research content and functionality to share best practice and experiences will also be added. Finally, to establish the platform as a trustworthy and reliable resource, WBCSD is seeking an expert moderator panel whose role will be to validate the accuracy and provenance of reporting provisions on the Reporting Exchange. Interested parties can register for the second pilot at www.reportingexchange.com.

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The Handprint - A complementary measurement of positive sustainability impacts of products

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Summary: The Handprint is an innovative and holistic approach to facilitate the measurement and evaluation of the ecological, economic and social sustainability impacts of products. The existing approach of the footprint focuses on negative ecological impacts of individuals, organizations or countries. The handprint on the other hand shall determine, measure and evaluate the positive sustainability impacts including the social and economic dimension.

Keywords: handprint, footprint, sustainability impacts of products, evaluation, approach

INTRODUCTION

The Handprint refers mainly to the concept of the ecological footprint, which has become globally broadly accepted and is extensively used in practice. This instrument enables a systematic and transparent understanding of ecological impacts of human actions. As a result it has contributed to a change in practice and science and has led to more objectivity of complex discussions. The handprint aims at complementing this approach by adding a measurement for positive sustainability effects concerning products or production processes, respectively, as well as by adding the social and economic dimensions to the analysis.

SCHOOL OF THOUGHT & KEY RESEARCH FINDINGS

One of the main challenges of the undertaking is to systematically distinguish between positive and negative sustainability effects generated through products. Current research focusses mainly on negative effects. The Sustainable Value Added approach, as an example, focusses on positive effects, however only covering the economic dimension. The Handprint-Based NetPositive Assessment focusses on positive ecological effects.

METHODS AND TOOLS

Among others, relevant scientific standards for measuring ecological impacts are the Environmental Life Cycle Assessment (LCA) which is laid down in ISO 14040 and 14044, or product declarations according to ISO 14024 and 14025. The Social LCA (SLCA) for measuring social impacts is still at the beginning of its development. The Product Sustainability Assessment (PROSA) offers further approaches. The methodology of the handprint relies on these approaches and further ones.

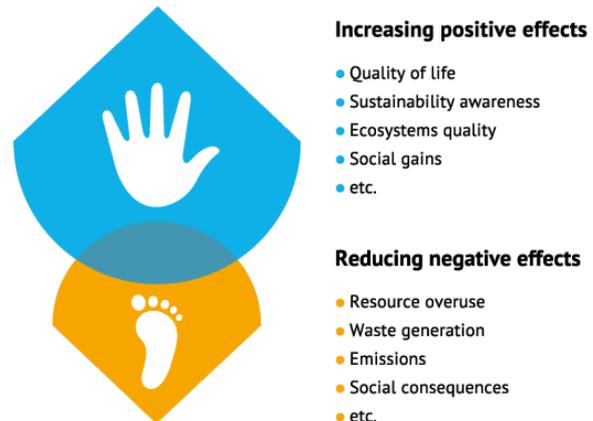


ILLUSTRATION 1: A COMPLEMENTARY VIEW - INCREASING THE HANDPRINT AND DECREASING THE FOOTPRINT

RELEVANCE TO PRACTICE

The additional value as well as the relevance to practice of the handprint methodology is given by enabling both, an evaluation of the reduction of negative sustainability effects, e.g. the decrease of CO₂ emission in a production process, as well as the identification and evaluation of positive sustainability effects as, e.g. the creation of sustainability awareness. Both effects can be seen as positive external effects which result in additional value to the operating business of companies.

CONCLUSIONS AND OUTLOOK

It is the ambitious goal of the handprint approach (and the project behind it), to create an instrument with a similar range and applicability as the footprint by adding a complementary measurement for positive sustainability effects as well as by covering the social and economic dimension, too. It is the overall goal to – for the first time – create a comprehensive methodology which allows this in a systematic and transparent manner.

ACKNOWLEDGEMENT

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Materiality in Sustainability Reporting in Higher Education Institutions

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Abstract summary: This study is focused on the principle of materiality in sustainability reporting in the context of Higher Education Institutions. In particular, it explores how stakeholder engagement is carried out to identify the material aspects of the sustainability reports, in addition to analyse the expectations of internal stakeholders to integrate sustainability into HEIs' operating processes and the degree of consensus among them. The results of this study open new questions about materiality in sustainability reporting that should be addressed in future studies.

I. INTRODUCTION

Higher Education Institutions (HEIs) are responsible for preparing most of future leaders and managers with ability to influence in social institutions, therefore, they should take the lead in responding to rising environmental and social demands, fostering sustainable development [1]. Sustainability reporting (SR) provides a tool to HEIs to transparently communicate their values, actions and performance towards sustainable development to their stakeholders. However, SR in the context of universities is still in its early stages [3], [4], owing to the lower number of HEIs publishing sustainability reports [2], [5], [6], the absence of consecutive reporting [6] and the low quality of the reports published [2], [5].

In SR, an important principle is materiality [7], which means that these reports "should cover aspects that reflect the organisation's significant economic, environmental and social impacts; or substantively influence the assessment and decisions of stakeholders" [8].

In this regard, stakeholder engagement plays a key role in defining the material aspects and, therefore, the contents of the reporting. In particular, regular engagement with stakeholders helps organisations to identify, understand, prioritize and communicate how they are managing the most material aspects. This issue is even specially relevant in the case of key internal stakeholders of universities (i.e. administrative staff, academics and students) given that their participation is subject to their temporary contracts or their studies program, having a limited stay in the HEIs [9]. Nevertheless, this topic is still sparsely developed in the literature.

Thus, the purpose of this study is to provide knowledge to better understand the reporting process in HEIs. For that end, first, this study tries to answer which and how stakeholders are engaged in sustainability reporting in HEIs; second, it explores the material aspects in the SR of universities; and finally, it analyses the degree of agreement among expectations of internal stakeholders to integrate sustainability into HEIs' operating processes.

II. METHODOLOGICAL APPROACH

This study adopts an exploratory approach through a content analysis and descriptive statistics. On the one hand, the sample consists of ten Sustainability Reports of universities listed in GRI database. These sustainability

reports represent all the reports from universities based on GRI-G4 framework with a materiality analysis. On the other hand, in 2013, internal stakeholder expectations were explored, in a specific case, by means of 405 surveys. An exploratory research is applied in order to show the stakeholder engagement of reports and, furthermore, it uses a content analysis to extract material aspects from the sustainability reports. Moreover, descriptive statistics are used to determine the degree of consensus on the material aspects of internal stakeholder expectations to integrate sustainability into universities' operating processes.

III. RESULTS

This research shows three remarkable findings. Firstly, the criteria grouping of stakeholders are diverse; consequently, the process of stakeholder engagement is heterogeneous. Secondly, the expectations of internal stakeholders are aligned with the material aspects of sustainability reporting. Among the material aspects, those who achieve higher scores are: environmental respect, efficient resource management, transparent management, and ethical values. And thirdly, among key internal stakeholders (administrative staff, academics and students), there is a greater consensus between the values of academics and administrative staff. However, prioritization of student expectations offers larger divergences compared to the average.

IV. CONCLUSIONS

HEIs play an important role as educators of future leaders and policy makers and, therefore, it has a large potential for enabling change towards sustainable development.

In this sense, this paper aims to enhance the knowledge of stakeholder engagement in HEIs. In this way, it contributes to identify current and future impacts, enhancing the quality of reporting and, consequently, improving the decision process of stakeholders about university sustainability performance and generating trust in HEIs.

Moreover, this study goes beyond the review of the content of the sustainability report and tries to identify to what extent the expectations of internal stakeholders are aligned with the aspects that universities consider as material. Finally, it also identifies new research opportunities in stakeholder engagement in order to explore potential conflicts and collaborations between and within stakeholders in the process of identifying material aspects.

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Sustainability performance of organic and conventional farms in Ticino. How well does the SMART-Farm Tool capture the differences?

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Abstract: The Sustainability Monitoring and Assessment Routine (SMART)-Farm Tool was developed to assess the sustainability of agricultural enterprises in a comprehensive, efficient and comparable way. This paper aims at evaluating the performance of the tool based on an application to conventional and organic farms in Ticino, Switzerland. The application of the tool revealed an overall higher sustainability of the analysed organic farms compared to the conventional ones and underpinned several differences in terms of sustainability. Major differences were found within the following SAFA sub-themes: “Due Diligence”, “Ecosystem diversity”, “Species Diversity”, “Local procurement” and “Product Information”. However, due to the small sample size of the study and the heterogeneity of the analysed farms, the results cannot be generalised. Moreover, the application of the SMART-Farm Tool showed that all 58 SAFA sub-themes can be efficiently and consistently assessed and thus the tool is able to provide a holistic result of the sustainability performance of agricultural enterprises. This aspect clearly suggests the potential complementarity of the SMART method to more quantitative and data demanding approaches such as Life Cycle Assessment (LCA). Finally, the application of the tool revealed the need to further integrate additional rating guidance’s to enhance and ensure rating uniformity, which finally determines the comparability of the results.

INTRODUCTION

As the concept of sustainable agriculture progressively gained importance throughout the last decades, a large set of approaches and tools aimed at measuring the sustainability performance of agricultural enterprises has been developed. Nonetheless, the majority of these approaches focuses just on one dimension or one specific sustainability theme (e.g. greenhouse gas emissions), thus do not embody the multidimensionality of the concept, and consequently are unable to provide holistic results. Furthermore, the tools are not harmonized nor do they follow the same framework, which means that results from the assessment of different tools are difficult to compare [9].

An important step forward in this context was done by the Food and Agriculture Organization (FAO) of the United Nations, which in December 2013 published the Sustainability Assessment of Food and Agriculture Systems (SAFA) Guidelines – a holistic and transparent sustainability assessment framework - through which it seeks to harmonize the different sustainability approaches and establish a common understanding of the sustainability concept and its assessment process [3].

Based on this framework, an interdisciplinary group of scientists at the Research Institute of Organic Agriculture (FiBL) developed the Sustainability Assessment and Monitoring Routine (SMART) - Farm Tool, to comprehensively measure the sustainability performance of farms in an efficient and comparable way. However,

the performance of this tool to effectively capture differences between different production systems was not evaluated so far.

Therefore the main aim of this paper is to evaluate the ability of the SMART-Farm Tool efficiently detect differences between production systems by applying the tool to two sets of comparable organic and conventional farms in Ticino, Switzerland.

MATERIALS AND METHODS

SMART-Farm Tool

Based on the SAFA Guidelines, it comprehensively models the performance of a farm with respect to the 58 SAFA sub-themes for which a globally applicable objective for operators in food and agriculture supply chains is defined (see Figure 1).

FIGURE 1. OVERVIEW OF SUSTAINABILITY ASSESSMENT OF FOOD AND AGRICULTURE SYSTEMS (SAFA) DIMENSIONS, THEMES AND SUB-THEMES.



Source: SAFA Guidelines (2013), FAO

For each objective, there are a number of indicators that in combination allow for an assessment of the level of goal achievement, which is expressed on a scale from 0 to 100%. 0% represents a state in which all applicable farm activities are counteracting the goal achievement, while 100% represent a state in which the respective sustainability goal have been fully achieved by implementing all relevant beneficial activities on a farm

and avoiding all relevant detrimental activities to the greatest extent possible [11].

Comparison methodology

Offermann and Lampkin (2005) proposed a set of guidelines aimed to harmonize the procedure followed for the definition and selection process of comparable conventional farms. The basic concept on which their theoretical framework is built on, is that different farming systems can be compared when they have a similar natural resource endowment (e.g. quality of the soil) and productive potential (e.g. farm size, livestock units) [9]. Consequently the following variables were selected:

- i. **Farm type**
To be comparable organic and conventional farms need to pertain to the same farm typology according to the FAT99 classification.
- ii. **Location**
The selected conventional counterparts need to be located within the same canton of the organic farm.
- iii. **Natural resource endowment**
As variables related to the natural resource endowment of the farms are not available, the variable “Zone” will be used as a proxy variable. Indeed, the environmental conditions such as climate, soil type and quality as well as water availability and quality, are more likely to be similar within the same zone.
- iv. **Productive factors**
To be comparable the Utilized Agricultural Area (UAA) of farms is required to be within a range of 30%.

Considering the matching procedure, comparing each individual organic farm with a group of comparable conventional ones is recommended in order to minimise the impact of differences determined by the management ability of the farmer [8]. However, within this study the assessment of a large number of conventional farms for each of the assessed organic farm has not been possible due to time and budget constraints. For this reason, a paired matching was performed.

Comparative analysis of the sustainability performances

Taking into consideration the small sample size (eight organic and eight conventional farms) of the actual study, the comparative analysis of the sustainability performance will be performed using descriptive statistics. The variation within the average scores will be used for the identification of a set of sub-themes majorly characterizing the two systems when compared to each other. The major differences are then analysed to identify and understand the factors impacting on the results.

Framework for evaluation

To evaluate the suitability of the tool to effectively undertake a comparative analysis between different

production systems, we determined a set of critical factors based on an adaptation of De Mey et al (2011), within these:

Comprehensiveness and data availability

Precision of data

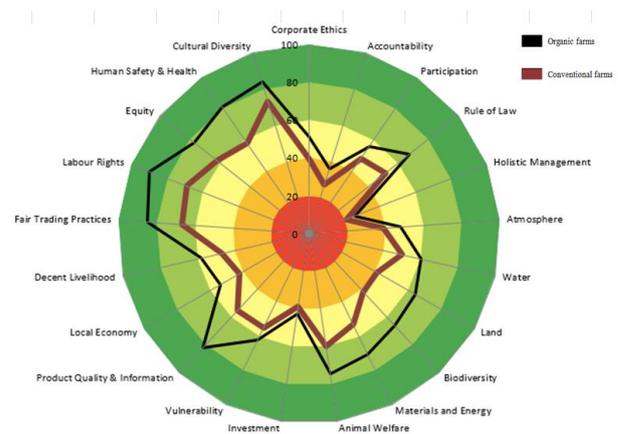
Rating uniformity & results comparability

RESULTS

Comparative analysis of sustainability performances

By comparing the average scores at the sub-theme level it appears clear that in general organic farms perform better in terms of sustainability performance when compared to conventional farms (see Figure 2). Moreover, even though in general differences at the sub-theme level between the two systems are relatively modest, a few exceptions arise: in fact 5 sub-themes (see Table 1) present a variation equal or higher than 30%, with the highest divergence reaching 38%.

FIGURE 2. GRAPHICAL REPRESENTATION OF THE RESULTS FOR BOTH THE ORGANIC AND CONVENTIONAL CLUSTER OF FARM FOR THE 21 SAFA-THEMES



Source: Own elaboration

TABLE 3 MAJOR SCORE VARIATIONS AT THE SUB-THEME BETWEEN ORGANIC AND CONVENTIONAL FARMS.

Dimension	Theme	Sub-theme	Score difference Organic. vs. Conventional (%)
Good Governance	Corporate ethics	Due diligence	31%
Environmental integrity	Biodiversity	Ecosystem diversity	32%
		Species diversity	31%
Economic Resilience	Product quality & info	Product information	38%
		Local Procurement	35%

Source: Own elaboration

For the purpose of generating a deeper understanding of the results and the factors determining these major differences between the two systems, an in-depth analysis of the most significant discrepancies follows.

Due diligence

The different performance is mainly explained by the scoring of one indicator referring to the environmental responsibility in procurement: while organic farms are bound by the Bio Suisse regulations to source environmentally certified inputs (thus get a full score for this indicator), conventional farmers are free to decide over the procurement of inputs, which often results in the selection of more convenient non-certified products.

Ecosystem and Species diversity

Even though the average scores of these sub-themes are influenced by a wide range of indicators (respectively 40 and 59 indicators), the performance gap between the two systems is clearly determined by the different scorings for the following indicators: “Proportion of Ecological Compensation Areas”, “Proportion of extensively managed grasslands” and “No use of herbicides”.

Product information

Indicators influencing the difference within the average results of the two clusters of farms for this sub-theme are mainly those related to the following indicators: “Meeting of environmental standards”, “Local procurement” and “Traceability of bought-in inputs”.

Local procurement

Only two indicators measure the performance of farms for this sub-theme: the proportion of inputs bought within a range of 50 km from the farm, and the proportion of inputs bought outside a range of 500 km from the farm. Therefore, the major difference in terms of performance between the two systems, definitively suggests that organic farms tend to benefit the local economy (here identified with the regional territory) through sourcing their inputs (mainly feed in this case) from local suppliers, while most conventional farmers tend to source their inputs from abroad in order to reduce their production costs (i.e. in most cases roughage is bought in Italy, as the price is significantly lower when compared to the price applied by local suppliers).

Evaluation of the SMART-Farm Tool

Comprehensiveness & data availability

The multidimensionality of the sustainability concept is clearly incorporated (see figure 1) within the SMART-Farm Tool and consequently allows a holistic comparison of the analyzed production systems. Moreover, in general the data requirements could be efficiently fulfilled for all assessments, except in the case of one conventional farm for which some data related to pesticides use could not be collected.

Moreover, the comprehensiveness of the SMART approach and its efficiency in terms of time required for data collection highlights the potential complementarity of this tool with more quantitative, theme specific and data demanding approaches as Life Cycle Assessment (LCA).

Precision of data

Within the SMART-Farm Tool a consistent portion of the data and information used to score the indicators – which are ultimately defining the sustainability performances of

the farms and the conclusions derived from their analysis - is provided directly by the farmers in response to the questions posed by the auditor. This configuration automatically implies that the quality of the assessments and ultimately the quality of the analysis of the results strongly depends on the correctness of the data provided by the farmer.

From the application of the tool, it resulted that in some cases the precision of the data used within the assessment might be rather low due to the objective difficulty of the farmer to estimate certain data used for rating of some indicators (e.g. fuel consumption). This determines a higher risk of distorted scorings, which subsequently might lead to ambiguous results.

Rating uniformity and results comparability

A relatively high proportion of indicators are scored by the auditor’s on the basis of their – to some extent “subjective” - perception of an observable situation or an answer given by the farmer. Therefore, it is clear that in order to ensure the reliability and comparability of the result the subjective component as well as the interpretational difficulties must be minimized. Even though this challenges are actually addressed through formalized trainings for the auditors [11] and the provision of an exhaustive list of definitions about most of the technical terms used throughout the questionnaire, the application of the tool revealed that further guidance’s must be integrated to maximise rating uniformity and increase the comparability of the results.

CONCLUSIONS

As a result of the application of the SMART-Farm Tool to two comparable clusters of organic and conventional farms, major differences in terms of sustainability performance were determined for the following SAFA sub-themes: “Due Diligence”, “Ecosystem diversity”, “Species Diversity”, “Local procurement” and “Product Information”. However, even though the results obtained through the application of the tool depicted reality, given the small sample size of the study a critical interpretation is required.

Moreover, from this study it clearly emerged that due to the reliance on readily available data, the SMART-Farm Tool is able to capture differences in terms of sustainability performance related to different management practices in a pragmatic and efficient way.

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Assessing the banking system role in sustainable development: Evidence from the UAE, Australia, Italy and Turkey

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Extended Abstract: There is growing evidence on the role of finance in the deterioration of natural capital and the accentuation of the social divide. Achieving sustainable development requires action within the real economy but also within the financial system, which is the recipient of, and conduit for, significant public financial support. The United Nations Environment Programme (UNEP) Inquiry into the Design of a Sustainable Financial System was established in early 2014 to explore how to align the financial system with sustainable development, with a focus on environmental aspects. To support sustainable development, the UNEP inquiry defines the sustainable financial system as being one that “creates, values and transacts financial assets in ways that shape real wealth to serve the long-term needs of an inclusive, environmentally sustainable economy” (UNEP, Inquiry, 2015: p54). The reform is a quiet revolution because it consists in effectively aligning the design and functioning of financial and capital markets to escort the transition towards a green and inclusive economy. It integrates sustainable development into the fabric of the financial system through an increasing consideration of social and environmental risks and opportunities in financial decision-making, which might lead to new performance criteria and adjusted returns for delivery of sustainability goals. The financial system we need should be guided by 10 principles that have to be supported by the rule of law. In this paper, we focus on banks which sit at the heart of the financial system. Also, we focus on three principles (the bank purpose / level of supply of green and inclusive finance and social and environmental impact due diligence / governance). Our study is focused on the assessment of the pathway of four banks from the United Arab Emirates, Australia, Italy and Turkey towards becoming sustainable banks. The countries are selected for the institutional diversity they offer to contextualize sustainability and to test banks responsiveness to diverse social and environmental requirements. To assess the true commitment of banks towards promoting sustainability, we use the model of integrity developed by Erhard et al, (2009) and Erhard & Jensen (2014) as analytical framework. Integrity is about honoring one’s word. When applied to banks, integrity is defined as the bank word being whole and complete. Integrity [the condition of being whole and complete] is a necessary requirement for workability, which determines for an individual, group, or an organization the available opportunity set for performance. To assess the integrity of banks in honoring their word, we collect data from their financial, governance and CSR / sustainability reports for years 2009 (during the crisis), 2012 and 2015 (when international community expectations culminated into the UNEP inquiry). Data analysis is performed using NVivo. The results are discussed in the backdrop of the national needs, regulations and sustainability agenda. If the bank word is not whole and complete with regard to purpose, green and inclusive financing and governance, the bank is considered out of integrity.

Keywords: Sustainability, Inclusiveness, Intergenerational Wellbeing, Sustainable Finance, Banking System, Model of Integrity, Corporate Purpose, Corporate Governance.

MAIN CONTENTS

There is growing evidence on the role of finance in the deterioration of natural capital and the accentuation of the social divide. Achieving sustainable development requires action within the real economy but also within the financial system, which is the recipient of, and conduit for, significant public financial support. Financing should be allocated away from wealth creation that generates environmental externalities valued at over US\$7 trillion annually [1]. Today model of growth is associated with a systematic depletion of natural capital and vital life support systems, which erosion is expected to reach 10% by 2030. “Four out of nine “planetary boundaries” have been crossed: climate change, loss of biosphere integrity, land-system change, and altered biogeochemical cycles” [2].

COP21 Paris agreement requires making finance flows consistent with a pathway towards low greenhouse gas emissions and climate- resilient development [3]. Hence, financing should be directed towards serving the needs of a green and inclusive economy [1], [4]. According to the United Nations Conference on Trade and Development (UNCTAD) 2014 World Investment Report, US\$5-7 trillion a year is needed to finance the Sustainable Development Goals [5]. Public finance will only provide a fraction of total financing needed for sustainability. Yet, the contribution of the financial system to sustainable development does not mean solely an incremental cost, but requires an appreciation of broader changes needed across the system.

The United Nations Environment Programme (UNEP) Inquiry into the Design of a Sustainable Financial System was established in early 2014 to explore how to align the financial system with sustainable development, with a focus on environmental aspects. As stressed by Achim Steiner the Executive Director of the UNEP, “in the wake of this global financial crisis, recognition has grown that the financial system must be not only sound and stable, but also sustainable in the way it enables the transition to a low carbon, green economy. Therefore to achieve the sustainable development we want will require a realignment of the financial system with the goals of sustainable development” [2].

Our Common Future (1987) defines sustainable development as “a development that meets the needs of the present without compromising the needs of future

generations to meet their own needs” [6]. According to UNEP, Inquiry [2], sustainable development means wealth creation that supports inclusive development while protecting and restoring natural assets (p. 1). This definition is aligned with the definition of sustainability introduced in the U.N. recent reports about inclusive wealth (2012, 2014) in continuity of the World Bank report (2006) on the wealth of nations. Sustainability is linked to inclusiveness that requires institutions to play active role in shaping interrelationships between people to empower them in achieving their capabilities in their life cycle [7]. Sustainability is also linked to intergenerational wellbeing, which requires the international community to recognize the complementarity between different forms of capital that form their productive base, composed of produced capital, human capital, health capital and natural capital; including fossil fuels, minerals, forest resources, agricultural land and fisheries, to be maintained for future generations to continue producing the same level of wellbeing. According to UNEP, Inquiry [2] “sustainable development requires a long-term view in order to deliver fairness between generations” (p. 10). To support sustainable development, the UNEP inquiry [2] defines the sustainable financial system as being one that “creates, values and transacts financial assets in ways that shape real wealth to serve the long-term needs of an inclusive, environmentally sustainable economy” (p.54).

Today, short-termism is key in the financial system, which discounts the importance of future generations in today’s decision-making and hinders sustainability. Financialization has led to financial returns increasingly arising from transactions that are disconnected from long-term value creation in the real economy. “There is little appetite for taking the long-term view. Few are ready to curb financial booms that make everyone feel illusively richer” [8]. As a consequence, the financial system is no longer channelling household savings to meet long-term investment needs. The over-sized and over-complex financial system led to a global financial crisis and to an unprecedented financial instability that has negatively impacted economic growth and income equality. Recent research by the IMF and the Bank for International Settlements depict that the financial sector continues to develop and grow relative to the size of that economy (the size of the financial sector could be measured in percentage of GDP, etc.), which negatively impacts its host (domestic) economy-wide productivity and growth. Moreover, in a recent work by the OECD, increasingly individuals lack access to finance in many parts of the world [2].

The inquiry reform goes beyond stabilizing the system by seeking further improvements in governance, transparency and regulatory measures through fiscal and other incentives. It is a quiet revolution because it consists in effectively aligning the design and functioning of financial and capital markets to escort the transition towards a green and inclusive economy. It integrates sustainable development into the fabric of the financial system through an increasing consideration of social and environmental risks and opportunities in financial

decision-making, which might lead to new performance criteria and adjusted returns for delivery of sustainability goals. This shift will reduce the gap of financing in underserved key sectors and critical social groups because of the current risk pricing methods. It will also question financial institutions on their liability for pollution damage to drive, which might strengthen due diligence in the credit process with regard to environmental impact.

The inquiry requires a systematic and systemic approach. The dispersed initial best practices highlighted by the inquiry are necessary to build appetite for more impactful measures. They could be crafted by coalitions, informed and further amplified through international cooperation to trigger wider significant changes in the behavioural, cultural and market dynamics of the financial system. The reform involves the financial system regulators, supervisors and standard setters as well as the market actors who control the major pools of assets: banks, debt markets (bonds), equities, institutional investors and insurance.

The financial system we need should be guided by 10 principles that have to be supported by the rule of law: the first principle (1) is related to the purpose of the system, which is “to serve the needs of society by facilitating payments, aggregating, protecting and allocating savings to the most productive uses and managing risk in ways which support an inclusive and sustainable real economy” [2]. Three principles are related to the core measures that should be linked to the purpose. (2) The pricing of risk and reward should internalize the value of human, natural and social capital to deliver sustainable development. (3) Access to the value of finance should be available to all. (4) System stability should support sustainable development across time. The two following principles are related to who pays and who is rewarded. (5) Reward earned by the sector should be commensurate with the value it creates. (6) Public finance should only support public interest outcomes that should not be delivered through private means. The three following principles are related to market integrity. (7) Market composition should encourage healthy diversity and innovation. (8) Impacted stakeholders should be empowered through rights, information and capacities. (9) Culture, value and norms should be aligned to purpose and supported by appropriate incentives. The last principle (10) is related to the system governance, which should be aligned to purpose, with appropriate transparency of decision-making, performance and redress.

Since banks sit at the heart of the financial system, particularly in developing countries by holding over 45% of global financial assets with an aggregate balance sheet of US\$135 trillion[9], our research is focused on the inquiry into the design of the banking system to support sustainable development.

Banks have a critical role in allocating credit to households and enterprises, and originating loans that can be bundled into products for long-term holders of assets. Considering sustainability may alter the underlying business model of banks. The inquiry identifies, besides

introducing the supporting governance architecture, three other priorities for banking: Extending risk-based governance, improving access to sustainable lending and improving banking culture and structure. Among the key tools proposed in the three areas: (1) regulatory requirements to incorporate environmental and social factors into risk management and due diligence to support voluntary market action whenever its scope is limited by market dynamics;(2) introducing sustainability stress tests to explore the impact of future environmental and social scenarios of the portfolios and business models of banks; (3) increasing the diversity and depth of financial markets to increase the supply of green finance, particularly low-cost debt, including priority lending requirements, below-market rate finance via interest-rate subsidies and central bank refinancing operations and establishing priority sector lending programs; (4) exploring variations in capital requirements for certain classes of lending to address risk / reward mismatch for green finance; (5) better aligning banking culture and structure through looking at underlying skills, values and market composition. A possible avenue could be to introduce dedicated green banks as well as banks with a clear mission to achieve social and environmental impact [2].

In this research, we focus on three principles (1, 3 and 8). We examine the declared purpose of banks compared to what ought to be according to the inquiry. Throughout the history of banking system since the merchant banks in Assyria and Babylonia around 2000 BC, the banks of northern cities of medieval and early renaissance Italy until the wonderful life business model of modern banks, the sole purpose of banks was to serve the human needs of the real economy. Since the 1970s, following a wave of deregulation, the business model of banks has dramatically shifted from the traditional intermediation between savers and borrowers. Banks found they could earn more from money than from providing services for the real economy. Their business model is market-oriented and based on speculation and making money out of money instead of being values-based.

Today most of banks strategies are geared towards generating non-interest income. In addition, intermediation is associated with household mortgages, which accounts for more than 80% of overall banking lending in some countries. The misallocation of credit to less productive economic activities reflects the extent to which the system became selfish, acting as the master of the economy instead of being its servant, and driven by shareholder value maximization endorsed by greedy managers [8]. This trend has also affected the portfolio choice of banks that has no respect to the imperative of ecological function or to the social interest. Accountability is limited to delivering shareholder value, which is also reflected in banks governance practices. As a result, in 2009, more than half of the world's adult population were unbanked [10] and more than 2.5 billion people do not have access to a bank account [11]. In addition, the World Bank estimates a US\$3- 4 trillion funding gap for micro, small and medium enterprises in the post 2008 world [8]. An economy is not sustainable in

the long term if it excludes people or communities, which requires the financial system to be truly inclusive.

Hence our second task would be to examine the banks current level of supply of green and inclusive finance (financing the underserved) compared to national needs that differ by geography and in time. We also examine their level of engagement in assessing the environmental and social responsibilities of their clients through the existence of any enquiry into the behavior of businesses they lend to or invest in. For that purpose, we examine more precisely if the studied banks adhere to Equator principles, which are primarily intended to provide a minimum standard for due diligence, based on IFC's environmental and social screening criteria, in determining, assessing and managing environmental and social risk in projects to support responsible risk decision-making [12].

Finally, we examine the level of inclusive governance that is the representation of impacted stakeholders in the bank governing bodies mainly their board of directors. Only by accepting diversity in the board is banking able to allow diverse needs to be fulfilled. For this purpose, we also look at the bank's commitment to GRI. The Global Reporting Initiative (GRI) is a framework intended to help businesses; governments and other organizations understand and communicate their impact on critical sustainability issues such as climate change, human rights, corruption and many others [13]. The adoption of GRI reflects an increased transparency and accountability on social and environmental impact of business practices, which could be considered as a step towards inclusive governance that makes the interests of the whole, one and the same. In fact, only by involving impacted stakeholders in their governance is banking able to make the interests of the relevant parties (stakeholders) the same as those of the bank, and those of the bank same as the interests of the community and the environment.

Our study is focused on the assessment of the pathway of four banks from the United Arab Emirates, Australia, Italy and Turkey towards becoming sustainable banks. The countries are selected for the institutional diversity they offer to contextualize sustainability and to test banks responsiveness to diverse social and environmental requirements.

Our focus does not cover all the fundamental pillars of sustainable banking developed by the Global Alliance for Banking on Values, which include: (1) a 'triple bottom line' at the heart of the business model (economic, social and environmental performance); (2) serving the real economy and enabling new business models to meet the needs of both (being grounded in communities); (3) long term relationships with clients and a direct understanding of their economic activities and the risks involved; (4) long term, self-sustaining, and resilient to outside disruptions; (5) transparent and inclusive governance; and (6) culture of the bank which embeds these principles [8]. These principles lead to what the inquiry calls "values based banking" that is purposively oriented towards the development of a values-based economy which embraces the image of sustainability.

To assess the true commitment of banks towards

promoting sustainability, we use the model of integrity developed by Erhard et al. [14] and Erhard & Jensen [15] as analytical framework. Integrity is about honoring one's word. When applied to banks, integrity is defined as the bank word being whole and complete. Integrity [the condition of being whole and complete] is a necessary requirement for workability, which determines for an individual, group, or an organization the available opportunity set for performance. Since there is a cascade beginning with integrity [integrity-of-design, integrity of implementation, and integrity-of-use], flowing to workability, and from workability to performance, "any diminution of whole and complete (a diminution of integrity) is a diminution of workability, and any diminution of workability is a diminution in the opportunity for performance. Integrity is thus a requisite condition for maximum performance" (p. 42).

The bank word consists of what is said between the people in that bank, and what is said by or on behalf of the bank. Moreover, according to Erhard et al [14], a word consists of each of the following: [1] what the organization says [all what was said to be done or will not be done]; [2] what the organization knows [their word also being constituted by what they know to do and doing it as it was meant to be done]; [3] what the organization is expected to do [unless it has explicitly said to the contrary, the organization is cause in the matter of what the community expects of it, it is then led to be highly sensitive, and motivated to ferret out those expectations and to take action to manage them]; [4] what the organization says is so; and [5] what the organization says it stands for; all what came first considering [6] moral, ethical and legal standards. Generally, "an organization's word is given by its actions, and by its agreements, its formal contracts, and its communications through annual reports, policies, slogans, advertising, and the interaction of its personnel with customers, employees, suppliers of all types [including materials, parts, services, and capital]" (p. 59).

Erhard et al. [14] give, as example of a State's word, the government's monopoly on violence to maintain peace by preventing the private use of violence by citizens on each other. Giving its word requires the government to provide compensation for citizens for certain actions such as the case of eminent domain where a public taking is ruled to be in the overall public interest the government has promised as part of its word. Today, most of banks publish CSR and sustainability reports. The question is "do they walk the talk"? If a bank gives a word about its contribution to sustainability, its honoring the word in the backdrop of the inquiry three principles we selected in this study requires the bank word to be whole and complete with regard to purpose, green and inclusive financing and governance. To honor its word, the bank is expected to portray an increasing trend towards aligning purpose to sustainability.

Simultaneously, it is expected to increasingly engage in some forms of supply of green and inclusive finance. We evaluate the current levels of such financing against the needs to deliver national priorities for sustainable development. To assess the needs, we investigate the

bank country specific context, namely the national sustainability agenda, banking regulations and the existing rules that align public incentives for financial activities with policy priorities, including financial inclusion and environmental issues. Finally, we expect the bank to increasingly involve impacted stakeholders in its governing bodies over the period of study. In the absence of such observations, the bank word is not whole and complete and the bank is out of integrity. Since integrity [the condition of being whole and complete] is a necessary requirement for workability, which determines the available opportunity set for performance, being out of integrity prevents superior performance of banks in effectively supporting sustainability.

In this study, contextualization is crucial in collecting data and conducting the analysis. "The Inquiry's Framework for Action provides a means for systematically considering options for action, based on practice and countries' forward-looking thinking and plans. Parts of the Framework for Action will be of varied importance to different countries. Each country should carefully assess the possibilities and associated benefits, costs and risks. Ultimately, there is no substitute for each country undertaking its own diagnostic, and on that basis, building out its options for actions and means for implementation" [2].

In this analysis we use both primary (websites of regulators such as central banks) and other relevant secondary data to characterize the national context for each bank. To assess the integrity of banks in honoring their word, we collect data from their financial, governance and CSR / sustainability reports for years 2009 (during the crisis), 2012 and 2015 (when international community expectations culminated into the UNEP inquiry). Data is collected directly from banks websites. Statements related to the three issues examined in this paper (Purpose / Credit allocation and environmental and social screening due diligence process / Governance) are copied from banks reports into a document for further processing. We use qualitative techniques offered by NVivo to structure and code these statements following Miles and Huberman [16]. A tree node structure is developed for each issue. The major branch nodes (child nodes) reflect dimensions suggested by the inquiry framework for a sustainable banking system versus business as usual practices. These categories are extended while we go through the data collected (see figure 1).

The results are discussed in the backdrop of the national needs, regulations and sustainability agenda. If the bank word is not whole and complete with regard to purpose, green and inclusive financing and governance, the bank is considered out of integrity.

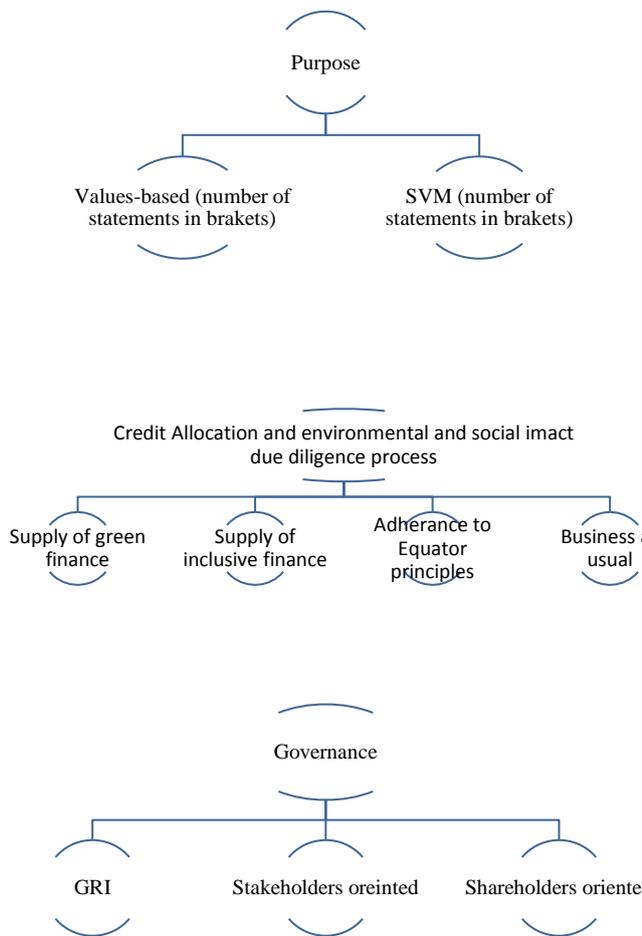


FIGURE 1: NVIVO NODE STRUCTURES

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A Framework to Improve MFCA-based Sustainability Accounting Cost Analysis

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Extended abstract: This research aims to improve the analysis of the current MFCA-based cost. In general, a negative products generally occur along the production stages, not only in the forms of defectives but also in the form of wastes. Without effective screening procedure such as 100% inspection, defectives from previous manufacturing stage can be escaped and sent to the next stage resulting in more loss and higher negative cost. When the defectives cannot be identified, unfolded and withdrawn, the traditional calculation of MFCA cost when applied cannot identify the inefficiency of the material and resources invested into each production stage. This research proposes a new framework of calculating MFCA cost based on virtual costs which can enhance the identification of loss and waste from the process better than the traditional MFCA approach presented in ISO14051. The virtual cost can capture the inefficiency of the process in terms of the inherited defectives which cannot be unfolded by ineffective screening and inspection. This proposed methodology takes into account these hidden waste and then quantifies these process inefficiency revealing the higher amount of resource wasted from the production system. Thus this research can help improving the existing MFCA-based Sustainability accounting cost analysis. This will lead to higher benefits of the sustainability reports and hence provide new platform for environmental accounting in general.

INTRODUCTION

Sustainability accounting has received widely attention in the past decades as one of a key management tools in driving sustainable economy and society. Various contexts and applications of the sustainability accounting in both corporate level and supply chain level can lead to identification of management improvement throughout the corporate and supply chain boundary. Sustainability corporate policy needs to be deployed throughout organization in order to attain the strategic implementation and planning at corporate level [1], [2]. Successful integration of social and environment strongly rely on sustainability management strategy [3], [4]. Best new practices in environmental system management and strategy to select and adapt suitable management tools are very important in deriving the counter measure for sustainable management strategy [5], [6].

Different sustainability indicators are also available for the supply chain corporate to assess and report how their organisational activities has impact on the environment and society. Traditional or online information systems can be used to report the current sustainability indicators. Sustainability reporting has been increasingly reported especially in the private sector. Even though there are many indicator available, some composite functions can be deliberately and widely adopted for assessing the performance of the management [7]. The assessment of the reported indicator provides opportunity for the corporate to initiate strategy and measures aligned with

sustainability outcomes such as green productivity [8], [9].

One common framework for an organization to mitigate the environmental impact is to analyse and identify the drivers of “green” product innovation and select the suitable green strategy [10]. One of the commonly and widely accepted driver for green productivity is to minimize the waste emission. Negative cost of Material Flow Cost Accounting (MFCA) framework has been considered one of the relevant indicator of the material and process inefficiency.

The MFCA is an environmental management accounting tool developed and practiced widely by industries [11], [12]. The MFCA technique can be used to identify the wastes and losses along with improvement measures that can enhance an efficiency of material and resource consumption [13], [14]. To increase efficiency, the waste identification along the manufacturing stream or supply chain need to be identified and analysed. The current and traditional approach of MFCA accounting may not be effectively used to effectively identify the “inherent” waste within the manufacturing stream or supply chain. For example consider a serial manufacturing process in which the incoming, in-process and outgoing inspection are based on zero acceptance number sampling plan. Negative products generally occur along the serial production stages, not only in the forms of defectives but also in the form of wastes. Without 100% inspection, defectives from previous manufacturing stage can be escaped and sent to the next stage resulting in more loss and higher negative cost. In the case of serial process where defectives cannot be identified and withdrawn, the traditional calculation of MFCA cost may not be applied to identify the ineffectiveness of the process. Hence, the negative cost of material, system, energy and waste treatment cannot be allocated along the manufacturing streams or stages since the actual inherent defectives are unfolded. Hence, this research aim to propose a new solution and framework on how to improve the MFCA-based sustainability accounting cost for such serial manufacturing process gated with sampling inspection scheme.

METHODOLOGY

For generality, we assume that the manufacturing process consists of S+1 stages and labelled as 0, 1, 2... S, S+1. The first stage (stage 0) is an incoming quality assurance (IQA) whereas the last stage (stage S+1) is an outgoing quality assurance (OQA). We assume the production lot size could be divided into subplot of smaller size than the incoming lot. All inspections are process after each manufacturing steps as shown in FIGURE1.

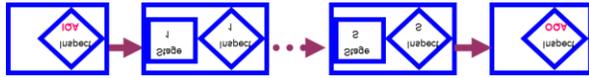


Figure 1: SERIAL PRODUCTIONPROCESS of S+1 STAGES.

Without loss of generality, we restricted our results to the case of zero acceptance number sampling plan. In the zero acceptance number sampling plan, the production lot will be sampled and inspected for defective. If the sample declares at least one defective, the whole production lot will be inspected with 100% (under rectification plan) and defective is removed before processing to the next stage. In this case the positive and negative cost of material, system, energy and waste treatment can be determined from the actual number of defective removed from the production lot. Unfortunately, when the production is not perfect, defective can be generated. If the sample does not contain and hence cannot declare those defective, the traditional or current approach of MFCA in calculating the positive and negative of material cost (MC), system cost (SC), energy cost (EC) and waste treatment cost (WC) cannot be correctly applied. This research proposed a framework to derive the notion of virtual positive and virtual negative MC derived from the actual value of waste or number of defectives of material generated within the production lot size. The virtual positive and virtual negative of SC and EC are derived based on the MFCA cost allocation with respect to the proportion of waste/defective generated within the production lot size as well.

Note that the actual (traditional) positive and negative cost of MC, SC, EC and WC are generated from the actual proportion of defective removal. Thus, without waste/defective removed from the process, virtual positive/negative MC/SC/EC/WC can reflect the inefficiency of resource used whereas the actual (traditional MFCA) positive/negative MC/SC/EC/WC cannot. When the waste/defective are removed from the process, these virtual positive/negative cost convert to the actual positive/negative cost (This property hold under rectification plan). Thus the proposed virtual positive/negative MC/SC/EC/WC can unfold the inefficiency of resource used similar to the concept of MFCA whereas the actual (traditional) positive/negative MC/SC/EC/WC cannot.

Actual positive/negative MC/SC/EC/WC	Virtual positive/negative MC/SC/EC/WC
<ul style="list-style-type: none"> Actual Positive/Negative MC are based on the actual removal of material Actual Positive/Negative SC/EC are based on the traditional MFCA cost allocation w.r.t. % actual removal of material 	<ul style="list-style-type: none"> Virtual Positive/Negative MC are based on the actual waste/defective of material Virtual Positive/Negative SC/EC are based on the MFCA cost allocation w.r.t. % inherent waste/defective of material

FIGURE 2: FRAMEWORK OF CALCULATING THE MFCA VIRTUAL AND ACTUAL COSTS OF MC, SC, EC, WC.

NUMERICAL RESULTS

For example, consider the production process consisting of the IQA stage, 9 manufacturing stages and the OQA stage. The starting production lot size is 120 units with 12 defectives inherited within the incoming lot. At both IQA and OQA, the same sampling plan are used in which 32 units are sampled and inspected with zero acceptance number of defective. At IQA, the sampling declared some defective. So the whole incoming lot of size 120 were rectified and those 12 inherited defective were then removed. The remaining 108 units are transferred and processed through those 9 manufacturing steps.

The production process is imperfect and equally and likely to generate defective with fraction of 1%. First suppose that there are no inspection taken after between stages 1 to 9. During each manufacturing stage, defectives were generated and accumulated up to total of 15 defectives at the 9th stage. At the OQA, the sampling declared some defective. So the whole production lots were again rectified with 15 defectives removed. The final production lot size was reduced to 93 units. The number of production units in and out of each stage were depicted in Figure 3.

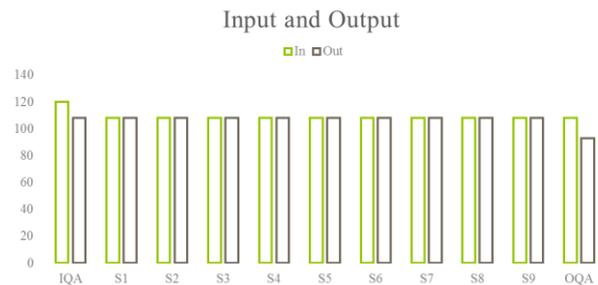


FIGURE 3: NUMBER OF INOUT AND OUTPUT UNITS FROM EACH STAGE.

At each manufacturing stage there are newly input of MC of \$10/unit inserted into the production lot of size 108. The SC and EC is also added with the same \$10/unit. If the traditional MFCA approach is applied, the positive and negative cost of MC, SC+EC are displayed in TABLE 1. The total negative MC is equal to \$500 and \$445.32 respectively.

TABLE 1: ACTUAL POSITIVE/NEGATIVE COST

	Actual Positive MC	Actual Negative MC	Actual Positive SC+EC	Actual Negative SC+EC
S1	1,040	40	1,166.00	22.00
S2	2,100	-	2,258.00	-
S3	3,160	-	3,350.00	-
S4	4,120	100	4,430.80	85.21
S5	5,160	-	5,502.80	-
S6	6,200	-	6,574.80	-
S7	7,240	-	7,646.80	-
S8	7,920	360	8,452.70	338.11

S9	8,920	-	9,484.70	-
OQA	8,920	-	9,516.70	-
	Total	500.00	Total	445.32

Virtual positive and negative costs are shown in TABLE 2 where the total virtual negative MC is equal to the total actual negative MC but the total virtual negative SC+EC is higher indicating that more energy and system are actually wasted than what we captured from the removed waste or defective material. So the proposed concepts of this new framework can reveal inefficiency of the production process and hence shall be replaced and added to the new ISO14051 framework.

TABLE 2: VIRTUAL POSITIVE/NEGATIVE COST

	Virtual Positive MC	Virtual Negative MC	Virtual Positive SC+EC	Virtual Negative SC+EC
S1	1,040	40	1,166.0	22.00
S2	2,070	30	2,236.7	21.30
S3	3,080	50	3,265.9	62.81
S4	4,120	20	4,348.3	83.62
S5	5,160	-	5,420.3	-
S6	6,130	70	6,429.8	62.43
S7	7,160	10	7,429.7	72.13
S8	7,920	280	8,244.0	329.76
S9	8,920	-	9,276.0	-
OQA	8,920	-	9,308.0	-
	Total	500.00	Total	654.05

Comparison between the actual and virtual cost structures are shown in FIGURE 4, 5. The results show that the total virtual negative MC is always converges to the total actual negative MC. The virtual negative SC+EC is higher comparing to the actual negative costs.

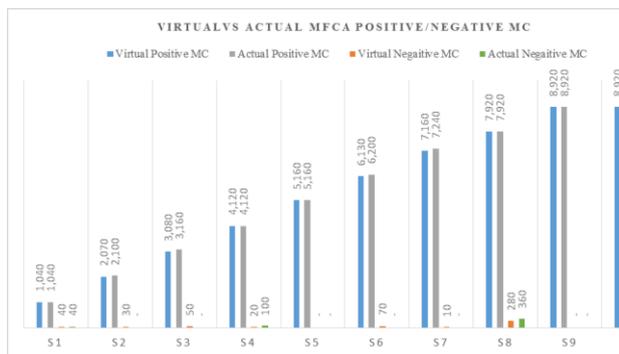


FIGURE 4: VIRTUAL VS ACTUAL POSITIVE AND NEGATIVE MC.

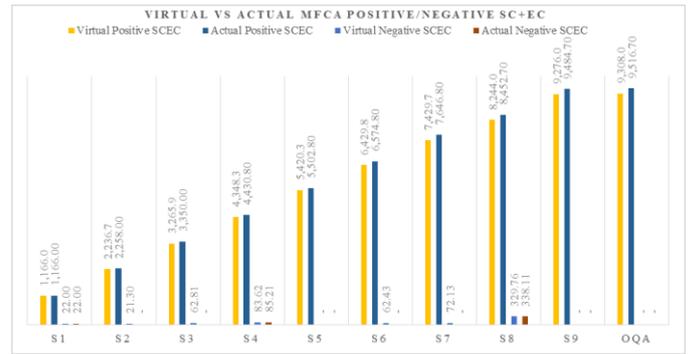


FIGURE 5: VIRTUAL VS ACTUAL POSITIVE AND NEGATIVE SC+EC.

CONCLUSION

This proposed framework of calculating MFCA cost based on virtual costs can enhance the identification of loss and waste from the process better than the traditional MFCA approach presented in ISO14051. The virtual cost can capture the inefficiency of the process in terms of the inherited defectives which cannot be unfolded by ineffective screening and inspection. These accumulated defective and waste cannot be quantified according to the traditional MFCA approach. In contrary, the proposed methodology takes into account these hidden waste and then quantifies these process inefficiency revealing the higher amount of resource wasted from the production system. The proposed methodology shall be publicized and augmented into the MFCA technique so that the accounting reports can be more effective in determining the driver of the improvement. Thus this research can help improving the existing MFCA-based Sustainability accounting cost analysis. This will lead to higher benefits of the sustainability reports and hence provide new platform for environmental accounting in general.

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Sustainability Indicators for Net Zero Water at Deployed Military Camps

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Abstract: This extended abstract presents sustainability indicators associated with water management for 'Net Zero Water' (NZW) at deployed military camps in international locations. The research conducted for this extended abstract has included review and analysis of literature and non-classified documents on water management practices at deployed military camps among the NATO members and partners military organizations.

The opportunities and challenges for implementation of NZW present themselves with possibilities for new sustainability indicators that military organizations can utilize in their sustainability external and internal reporting. Those innovative sustainability indicators do not present information that has built in number of soldiers, units, or activities. Instead the sustainability indicators for water management are based on NZW's three elements of water conservation and efficiency, water reuse, and water security. On the basis of literature review and analysis, the capacity of the NZW model is assessed for facilitating creation of a more sustainable context of deployed military camps. Thereby, the effectiveness of the NZW model is addressed.

Keywords: Water Management, Net Zero Water, Sustainability Indicators, Military Deployed Camps

INTRODUCTION

The world's leading defense organizations started establishing their sustainability strategies and preparing annual sustainability reports or sustainability plans in the mid 2000s. Their sustainability planning and reporting formats and requirements have been varied and driven by different national requirements or individually selected standards. Among the first sustainability reports were the United Kingdom Ministry of Defense (MoD) Sustainable Development Report issued in 2005 [1] and the United States (U.S.) Army Sustainability Report issued in 2007 [2]. These developments have built upon earlier approaches such as energy savings and environmental management programs [3]. The capacity to inform managers according to their information needs and decision-making context, as well as performance dimensions, has been very much relevant for the success of the programs.

Though, the U.S. Army started the sustainability reporting in 2007, it was not the case for the entire U.S. Department of Defense (DoD), which published their first Strategic Sustainability Performance Plan in 2010. The U.S. Army-chosen reporting standard has been the Global Reporting Initiative (GRI) format, while the U.S. DoD has been adhering to the U.S. federal requirements for sustainability planning. The GRI was started in 1997 as a multi-stakeholder process that uses ecological footprint analysis. The use of the sustainability indicators by both organizations has differed from the very beginning,

though the U.S. Army still has to provide all required information to the DoD for the cumulative data aggregation and presentation by all DoD services and agencies. The sustainability reporting for defense organizations has evolved around changing frameworks in response to not only national requirements but also to considerations for better ways of measuring and reporting commitments and goals while aligning with new defense strategies. The defense organizations' sustainability reporting has been focused primarily on organizations' domestic infrastructure of military complexes and installations, with a little or no attention to the operations of international installations or international deployed camps. Similar conclusions have been made with respect to military camps in the context of military missions in foreign countries. In 2012 the French MoD presented a new strategy for sustainable development with nine (9) key goals of which one addressed the international operations in the 2011 Sustainable Development Strategy and Report [4]. The report was unique in addressing implementation of environmental considerations for military operations outside the national territories, including a diagnosis of the environment at the entrance to the theatre of operations and the ambitions for the environmental management of water and waste. However, the report did not provide details in the area of water and waste management. In 2014 the U.S. Army prepared the latest available Sustainability Report, which devoted a separate section to sustainability in operations to address the Army missions worldwide supported by more than 168,000 soldiers [5]. The reported water sustainability indicators have been only partially addressed due to numerous aspects, which include classification of information pertaining to number of soldiers at different locations and types of military conducted activities. The report states that the reason for not reporting has been that public information is unavailable, regarding non-potable water use or types of water sources. The status of the GRI indicator for total water withdrawal by source has been only partially addressed, with no reporting on water sources significantly affected by withdrawal of water or percentage and total volume of water recycled and reused. This underlines the sensitivity of military information used in reporting of sustainability indicators.

As much as the military organizations protect their sensitive information domestically, it may become an even more pressing matter for international operations. The water use and requirements at different deployed military camps depend on numerous factors, including types of military camps, their size and population, and types of military missions and operations. The water-use

types at deployed military camps can be divided into a few categories. Based on the land-use function, the following categories have been identified in the U.S. DoD publication [6] in 2003:

- Administration – support of general base operations, community services, and housing
- Quality of Life – health services, retail, food services, clubs, and housing
- Operations – core military operations
- Industrial – maintenance, logistics, and supplies; and
- Training

The water requirements based on the basic military needs are:

- Drinking
- Food preparation
- Personal hygiene
- Central hygiene
- Heat treatment, and
- Force protection

The additional water requirements based on case-by-case scenarios may include:

- Hospitals
- Engineering construction
- Vehicle maintenance and wash
- Firefighting
- Mortuary affairs
- Tactical ice plant
- Aircraft wash
- Nuclear, biological and chemical decontamination, and
- Refugee and detention camps

The U.S. DoD publication has also provided an example of water consumption at a military camp for semi-permanent conditions for 2,500 soldiers that would require 600 cubic meters of water per day to support basic camp requirements in addition to thousands of bottles of drinking water. Low-efficiency water use by a laundry system would consume approximately 128 cubic meters of water per day. Two key water-consuming activities would be laundry and ablution, with both requiring up to 20 percent of the total water rate each. This example shows how much water demand at a deployed military camp puts a stress on local natural water resources. If this scenario is superimposed on a geographical location where water is scarce or where the local host nation stability is fragile, the potential impacts of military camps on local population and communities could become significant.

The documented examples of water-related impacts from military camps on local population and communities have ranged from severe biological pollution from untreated wastewater from a camp, as experienced during a recent UN deployment in Haiti that caused an outbreak of cholera [7], to drying up of local water karez systems in Afghanistan caused by excessive pumping of water at international military camps [8].

The competing water objectives [9] for military deployed operations have identified the following security issues:

- War fighter needs
- Transportation and storage
- Local source utilization
- Host nation relationship
- Equipment, and
- Infrastructure planning and design

Developments in establishing relationships with host nations by international military camps can be shaped by positively or negatively impacting local natural water resources. The actions include minimizing depletion of water resource and not adversely affecting availability of water for host nation communities, reducing negative environmental effects of wastewater disposal, and maximizing goodwill through water resource development. These competing water objectives present both opportunities and challenges for military organizations, which could be addressed by implementing sustainable water management practices. The unique military camp design and operations would offer different solutions to water management systems and associated sustainability indicators.

Types of water sources at military camps depend on a camp's location and selected logistical and delivery options or combinations of these, to include:

- Bottled water delivered over long distance
- Water trucks delivered over long distance
- On-site water generation from groundwater or surface water and treatment; and
- Purchased water from local water producers and suppliers from local communities through water trucks delivery or water piping

The NATO member countries and partners have started discussions and exchanges of the best management practices as well as technologies related to improving water management for implementation of sustainability objectives at deployed camps, with an aim to develop NATO standardization [10]. The subject military organizations are 28 NATO members, including 26 members of the European Union, and 41 NATO partner nations. The NATO standardization agreements include documents that cover the water quality standards by medical authorities, as well as the water management standards by the military engineers and environmental specialist. As much as possible, the NATO Environmental Protection Working Group tries to keep all standardization documents accessible to all military organizations and ensures that environmental protection information is not classified and is always available. This allows the environmental protection information to serve its intended purpose.

Recent NATO workshops have devoted a lot of effort to military research on Net Zero or Zero Footprint

military camps. The aim is to reduce the footprint not only at camp locations but also along the logistical tails for reduction of the basic needs for water and energy supplies, as well as delivery of the camps' basic materials [11].

While the diversity among military organizations in addressing sustainability indicators is significant, it presents an opportunity to establish common indicators that are useful despite the limitations of military sensitive and classified information. The indicators can be expressed in positive or negative statements regarding water matters or in percentages of water usage. By avoiding integration of number of soldiers into indicators and thus providing dimensionless values, the main military concerns regarding sensitive and classified information are addressed.

NET ZERO WATER MODEL

The 2014 U.S. Army report discussed the Army Net Zero Initiative that had been started in 2010 and focused on energy, water, and waste. The initiative has encompassed only a few selected permanent installations in the United States and has not addressed the contingency basing in numerous overseas countries. The U.S. Army NZW has been defined as: "A net zero water installation limits the consumption of freshwater resources and returns water back to the same watershed so as not to deplete the groundwater and surface water resources of the region in quantity and quality over the course of a year [12]." The NZW is applicable to both permanent installations and deployed camps for sustainable water management, and especially military camps with significant footprints on scarce natural water resources in fragile states. The driving force for the NZW has been the potential threat to availability of water sources and continuity of military missions at deployed camps. Water security has become a new requirement for assurance of military missions. Water security is defined as "the assurance that water, potable and non-potable, of suitable quality will be provided at rates sufficient to fully support the military organizations wherever they have, or are anticipating having, a mission in the future.[13]"

Employing the NZW hierarchy allows military organizations increased water security by assuring sufficient water rates of suitable quality, which is derived from a reduced total volume of water used and with higher water quality. The NZW is a strategy and thus offers an opportunity to be viewed as a model for military deployed camps to adequately manage natural water resources while maintaining and building upon existing environmental and sustainability programs. The NZW model meets the model concept requirements and is synonymous with a framework.

The U.S. Army supports creation of a culture that recognizes the value of sustainability with measures that are in financial benefits, maintenance of military mission capability, soldier quality of life, relationships with local communities, and the preservation of options for the Army's future. The NZW requires the military personnel

to possess awareness around the subjects of water security and NZW hierarchy to drive the organizational cultural change. This awareness is not solely devoted to sustainable water management but also focuses on two other Net Zero initiatives of energy and waste. Only then can the Net Zero military camp be materialized/achieved.

The NZW model embraces the key sustainability criteria of [14]:

- Governance, planning, and management
- Finance
- Environment
- Society, and
- Technological innovation

This set of criteria addresses two key factors: "What use will be made of this set of criteria? To what extent can any set of criteria encompass the range of issues to be considered under the heading of 'sustainability'?[14]" The NZW model with its strategy focuses predominantly on financial, environmental, and technological innovation benefits to drive the reduction of overall water usage. This is accomplished by recognizing different types of water uses. The governance criterion is integral to the NZW strategy and its formalized roadmap. Finally, the society criteria address both internal soldier quality of life and relationships with local communities.

The current water threats are droughts and water scarcity, amplified by the complexities of climate change. The military sector has recognized new terms and definitions for sustainable water management that include blackwater, direct potable water, graywater, indirect potable reuse, rainwater harvesting, reclaimed water, wastewater and water reuse. **Table 1** summarizes the commonly used water reuse terminology definitions by military organizations [15]. For each type of water reuse and recycling, a new water sustainable indicator is later developed. These indicators present information in accordance with the needs of those who want to inform about water usage in terms of both quantities and qualities. The appropriate measurements and reporting structures can be then developed. The NZW model contributes to this implementation of sustainability indicators.

The NZW hierarchy includes water reduction, increased efficiency, recycle, reuse, and recharge as depicted in **Figure 1**. Increased water security is also depicted on the same figure as water security is linked with the NZW hierarchy; they both support each other. Similarly, awareness and cultural change of military organizations are linked with the NZW hierarchy. The organizational cultural change is essential to the success of the NZW hierarchy that depends on the change of behavior of water users.

TABLE 1: DEFINITIONS OF WATER REUSE TERMINOLOGY

Term	Definition
Blackwater	Water captured from toilets and urinals along with kitchen waste.
Direct	Introduction of highly treated water either directly into

potable reuse	the potable water supply system downstream of a water treatment plant or into the raw water supply immediately upstream of a water treatment plant.
Graywater*	Water captured from sinks, baths, showers, and laundries that can be treated and reused. It does not include water from kitchen sinks or dishwashers.
Indirect potable reuse	Incorporation of reclaimed water into a raw water supply, such as in potable water storage reservoirs or groundwater aquifer, resulting in mixing and assimilation, thus providing an environmental buffer.
Rainwater harvesting	Runoff captured from rooftops or other hard surfaces that can then be used for beneficial use after minimal treatment.
Recycled/ Reclaimed water	Wastewater that has gone through various treatment processes to meet specific water quality criteria with the intent of being used in a beneficial manner such as irrigation. The terms recycled and reclaimed are synonymous.
Wastewater	Discharged used water.
Water reuse	Treated wastewater used for beneficial uses such as irrigation or cooling.
* Some organizations do accept a definition of “graywater” that does include kitchen and dishwasher wastewater along with wastewater from soiled diaper washing. This graywater has higher levels of risk.	

Different types of water uses are associated with different types of quality of water. The hierarchy starts with water reduction and progresses through repurposing. Three key elements of NZW are water conservation and efficiency, water reuse, and water security, with an overall goal of reduced water use. Water-use efficiency is accomplished through better equipment and technologies and improved integrity in water distribution systems. Water is re-purposed by using graywater and capturing precipitation and storm water run off for on-site use. Wastewater can be treated and reclaimed for other uses or recharged into groundwater aquifers.



FIGURE 1: Net Zero Water Hierarchy [12]

Detailed steps for each level of NZW hierarchy address the following:

- Water conservation with leak detection and repair, enhanced by influencing positive behavior
- Maximized efficiencies of new construction, life-cycle replacements, and operation and maintenance (O&M) practices
- Water reuse strategies for grey water and purple pipe

- Water security and reliability strategies include alternate water supplies; and
- Water recharge strategies

Military camps need to apply some efforts towards achieving the NZW goals, such as:

- Reduce overall water use, regardless of the source
- Increase efficiency of water equipment
- Recycle and reuse water, shifting from potable water use to non-potable sources as much as possible
- Minimize inter-basin transfers of any type of water, potable or non-potable, such that a NZW installation puts as much water back into the aquifer as it withdraws

Different activities and operations at military camps require different minimum quality (category) of water used. This allows for design of reclaim, reuse, and recycle alternatives. Water requires generation, purification, storage, distribution, and finally, conservation. **Figure 2** depicts a schematic of water recycle and reuse concept.

To date, the best practices documented so far have identified for NZW the following actions:

- Implement leak detection and repair on the potable water distribution system
- Maximize water recycling and match water quality to intended use
- Install purple pipe and separate reclaimed water via installation of purple pipe system
- Maximize use of alternative water sources

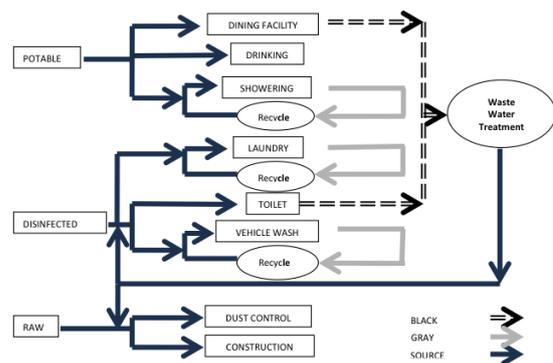


FIGURE 2: Example of Military Camp Recycle/Reuse Concept [10]

Water efficiency is derived from the technological aspects of equipment used at military camps. Higher quality and efficiency of appurtenances allow for conservation at the point of use while still allowing for durability and longevity of equipment. Efficiency and conservation of water measures have emphasized the need for following technical aspects of water handling equipment:

- High efficiency faucets and shower heads
- High efficiency toilets
- High efficiency urinals, and

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- High efficiency kitchen equipment

Water recycling/reclamation measures require treatment processes to meet desired quality criteria. Water for cooling will not require standards as high as water used for incorporation into potable water. Technological solutions at different military camps depend of the type of camp and investments both materiel and personnel. The measures are:

- Reclaim waste water to reduce potable water
- Reclaim waste water for cooling
- Reclaim waste water for irrigation

Use of rainwater is not always an option, especially in dry geographical locations. However, it should be considered in all cases since rainwater, instead of causing a significant flooding problem in the least expected locations, can be harnessed and utilized for camp water purposes. Typical water reuse examples include:

- Harvest rainwater for toilets/urinals
- Harvest rain water for irrigation
- Harvest rain water for cooling and make-up water

Potential water recharges to local aquifers and surface water bodies are in a form of:

- Storm water infiltration
- Rapid infiltration basin for treated waste water
- Injection of treated waste water into the ground
- Return of treated waste water to surface water resources

The possibilities exist to positively impact the inputs to the water hierarchy. This is up to the military organizations to embed the concepts in the military camp planning, design and operations, and maintenance phases of camp life cycle approach. Even with changes to military missions and modifications to camp operations, the organizations can still adopt the NZW model with its hierarchy and embed its elements into the military camp sustainable water management systems.

SUSTAINABILITY INDICATORS

The NZW model provides opportunities not only by implementing the hierarchy for water but also by capturing data that could support sustainability indicators for deployed camps.

Table 2 lists the possibilities for different types of water to be used for different types of activities and operations carried out at military camps. Each type of use can be associated with opportunities for different qualities of water. It is for the military camp planners, designers, operators, and commanders to decide what the best management practices and solutions are.

TABLE 2: DIFFERENT TYPES OF WATER FOR DIFFERENT APPLICATIONS

Use of Water	Potable	Recycled	Reused	Harvested Rainwater
Drinking	X			
Food preparation	X			
Hygiene	X			

Sanitation		X	X	X
Medical	X			
Vehicle wash		X	X	X
Equipment maintenance		X	X	X
Cooling	X	X		X
Other: Irrigation			X	X

Understanding that certain formats of information related to military activities could not be presented and later published, the sustainability indicators need to be defined and built solely around openly-provided information, types of water reuse and recharge concepts with overall percentages of water used at military camps, and technologies implemented to achieve the results. This will allow presentation of information that avoids discussion of number of soldiers, units, or activities.

Five categories of sustainability criteria are water governance, financial, environmental, social and technological innovation measures that are linked with the NZW model. Each category with respective indicators is presented below.

Water Governance

Military camps' water management systems are embedded in regional and national policy approached to water governance [16]. These systems should be governed by well-developed and implemented water management programs that have in place policy, compliance requirements, and planning, design, and management plans. Such plans should be able to address military camps' life cycle requirements from the onset of support to military missions, plans and designs, construction, operations and maintenance, and final transfer and closure. The water governance indicator should include presence of:

- Water system management plan for each military camp, including information gathering for pre-construction planning and design; and
- Established compliance requirements in accordance with regional and other relevant local and national approaches

Financial Indicators

Financial indicators that capture financial, environmental, and social criteria should apply to expenditures for military camp water management systems and address management of risk to the environment, safety, and occupational health. Fair water pricing may be stimulated with attention to the internalization of external costs (for example environmental costs of pollution and water shortages). This indicator should be consistent with the way the other financial indicators are used by the military organizations such as:

- Reduced costs and calculated savings by not transporting water long distances; and
- Absence of claims for payments of damages arising from pollution of local water resources

Environmental Indicators

The environmental sustainability indicators based on the NZW hierarchy should include non-financial indicators such as:

- Percentage of total water recycled/reclaimed
- Percentage of total water reused
- Percentage of total water harvested as rainwater
- Percentage of total water returned to groundwater aquifer or surface water
- Percentage of total water discharged as wastewater treatment effluent not suitable for recharge; and
- Energy savings from using solar power for water and wastewater treatments

Social Indicators

The social sustainability indicators can take different forms such as preventing contamination and spread of pollution to natural water resources. The social indicators should include:

- Presence of water pollution prevention measures in place
- Presence of analytical data for maintenance of water resource quality criteria
- Transfer of excess water or rainwater or recycled/reused/graywater for local irrigation and farming
- Soldier education regarding water conservation and protection; and
- Plans for continuation of water programs and equipment transfer to local communities after military has departed

Technological Innovation Indicators

Military organizations are known for striving for technological innovation. Their annual budgets support applied research in support of improved military organizations' performance at home and in field operations including international deployments. The current improvements in the military camp design and construction are continuously re-evaluated based on the latest experiences. The improvements have been incremental. However, they have not been keeping up with the changing requirements for sustainable water management in water-stressed regions. Progress in innovation is critical for the future success of water management systems installed in difficult and, at best, challenging locations around the world. In the area of sustainable water management, the technological innovation indicators to include increased efficiencies of water management systems and energy and materials used are:

- Positive statements regarding use of high-efficiency water equipment
- Percentage of water reduction from the total water usage derived from high-efficiency equipment as compared to average equipment
- Percentage reduction of energy consumption for water management derived from high-efficiency equipment as compared to average

equipment

- Percentage of water obtained using enhanced technological equipment such as water from the air via condensation; and
- Percentage of water obtained using technology to access previously inaccessible water sources, such as drilling into deep aquifers that would be otherwise impossible

At the end, one needs to keep in mind that “The common thread running through these various approaches [has been] thus the production of a classification of criteria [with sustainability indicators], which would be forward-looking in order to be useful in decision-making, and would be relevant to the decision-making process in question.[14]” The water sustainability indicators would be relevant to the military decision-making regarding planning, design, construction and operation and maintenance of deployed military camps while assuring the military mission.

CONCLUDING REMARKS

The NZW model with its water hierarchy is applicable to deployed military camps. The analysis of NZW model elements confirms its relevance to important issues of sustainable development at both permanent installations and deployed military camps. The initial list of water sustainability indicators derived from the literature review and analysis based on the NZW model is provided. These indicators will require further refinement.

A pilot survey is to be developed and conducted among the NATO member military organizations with an aim of establishing sustainability indicators that are useful and not hindered by the sensitivity of military information. Additionally, broader research on the NZW model for military deployed camps in support of international military missions is underway.

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Water management accounting: the next step in EMA

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Summary: The importance of water management to business is receiving growing attention. Water management accounting (WMA) as a specialist area within environmental management accounting has very recently emerged as a potential way to move water accounting forward in the face of issues identified. The case for using WMA to improve water management is illustrated using the global wine industry. Specific practical ways in which WMA can help managers of wine businesses are identified. Finally, the benefits of conducting further water WMA research are outlined.

INTRODUCTION

The previous two decades have brought increased interest in environmental matters to the fore. Although the recent focus at both the macro and micro levels has primarily centred on climate change and the generation of greenhouse gas emissions, the risk associated with insufficient quantities and qualities of freshwater to support society's needs is beginning to gain attention. Of particular interest is the way in which the corporate sector impacts on, and is impacted by, the quantity and quality of freshwater currently available. The interconnected nature of business and water generates the need for a comprehensive management strategy at the corporate level. It is the purpose of this paper to consider how a water specific focus to environmental management accounting can assist in this space. The potential for water management accounting, or WMA, will then be demonstrated using the global wine industry as a case in point.

THE GROWING WATER CRISIS AND BUSINESS

Water is a non-substitutable commodity required to support all life and activity undertaken on Earth. In addition, water resources are characterised by the interconnected nature of different users with the actions of one user able to affect, positively or negatively, the capacity of other users to meet their own needs. Although generally considered renewable, the amount of water that is available at any one time is finite and with demand growing it is predicted that by 2030 global demand for freshwater will exceed supply by 40% [1]. Demand in the industrial sector is also expected to increase markedly [2]. Given its importance it then follows that the management of freshwater is something that must be addressed at all levels of society.

Despite being one of the largest users of freshwater in modern society, previous research reveals the corporate sector is often inefficient and ineffective in its use of water resources, a fact that also extends to pollution of water sources [1]. It is possible the failure to consider water as a strategic concern has been driven by the historic low cost of water as a business input. However, with water markets and other macro level initiatives the

cost of freshwater is increasing. In addition, given its importance to business activity, Sarni [3] submits business leaders need to look beyond measuring the mere cost per litre associated with acquiring water and instead consider its true value to the business. "Questions to ask include: What would happen if we don't have water? What if we fail to comply with water-related regulations? What if stakeholders view our use of water as irresponsible, even if we comply with necessary regulations? What if the supply chain is crippled by a lack of access to water? How might water scarcity affect our global growth strategy, either directly or by limiting our access to energy?" [3: 95-6].

The need to improve corporate level water management gave rise in the last decade to corporate level water accounting. As a result, numerous tools and techniques have been proposed. However, evidence suggests most have been developed in isolation from the others without considering the needs of business or what was already available. The monetary implications of water-related decisions are often ignored and there is no generally accepted framework to guide business through the selection of tools to ensure they are fit for purpose. The shortcomings associated with existing approaches to corporate water accounting led Christ [4] and later Burritt and Christ [5], and Christ and Burritt [6], to propose that an extension to conventional environmental management accounting (EMA) might be the 'missing link' required to move corporate water accounting forward. Hence WMA was born. The next section will consider the topics of EMA in general, and WMA specifically, in more detail. This section will be followed by discussion concerning the global wine industry as a working example of how WMA might be employed to assist business in the future. The benefits of WMA and directions of future research are then considered in the conclusion.

ENVIRONMENTAL (AND WATER) MANAGEMENT ACCOUNTING

EMA was initially proposed in the 1990s as a way for business to capitalize on the potential for eco-efficiency in which economic and environmental performance could be enhanced simultaneously. EMA focuses on two types of information: physical information concerning environmental impacts and stocks expressed in units such as kilograms, and monetary information concerning environment-related matters that impact on the economic position of the company. Burritt et al. [7] suggest EMA information and tools can be further categorized according to whether the information concerned is past or future oriented, has a short or long-term focus, and whether it is generated on a routine or ad hoc basis. In summary the focus of EMA is on the generation of quantifiable data from which corporate decision making

can be improved. EMA data is also recognised as providing the foundation for different but relevant decisions made by different types of managers in businesses, e.g. environmental managers, accounting and finance managers, top managers.

The potential for EMA has been demonstrated via numerous studies (for example, see [8]-[12]). However, to date this research has tended to focus on generic environmental management as opposed to specific areas of environmental concern. Nonetheless recent times have seen explicit focus given to carbon-related matters via a new sub-discipline which has come to be known as carbon management accounting or CMA [13]-[15]. In contrast, despite its importance as a critical business resource a separate focus in the EMA literature on water has until recently been conspicuous by its absence and it was only in 2014 that the potential for water management accounting (WMA) as a sub-discipline and framework for corporate water management was explicitly acknowledged [4].

While accepting existing effort in the corporate water accounting arena, prevailing methods have been associated with a number of issues. These include a primarily external focus based on reporting and disclosure, an orientation towards past events, a lack of emphasis on future management and limited consideration of monetary information and impacts [4]-[6]; [16]. In addition, current methods have generally been developed in competition with each other which can create confusion for managers leaving companies reportedly eager to see increased harmonisation in water accounting methodologies and tools [17]. With its focus on internal decision making and ability to identify different “management decision settings within which tools for management decision making fit”, Christ and Burritt [6: 26] argue the value added from WMA is indisputable. In addition to standard EMA tools, such as material flow cost accounting, which can be applied to specifically to water, WMA provides a comprehensive framework by which existing water accounting tools can be categorised thus providing the harmonisation sought in Daniel and Sojamo [17] and also by The CEO Water Mandate [18]. Furthermore, WMA highlights the monetary aspect that often dictates corporate decision making yet has frequently been ignored in generic corporate water accounting techniques that focus instead on the physical aspects of water management and measurement. The flexibility of WMA also accommodates the needs of small business organisations which have generally been overlooked in more well-known techniques but are nonetheless important economic and environmental players.

The next section will consider the potential use of WMA in practice by reflecting on a setting in which the practice is expected to be especially useful; the global wine industry.

THE GLOBAL WINE INDUSTRY AND WATER MANAGEMENT: BUILDING THE CASE FOR WMA

The practice of viticulture and production of wine are water intensive activities. Not only are both endeavours reliant on vast quantities of high quality freshwater, they also have potential to impact surface and ground water sources negatively via the generation and disposal of wastewater, runoff and other sources of chemical contamination (e.g. leaching of pesticide and fertilisers in the vineyard) [19]. Given the industry’s dependence on water resources it would be reasonable to assume most wine organisations are well versed in the intricacies of water management with advanced systems for gathering quantitative data to support decision making; indeed such practice is generally recommended. However, evidence available from academic and practitioner based sources suggests the reality is markedly different for organisations from many of the world’s wine regions.

Research indicates water management in the global wine industry is often approached in a piecemeal and ad hoc manner with decisions based on rough estimates and best guesses. This is concerning given evidence which suggests a veritable chasm between actual amounts and guess work when it comes to water use and pollution in wine producing organisations. For example, Sheridan et al. [20] found that when asked to report an actual value 80% of South African winery managers would underreport their winery’s water use by an average of 60%. A study by Kumar et al. [21] revealed that 60% of Australian wineries could not provide an accurate measure of the quantity or quality of wastewater generated in their facility. Further, Frost et al. [22] found that the bottling process was responsible for 40% of the wastewater generated in Australian wineries yet only 1% of their study’s respondents believed the bottling line to be a significant contributor to wastewater volume. In a more recent study, Grimstad and Burgess [23] found despite reporting a commitment to water savings activities only 16% of the wineries in their study had a formal plan with measurable targets (also see [24]-[27]).

The lack of formal measurement and monitoring is worrying from both an economic and an environmental perspective and there is much potential for wineries to benefit from eco-efficiency and cleaner production informed by WMA information. For example, Conradie et al. [28] recommend what they call water auditing to identify areas of unnecessary waste and argue many wineries could reduce their wastewater by up to 30% through simple changes for minimal cost. Mosse et al. [25] observed that failure to measure and monitor wastewater effectively had potential to cost a large facility, with between 5 to 10 million litres annual production, as much as AU\$ 2.4-3.4 million dollars per annum. Likewise, Taylor [27] demonstrated that a large Ontario winery was able to achieve a 30% reduction in water use and a 6% increase in wine yield by adopting principles synonymous with cleaner production and

EMA. Finally, Ibrahimov et al. [29] demonstrate the economic and environmental benefit to be obtained from optimising the wine supply chain, however, in order to do this and to calculate the costs and benefits associated with different options appropriate physical and monetary data are required. Thus WMA offers much potential as a source of benefit to wine organisations the world over as will be discussed next.

Two WMA tools illustrate potential short-term operational and long-term investment benefits to the wine industry: material flow cost accounting (MFCA) and environmental investment appraisal (see Burritt et al. [7] for a comprehensive review of tools). MFCA based on the International Organization for Standardisation (ISO) standard 14051, provides physical and monetary information to managers about operational environmental and monetary performance. Water is a key part of the material flows into and through a business – in particular water consumed and wastewater produced. MFCA can identify and track these flows through viticulture where grapes are grown, the wine produced and wastewater generated, to packaging and the final product [19]. Research reveals up to 70% a winery's total intake of water ends up as wastewater [30]. The processes leading to wastewater generation, a non-product output, are the target for eco-efficiency improvements under MFCA. The monetary costs associated with obtaining, storing, recycling such water through closed loop systems, and replacement can be identified and saved when more eco-efficient processes are introduced. Water consumed by business in processes that do not lead to saleable wine has effectively been wasted and WMA, via MFCA, both measures and identifies such waste, and attributes responsibility to different managers. Armed with WMA information managers of wine businesses have the ability to identify these potential losses, reduce the consumption of water, and help improve profitability by cutting wastewater and associated treatment costs, and reducing purchase, extraction and storage costs for freshwater.

WMA does not solely have a focus on short-term gains. Through well informed planning the MFCA information can also act as input data to long-term environmental investment decisions which impact on water management and use and help towards environmental sustainability [31]. Investment decisions about water management also rely on provision of physical and monetary data, whether relating to sourcing decisions such as dam storage, groundwater or river extraction, or recycling, to the type of irrigation system used in viticulture [19]. Also of interest are wastewater treatment plants which are a significant source of capital expenditure for wine producers where inappropriate choices are associated with substantial negative environmental implications. In summary, through MFCA and environmental investment appraisal WMA could assist managers of wine organisations by:

- increasing awareness of the full range of WMA tools available to assist with decision making, thereby

overcoming the current piecemeal approach

- emphasising the importance of long-term closed-loop investment as well as short term operational thinking about water supply and demand in the industry
- providing data to help overcome current misperceptions about actual efficiency of water and wastewater management in the industry
- adding monetary water data to the physical data collected by the various tools to support development of eco-efficiency and effectiveness business cases for improving water management
- identifying specific management roles which would benefit from WMA and linking specific tools with these roles, e.g. physical information for environmental managers, monetary information for finance officers, etc.
- building greater knowledge of water management in wine supply chains and where value could best be added
- providing a link between internal decision making and external reporting to improve accountability.

However, while WMA provides a toolset to improve the eco-efficiency of viticulture and wine production not all growers and producers are looking for the highest profitability as in some cases owning or operating a wine business is chosen for the lifestyle it presents, or is cross-subsidised by other activities such as wine tourism [32]. Yet, even if the emphasis is not on profitability, better water management is also a key in these circumstances, for making well informed decisions about environmental performance in relation to water and for managing business specific water risk. In summary, irrespective of their motivations for engaging in wine related business activity all wine organisations require their vines to be irrigated, are required to comply with environmental regulations (e.g. in relation to water withdrawals and disposal of wastewater), and, depending on knowledge of the financial resources available, would have other alternatives on which to spend potential savings, making WMA data necessary for their decisions.

Given the potential benefits of WMA to practice the next section considers how researchers might encourage take up.

BENEFITS OF WMA RESEARCH

Future research opportunities in WMA are related to several considerations. Water is a local resource, with spatial and temporal peculiarities and is being affected by long run climate change and changing rainfall patterns, as well as local short run extreme weather events, and tighter environmental regulations, etc. WMA provides information about these happenings as they affect individual wine businesses, and it delivers foundational data for improving operational and investment decisions through measures of environmental and monetary performance of companies. Because it is managed differently from other material inputs and outputs water data tends to be gathered and classified separately in the

accounts [33] and merits development of a focused sub-system of EMA. Also, the extent of local water crises at a point in time and over time make access to WMA data relatively more or less urgent for companies striving to be environmentally aware and economically responsible.

Various questions for further research are inferred by the growing importance of water for business and the need for these to be managed.

First is the need to investigate the importance of WMA to improve awareness about water issues. WMA is expected to provide accountants and environmental managers with ways to raise awareness about water crises and risks, and to provide better planning, control, environmental performance and reporting as a foundation for the business case for improved water management.

Second, application of WMA in additional sectors could be examined. Agribusinesses, such as those in the wine industry, are known to be large users of water and so systematic investigation of the application of WMA is to be encouraged. But application of WMA to other industries, such as different types of manufacturing, could help build up knowledge about sensitivities and resilience in the face of water risks, leading to better water use investments.

Third, the relevance of WMA to companies of all sizes merits investigation through case studies and empirical surveys. In particular research into the potential impact of WMA in small companies is needed given they are the dominant form of business, turnover rapidly and being more agile could add administrative innovations such as WMA much faster than larger global companies are able to do. Separate research is also to be welcomed into the WMA tools of most use in the small business sector – ex post, ex ante, etc. – and which managers find them of most use.

Research into the patterns of WMA use over time in different corporate decision settings would clarify the links between water impacts of current and future operations, demonstrating the net benefits arising for the environment, for local communities, and the monetary valued added for the company.

Finally, the most effective ways to implement WMA in companies with different internal structures (e.g. departmental or divisional), external collaborations (e.g. joint venture, supply chains or networks) and strategies (e.g. cost leadership or product differentiation) could be another important target for research.

In 2014, Christ proposed WMA as a new sub-system of EMA. This development constitutes a logical progression for practice and research following the earlier work on carbon management accounting. Using the example of the global wine industry this paper demonstrates WMA to have much potential to help reduce corporate freshwater use and the generation of

wastewater streams through the collection, analysis and targeted use of high quality, relevant, physical and monetary information. Because it is such a recent development the future of WMA is speculative, but the critically of water to business in the future and the need to embed tools to help improve corporate water management are almost certain.

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Smart Cities: A call for research in Accounting, Control and Strategy

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Abstract: This paper proposes a multidisciplinary review of the literature on smart cities and related concepts like intelligent or sustainable cities. It identifies a series of relevant questions for future research, especially in the fields of accounting, control and strategic management.

CONTEXT

Currently half of the total population lives in cities and the world is at an unprecedented level of urbanization [1]. The rapid urban population growth leads to a variety of challenges (eg. energy, urban mobility, waste, water challenges). It requires a demanding imperative for sustainable development and better livability.

Making a city “smart” is emerging as a strategy to mitigate the problems generated by the urban population growth and rapid urbanization [3]. According to Kourtit and Nijkamp (2012), smart cities are “*the result of knowledge-intensive and creative strategies aiming at enhancing the socio-economic, ecological, logistic and competitive performance of cities. Such smart cities are based on a promising mix of human capital (e.g. skilled labor force), infrastructural capital (e.g. high-tech communication facilities), social capital (e.g. intense and open network linkages) and entrepreneurial capital (e.g. creative and risk-taking business activities)*”.

Actually, there is an obvious increasing interest for issues related to “smart cities” at the international, European, national (Belgium) and regional (Flanders/Wallonia) levels. For example, the European Commission launched the European Innovation Partnership for Smart Cities and Communities in 2011 and numerous practitioners/businesses have developed an expertise as well as practical reports on smart cities (eg. IBM, Siemens).

Yet, little academic research has sparingly discussed the phenomenon [3]. The smart city concept itself is thus still emerging and the work of defining and conceptualizing is in progress [1].

Actually, we have identified a limited number of recent scientific publications in the field of urban and regional planning, urban studies and technology innovation and we have not identified any publication focused on “smart cities” in the management literature while this topic needs to be analysed under the angle of various disciplines, management being one crucial angle [1], [3].

RESEARCH OBJECTIVE

This paper proposes a multidisciplinary review of the literature on smart cities and related concepts like

intelligent or sustainable cities. This research derives two schools of thought - technology centric school and human centric school which have opted different stand to promote the concept.

Further, the paper offers the development of the concept in four phases and analyses their contribution to its development.

Finally, referring to Ricciardi and Za (2015)’s call for further research dedicated to smart cities in business and management sciences, our paper identifies a series of relevant questions for future research and, especially in the fields of accounting, control and strategic management.

METHODOLOGY

Based on key-word searches in various bibliographic databases (EBSCO, Google Scholar, ProQuest, Science Direct) - including research outputs in urban planning, technology innovation, political sciences, environmental sciences, sustainability and strategic management), a limited amount of scientific publications has currently been identified and reviewed.

FINDINGS

The vast majority of these publications have been recently published (after 2011) and come from the areas of urban and regional planning, urban studies or technology innovation. This observation is quite logical as smart cities have become a landmark in urban planning [4]. Until now, very few publications have been identified in the management literature while these initiatives need to be analysed under the angle of various disciplines, management being one crucial angle [1], [3]. In addition, avenues for research in the fields of accounting, control and strategic management are proposed.

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Social Responsibility in Banking Sector: Declaration vs. Quality of Disclosure

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Summary: Currently, many banks declare that they are socially responsible by joining social networks and demonstrating their social responsibility in mass media. The paper examines the quality of banks' social responsibility reports by creating methodology, which contains five criteria of the reports' quality assessment: relevance, reliability, objectivity, comparability and sustainability. The purpose of the paper is to identify the gap between declaration of social responsibility activity and factual CSR information disclosure and quality in the banking sector. Research results showed that banks, which have declared that they are socially responsible by joining local networks of sustainable business, still have very poor social responsibility reports.

INTRODUCTION

Recently, banks and financial institutions have paid huge fines and agreed to massive settlements to resolve major scandals, ranging from money laundering to facilitating tax evasion. The recent financial crisis and bankruptcies of numerous banks has shown that mere submission of social responsibility reports does not prove that the organization is socially responsible, and that the disclosed information about a company's social activity is transparent, reliable or beneficial for the consumers. Thus, promotion of integrity and transparency in the banking and financial sector – including the importance of integrating transparency in their operations and the role of investors, regulators and society – is pretty relevant in order to restore trust and change behaviours.

As a result, today while determining the social responsibility levels of various banks [37], it is essential to investigate the quality of social responsibility reports, assessing not only the quantitative, but also the qualitative aspects [31].

Quite often sustainability reporting is one of the conditions for socially responsible business membership. Many authors [8], [9], [12], [27], [29], [31], [35], [39], [41]-[44] discussed and analysed broad areas of sustainability reporting in different sectors by explaining and providing a context for researchers, drawing their attention to it as a general issue of information disclosure. However, there is a limited amount of research [1], [7],[11], [13], [14], [16], [17], [21], [22], [24], [25], [28] with orientation to understand and assess the quality of information disclosure in a sustainability-reporting context, especially in the

banking sector [4], [26], [29], [31], [42], [43]. To fill this gap, the paper seeks to answer the following research aim – to identify the gap between declaration of social responsibility activity and factual CSR information disclosure and quality in the banking sector.

LITERATURE REVIEW

In this paper we will consider the stakeholder and legitimacy [5] theories as being complimentary [46]. Qualitative disclosure of CSR information in the banking sector is important to aid the pressure of stakeholders and meet the growing interest of public opinion [46]. Scientific research proves that CSR initiatives strongly influence the positive behaviour of bank clients [29], as well as the recognition of the brand [41]. Referring to outside-in approach logic [10], banks are also social organizations embedded in society, and stakeholders will judge its CSR, on which the bank depends.

CSR information disclosure can provide benefits to the company and other stakeholders only if the information is correct. Various authors argue that without high quality data presented in CSR reports one cannot expect long-term benefits for businesses and their surrounding environment [24], [18], [21], [33]. Habek and Wolniak research results show that the quality level of such reports is generally low [22]. The analysis of scientific literature has shown that the quality of social reports determines fair or erroneous evaluation of the company's performance by the stakeholders [4], [17], [30].

The financial crisis in 2008-2009 has highlighted the importance of the quality of CSR information disclosure in the banking sector because highlighting the irresponsible behaviour of financial institutions is important for both individuals and businesses, and even the economy of countries. Banks, especially as organizations, which have a significant impact on the public, as other companies, also provide CSR reports, but there are only a few studies analysing the quality of the data of such reports [31]. After the intensification of the scientific research, it was noticed that some banks, which prepare CSR reports, are providing information that is only partially correct. The research done by Laidroo and Bik has shown that after the financial crisis,

Scandinavian banks have evaluated the dangers of faulty data of CSR [27].

GRI Reporting Principles highlights the following six quality characteristics [38]: balance, comparability, accuracy, timeliness, clarity, and reliability. Meanwhile in scientific literature, the perception of the quality of the CSR information disclosure evokes a great deal of discussion [1], [23], [48]. In the literature, preference is given to attributes that characterize the content of the report, i.e. the volume of the report, the style of disclosure, the inclusion of topics, the range of the addressees of the publication, the nature of disclosure, the manner in which knowledge is disclosed, the period of submitted information, the frequency of the report and so on [6], [34], [36]. Researchers supplement the range of the quality characteristics with features such as relevance and reliability, substantiality, comparability, objectivity, sustainability, timeliness, clearness, conciseness, accessibility, connection formation and future orientation [1], [3], [22], [48]. The abundance of listed characteristics demonstrates that the objective of the research to determine the set of quality characteristics is still relevant.

RESEARCH METHODOLOGY

The aim of this research led to the choice of content analysis method, because this method enables assessing the content of the communication objectively, systematically and quantitatively [19], [25] [27]. This empirical study uses the combination of mechanical and interpretation techniques [2], [15], [21], [32].

The CSR reports, which were submitted separately or as part of the annual reports have been analysed in this study as well.

Different studies involve the use of different sets of criteria characterizing the quality of social responsibility information. This study presents quality assessment methodology by these criteria:

- **Relevance** includes source, frequency, format, language, and breadth of disclosure (volume and visualization) [6], [48], [22], [27].
- **Reliability** is concerned with whether the CSR reports are externally assured, and whether the companies have implemented certain standards in their activities, which could enhance the reliability of the information, awards by rating agencies or governmental institutions [40], [48], [22], [28], [37].
- **Comparability** was analysed according to whether standard units and quantitative ratios were used in the reports and whether they were compared with previous data [48].

- **Objectivity** was assessed by analysing whether the reports contain only positive or/and negative information, and whether the company is objective and able to provide negative information about their socially responsible activities as well [3].
- **Sustainability** helped to assess information about all the stakeholders receive equal attention in the CSR reports (as number of sentences and percentage) [30], [7].

In total 23 social responsibility reports were submitted in 2007-2012 per one Baltic country [45].

FINDINGS

During the investigated year period, all bank reports were distinguished for their conciseness and the use of the created research methodology.

Relevance criteria: 26% of the CSR reports were submitted in English, others in a national language. All reports except one were prepared in PDF format. All CSR reports were submitted as separate stand-alone reports.

Four banks issued CSR reports annually; only one bank presented its reports biannually.

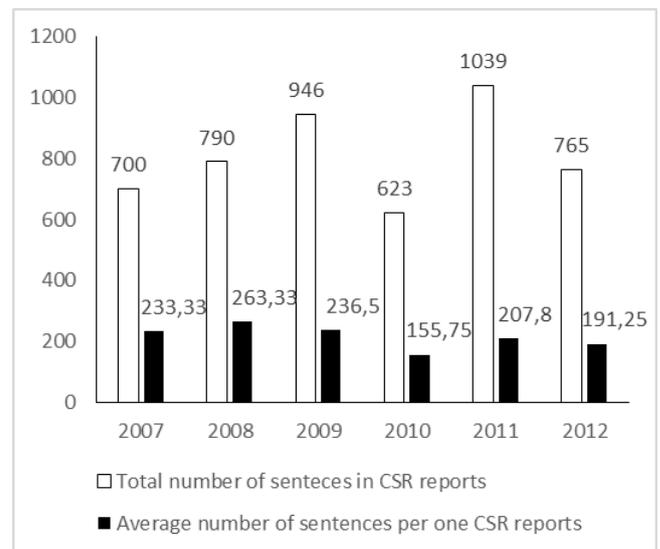


FIGURE 1: NUMBER OF SENTENCES IN BANKS' CSR REPORTS.

Figure 1 reveals that the highest number of sentences in CSR reports appears in 2011 and 2009 respectively. However, having considered the amount of sentences providing social information in one report, this index was the highest in 2008 and was equal to 263 sentences/1 report.

Reliability criteria: The research results revealed that only 17% (4) of banks' social responsibility reports were prepared according to the GRI, 70% were based on the UNGC principles, and 13% of

the reports were made using other unknown methodologies. The most advanced reports were by international banks, which submitted corporate social responsibility of the whole bank group. In this case, by preparing CSR reports, they also referred to the United Nations Principles of Responsible Investments (UNPRI), OECD Guidelines for Multinational Enterprises, Code of Business Conduct.

None of the CSR reports were assured by third parties.

More than half of the examined banks (3) were awarded for the promotion of socially responsible business in different areas at least once. However, any CSR reports were recognized as the examples of good practice.

Comparability and objectivity criteria: Only 4 reports prepared according to GRI methodology can be comparable. Other banks mostly use descriptive analysis, indicating no strategic aims and measurement indices. Based on most of CSR reports, it is very difficult to understand the exact impact of banks' activity on the environment and society. It should also be admitted that any bad news is presented in the reports. In most cases, CSR information provided in the report is hardly comparable to previous periods.

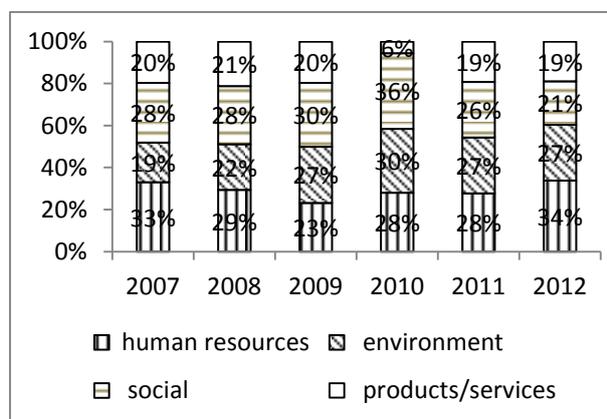


FIGURE 2: DISTRIBUTION OF INFORMATION DISCLOSURE BY SUSTAINABILITY CRITERIA.

Sustainability criteria (Figure 2): During the researched period of 2007-2012, Lithuanian banks mostly disclosed information about human resources, followed by public relations, environment and the products/services. Looking at each year separately, human resource disclosures are the most common. Distribution of information on environmental protection, society and products was similar ever year – approximately 20%-23%, except for 2007, when information on public activity comprised a considerable part of CSR reporting – 32%. This may be explained by qualitative changes in report preparation (at the beginning, CSR reporting was understood as the

disclosure of information about projects and events meant for local society).

CONCLUSION

The analysis of the scientific literature showed that most scientific research concentrates on corporate disclosure, not valuing the quality of disclosure. Thus, this study extends the CSR literature by providing initial evidence about the gap between declaration of CSR and factual CSR information quality in the banking sector.

The analysis also revealed the existence of the multidimensional perception of quality of CSR reports and information included in them. The research results showed that banks, which have declared that they are socially responsible by joining local networks of sustainable business, still have very poor social responsibility reports in the point of view of relevance and sustainability. Most banks' CSR reports do not satisfy the comparability, objectivity and reliability criteria of quality assessment.

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Integrated reporting: Background, review, and future research opportunities

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Summary: Integrated reporting is promoted as a new reporting format to narrate future value creation opportunities for financial stakeholders, linked to strategy and the business plan, specifically articulating the way the various capitals are used to create value. The capitals are financial, manufactured, intellectual, human, social and relationship, and natural capital. Integrated reporting also relies on management employing 'integrated thinking' in planning, managing, and reporting. The aim of integrated reporting is to address traditional accounting and reporting's shortcomings, such as being historical in nature and promoting a short-term outlook. We provide a literature review of the nascent research in this area and identify some of the many research opportunities around the implementation of integrated reporting and its supposed benefits.

Keywords: Integrated reporting

INTRODUCTION

Accounting has long been criticized for its historic orientation, its inability to provide sufficient relevant information on corporate strategy, and on environmental, social and governance (ESG) matters. Integrated reporting can be seen as the latest attempt to address these shortcomings [10].

Integrated reporting emerged in practice prior to any established theory or standards. In 2002, Novo Nordisk, a Danish company, was the first corporation to issue an integrated report [17]. Since March 2010, the Johannesburg Stock Exchange requires listed companies to comply with the King Code of Governance Principles for Southern Africa of 2009 (King III), or explain why they do not. King III specifies an integrated report, encouraging companies to connect financial with sustainability information [25]. In the same year (2010), the International Integrated Reporting Council (IIRC) was established by a global coalition of regulators, standard setters, non-governing organizations, investors, companies, and the accounting profession (IIRC, 2013). The IIRC published the International Integrated Reporting Framework (the <IR> framework) in December 2013, presenting a principle-based framework to guide organizations in the preparation of an integrated report.

In terms of the <IR> framework, an integrated report focuses on communicating the

organization's future value creation plans to capital providers. It describes how an organization's strategy is operationalized in its business plan, and how organizations consider and utilize the interdependencies of the 'six capitals' in its quest to create value. The six capitals are financial, manufactured, intellectual, human, social and relationship, and natural capital. In addition to being future orientated, strategy focused, and encouraging of non-financial disclosures in an interconnected way, an integrated report should, according to the IIRC, be the result of integrated thinking and is meant to foster a long-term vision that will counteract the short-termism that increasingly dominate the capital markets.

There is an increasing number of corporations engaging in the spirit of integrated reporting, as well as increasing regulations in support of sustainability reporting, and mentions of integrated reporting in academic and practitioner articles [15]. The rapid development of the integrated reporting landscape, and the organizations behind its promotion have created new research opportunities. These research opportunities are being taken up by social and environmental researchers, voluntary disclosure researchers, as well as other accounting researchers.

LITERATURE REVIEW

Integrated reporting has a short history of publications given that the concept is relatively new and was only formalized in 2013 through the <IR> framework. Nevertheless, there is a growing body of literature on integrated reporting and themes are emerging within it. The initial articles are mainly authored by Robert Eccles and his colleagues. Eccles is famous for his advocacy of the triple bottom line, and the disclosure of social, environmental, and financial matters. In 2010, he started to call for the One Report, otherwise known as an 'integrated report', and from that point onwards Eccles and his colleagues started advocating for integrated reporting through trade journals and books (see for example, [12], [13], [14], [17]). Integrated reporting was believed to be an opportunity for mainstream investors to acknowledge environmental, social and governance (ESG) issues as material to investment decision-making. It was also to act as a platform for

sustainability by emphasizing ESG issues as responsibilities of board of directors and top management.

Sustainability and accountability to stakeholders were initially strong features of IIRC's discussion papers; however, by the time the <IR> framework was published, the emphasis had shifted to sustainable value creation for capital providers. The investor-centric nature of the framework disappointed a number of social and environmental accounting academics, leading to a spate of articles critiquing the IIRC for abandoning the sustainability imperative. One of such critiques is given by Flower (2015), who view this shift as a failure primarily due to IIRC accommodating the needs of multinational enterprises and the accounting profession. The early advocacy of integrated reporting, and its subsequent concerns and critiques are the first themes addressed in the following subsections. The tools proposed by the academic community to support the advancement of <IR> are then introduced.

Apart from nominal debates and suggestions over integrated reporting, the literature is beginning to reflect a more balanced view of this new reporting practice. For instance, the 2014 AAAJ special issue on integrated reporting contains articles that empirically researched and critically discussed the potential for integrated reporting to stimulate organizational sustainability [10]. Another special issue focused on case study insights around <IR> implementation will be published in 2017. Therefore, further interdisciplinary and case study approaches to integrated reporting research are well under way.

Extant research has begun exploring integrated reporting from various angles, researching this new accounting phenomenon from both qualitative and quantitative research approaches. Integrated reporting has been studied from the perspectives of organizations and investors, and from assessments of corporate disclosure quality. Other studies have examined the economic consequences of integrated reporting, and the cultural and institutional influences on the preparation of integrated reports. It may be important to note that as the concept of integrated reporting was present prior to the release of the <IR> framework, the studies published before the release of the framework would have interpreted their results based on a stakeholder perspective rather than a shareholder perspective. As a consequence, research findings, for instance in Jensen and Berg (2012) and García-Sánchez et al. (2013), may have reached different conclusions if the researchers focused on the needs of shareholders instead of undertaking a stakeholder perspective to integrated reporting. The findings of

the articles published are now discussed in more detail under the themes identified.

Early advocacy

Early advocates of integrated reporting envisioned it as a catalyst for sustainable capitalism and an opportunity to rebuild the trust between businesses and society. Integrated reporting has the potential to change corporate operations and the mindset of investors towards long-term and sustainable orientations [13]. Such practices also have potential to enhance corporate transparency, which is an essential element to rebuilding public trust and market reforms [28]. Early advocates have suggested the utilization of the web as an effective means of communication and cloud computing to facilitate the adoption of integrated reporting [11], [28]. Eccles and Serafeim (2011) calls for the collaboration of market and regulatory forces in making integrated reporting a mandatory universal practice, arguing that integrated reporting is urgently needed to address issues such as financial instability and natural resource limitations.

Perceived benefits and challenges to integrated reporting have been noted. Integrated reporting is promoted as beneficial to both practicing organizations and their stakeholders. Corporations benefit from a greater understanding of the interrelationships between financial and non-financial information, as this could provide an alternate view of what activities constitute as creating the greatest value for a corporation. Integrated thinking is said to improve resource allocation decisions, strengthen stakeholder engagement, lower reputational risk, and help corporations manage regulatory risks [14], [17], [28]. Adams and Simnett (2011) suggests the not-for-profit sector also benefit from adopting integrated reporting. The strategic and forward-looking nature of integrated reports provide more information to funding organizations about the long-term strategy and vision of the applicant, which is important in a sector that is highly competitive for funding. Stakeholders benefit from increased information transparency about ESG matters and the acknowledgement from corporations regarding their role in forming a sustainable society [14], [17].

Challenges to the integrated reporting movement include a lack of development in a globally accepted standard for measuring and reporting non-financial information, which according to Eccles and Saltzman (2011) and Eccles and Serafeim (2011), this hinders the comparison of performances across multiple corporations and results in less use of such information to investment analysis. Furthermore, the relevance,

applicability and adoption of integrated reporting is expected to vary across jurisdictions [3], [18].

Concerns and critiques from the research community

Through the process of formalizing the concept of integrated reporting into a specific framework, conflicts arose from a difference in opinions regarding the technical details of <IR>. The Framework has been criticized for diverting from the vision originally held for integrated reporting. It appears to some that <IR> have moved away from IIRC's original intention of accountability to stakeholders and encouraging sustainability, as it has become focused on value to investors and promoted as a business case (Brown and Dillard, 2014; Cheng et al., 2014; Flower, 2015; Thomson, 2015). Flower (2015) argues that the business case for integrated reporting is based on "the capitalistic theory of the firm" and such theory fails to consider the conflict between maximizing corporate wellbeing and maximizing societal wellbeing (p. 13). Flower also criticized the <IR> framework for allowing too much management discretion, and for kowtowing to the needs and convenience of corporations. Similarly, Brown and Dillard (2014) considers that emphasizing a win-win situation reinforces business as usual practices instead of encouraging reflection and change. Integrated reporting has become focused on 'stakeholder management' rather than 'accountability to stakeholders'.

Counter to some of these criticisms, Adams (2015) emphasizes that the main purpose of <IR> is not to address sustainability, as this was already a core mission of initiatives such as the Global Reporting Initiative; but rather <IR> encourages a different way of thinking about the notion of profit maximization and corporate success. Adams explains the rationale for focusing on capital providers to be because this stakeholder group associate value creation with potential future cash flows and long-term returns, and this was deemed as accommodating to the diversity and discrepancy of the meaning of 'value creation' to different stakeholder groups. Indeed stakeholder groups have different views on the purpose of integrated reports, but fixating on a specific group may not be a solution to social and economic sustainability. Van Bommel (2014) interviewed multiple groups of stakeholders and identifies integrated reporting to be considered as fitting either an institutional, market, civic, or green 'worth'. These different 'orders of worth' could be described as what various stakeholders think about integrated reporting for it to gain legitimacy in society, and these differences signal alternate views on what integrated reporting should emphasize and what determines its success. To reconcile these

differences, van Bommel suggests there needs to be compromise, suggesting establishment of a common interest, and avoidance of clarification while maintaining ambiguity and plasticity. The current state of <IR> appears to be biased towards a certain group of stakeholders, namely capital providers, and this generates bias rather than a legitimate compromise.

However, the tendency for <IR> to have a strong market orientation and emphasized as a business case may be contributed by a lack of stakeholder engagement in the Framework's development process. Comments submitted for <IR>'s discussion papers are primarily from large multinational enterprises, sustainability service firms and professional bodies from English-speaking and well-developed economies [31]. Reuter and Messner voiced the concerns that the lobbying process in the development of <IR> may have resulted in the Framework becoming not equally applicable to small and medium enterprises or other organizational forms, and may not be reflective of investors' information needs. Cheng et al. (2014) identifies other issues associated with <IR>, notably the ambiguity of the meaning of capitals and the assessment of trade-offs between capitals, and the complexity faced to provide assurance of integrated reports. There needs to be further developments in accounting to advance the measuring and reporting of non-financial capitals for integrated reporting to succeed [2].

Tools to support integrated reporting

To address the vagueness and ambiguity surrounding integrated reporting, academics have begun putting forward ideas to further advance integrated reporting in practice. Abeysekera (2013) introduces an integrated reporting template, suggesting reports should be concise and less than ten pages. The contents should combine narrative, numerical and visuals to allow a more holistic picture of an organization. Haller and van Staden (2014) suggests the 'value added statement' is supportive of <IR> as it resembles the concept of integrated reporting and is relevant to all stakeholders as it integrates shareholder with stakeholder concepts. Rambaud and Richard (2015) proposes the 'Triple Depreciation Line' accounting model as a method for financial accounting to take into account different stocks of capital in a symmetrical way. This proposed method is based on the traditional methods of capital maintenance, where the goal is for corporations to become obligated to maintaining financial and non-financial capital, setting enough money aside to secure its maintenance.

Organization-based studies

Research from an internal perspective has primarily been investigated through case studies and interviews. For instance, Parrot and Tierney (2012) conducted a case study on American Electric Power, highlighting the difficulties managers face when balancing multiple stakeholder interests, as well as financial and ESG considerations. In this case, integrated reporting and stakeholder engagement is seen as a core to the company's success as following from this mentality, managers consider maximization of long-term value to involve addressing ethical and relational concerns. Another case study by Knauer and Serafeim (2014) found practicing integrated thinking and reporting changes the investor base of corporations. This case suggests long-term investors are attracted by increases in corporate transparency and initiatives that enhance ESG performance, where the long-term investor base contributes to stronger economic performance. An extension of this study was conducted from a quantitative data analysis approach. Serafeim (2015) found similar results to its qualitative counterpart, identifying a correlation between integrated reporting and long-term investor base.

Other studies examined the institutionalization of integrated reporting amongst early adopters of integrated reporting in Australia. From interviews with managers, Stubbs and Higgins (2014) found no evidence of integrated reporting practices stimulating changes or innovations in the reporting processes; instead, integrated reporting is considered an extension to sustainability reporting. Similarly, Higgins et al. (2014) found managers are uncertain about whether integrated reporting is meant to reflect a change in the nature of reporting or change in the format of disclosures. As managers consider integrated reporting to be about story-telling and meeting institutional expectations, at the present stage integrated reporting is unlikely to lead to a radical change to the norms of corporate reporting. There is however an expectation that as integrated reporting naturally evolves, organizations will follow on to meet additional expectations.

Investor-based studies

The attitude of investors towards non-financial information is gradually changing, with ESG information becoming increasingly accepted as material and financial in nature [5], [4], [27]; however, the change for mainstream financial analysts are more subtle as they remain resistant to engage on ESG issues [5]. From interviews with South African institutional investors, Atkins and Maroun (2015) suggests integrated reports are seen as an improvement from traditional annual reports, but there is a need for the investment community to

engage in the reporting process and the need for assurance of disclosures. There remains room for improvement as the quality of disclosures varies. Institutional investors consider integrated reporting as stakeholder-centric and emphasizes substance over form. While there are some exceptional reports, there are others that have been criticized as too lengthy, contains excessive repetition, and follows a box-ticking approach. Atkins and Maroun also found investors consider there to be an element of managers using integrated reports to manage their corporate image.

Disclosure-based studies

There are researchers who employed content analysis to assess the quality of integrated reports, or corporate disclosures according to a <IR>-based criteria, and identify areas of improvement for current reporting practices. Solomon and Maroun (2012) suggest a need for greater detail on the materiality selection processes and the meaning of materiality for South African integrated reports. Similar to the concerns identified by Atkins and Maroun (2015), Solomon and Maroun (2012) found report contents to be highly repetitive. There is however suggestions that directors' are prioritizing sustainability and stakeholder engagement, with greater emphasis on environmental and social issues and the inclusion of such issues into a corporation's internal systems. Eccles et al. (2015b) suggests corporations need to be more detailed on their interpretation of 'stakeholders' and how they determine which groups are prioritized. Eccles et al. also found a tendency for manufacturers to link strategy to product information to suggest consumption of fewer resources, while companies that are not producing tangible items link strategy to practices that develop human capital or benefit consumers. Although corporations are utilizing graphics to convey their sustainable value creation process, risks were not related to corporate goals, and forecasts of ESG performance and forward-looking information were uncommon. As opposed to assessing integrated reports, Stent and Dowler (2015) examined New Zealand best practice disclosures with a self-developed framework based on the requirements of <IR>. There is a small gap between best practice disclosures and an integrated report, where disclosures are failing on connecting the different strands of information, reporting against industrial or regional benchmarks, and reporting on uncertainties in future outlook. Stent and Dowler (2015) suggests engagement in systems thinking may be a way to bridge the gap.

Economics-based studies

Quantitative research examining the economic consequences of integrated reporting is also starting to emerge. Churet and Eccles (2014) found

no significant relationship between integrated reporting practices and greater financial performance, but suggests integrated reporting can improve the quality of corporate ESG management, which in turn assists businesses in meeting short-term goals while maintaining long-term competitiveness. Researching from a different view and focusing on the disclosure quality of integrated reports, Barth et al. (2015) found high quality integrated reports to be positively associated with stock liquidity and firm value.

CULTURAL AND INSTITUTIONAL-BASED STUDIES

Based on the expectation that countries in similar cultural systems adopt similar patterns of behavior, studies have quantitatively examined the influence of culture and institutional settings on the preparation of integrated reports and found that country-level factors do influence report preparation. Jensen and Berg (2012) found corporations operating in countries with higher investor protection laws tend to prepare integrated reports. Moreover, integrated reporting tend to be engaged in economies with: greater market coordination and dispersed ownership structures, higher private expenditures on tertiary education, higher trade union density, greater sense of national corporate responsibility, and higher levels of self-expression, such as values towards environmental protection, and higher secular-rational values, as reflected by engagement in societal matters. Although Jensen and Berg's study did not identify significant results on the effects of a country's legal system on integrated disclosures, Frías-Aceituno et al. (2013) found that corporations operating in civil law systems are more likely to prepare integrated reports. Frías-Aceituno et al. explained this finding as civil law systems are more stakeholder-orientated than common law, and therefore there is more social demand and interests in ESG information. Moreover, the study found stronger enforcement of state regulations positively affects the disclosure of integrated reports, and more profitable corporations as well as those large in terms of diversity of products, distribution networks, and capital market financing are more likely to engage in integrated reporting. Specifically focusing on cultural dimensions, García-Sánchez et al. (2013) used Hofstede's cultural dimensions as an analytical framework and found companies operating in stronger collectivist and feminist cultures have a greater tendency to integrate information. García-Sánchez et al. explained this finding as there is greater demand for corporate managers to respond to ESG demands in collectivist and feminist cultures, as such cultures focus on improving the quality of life for the overall society.

FUTURE RESEARCH OPPORTUNITIES

The quick adoption of <IR> and the level of interest it has garnered among managers, the accounting profession, and regulators around the world have conspired to create many research opportunities. These opportunities can be classified into streams, such as researching 1) whether the various IIRC claims for the strengths of <IR> can be sustained with empirical evidence, 2) the implementation issues faced by organizations that adopt<IR>, 3) investor and analyst reaction to various formats and informational content of integrated reports, 4) the spread of <IR>, 5) the <IR> promotion activities of the IIRC, and 6) the business opportunity and job reservation activities of the accounting profession around <IR>. Several research methods can be employed in providing empirical evidence around these issues, for example the archival method could be used to explore the economic consequences of <IR>, experiments can be used to explore investor/analyst reactions to different disclosure formats and different information contents, case studies can be used to explore internal changes and implementation issues, as well as to explore the activities of the IIRC and the profession around <IR>. In addition, surveys may be helpful to explore how various parties view <IR>, and the likelihood of <IR> adoption.

CONCLUSION

The IIRC and <IR> are fascinating phenomenon that will be of interest to accounting and finance researchers, given their reporting, disclosure, and capital markets influencing properties. The rapid spread of <IR> and the activities of the accounting profession in this space are bound to create many interesting research opportunities in years to come. As researchers, we are like referees in a sports contest: whether the 'game' is successful in reaching its own goals or not, and independent of who the winners turn out to be, there will always be ample need and opportunities for referees/researchers to do what they do best. We have articulated some of the broad avenues of <IR> research opportunities and we have no doubt that these opportunities will be taken up by researchers globally.

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Corporate Sustainability promoted by the assessment process of Socially Responsible Investment

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Extended abstract: Through an exploratory research approach, this paper analyzes the potential impact of sustainability indices and rating agencies on the nature of corporate sustainability and stakeholder management of organizations and in the financial market.

Keywords: corporate sustainability, socially responsible investment (SRI), sustainability indices, sustainability ratings agencies.

INTRODUCTION

Financial market system can be a driver of corporate sustainability management, especially through socially responsible investments (SRI) [1]. SRI market has grown substantially over time and the discussion about the impact of this development over corporate sustainability practices is gaining momentum [2].

As a consequence of the growth of SRI, investors need accurate information not only regarding financial performance but also about environmental, social and governance (ESG) aspects in order to invest in sustainable companies. These factors gave rise to the inevitable appearance of sustainability indices and rating agencies. In fact, in spite of the lack of consensus in terms of definition, measurement and, consequently, management of sustainability performance, sustainability indices have been the reference to track corporate sustainability performance of the leading sustainability-driven firms [3] in a capital markets context.

However, as Slager [4] highlights, knowledge is limited about how metrics for responsible investment are used within companies to achieve organizational change.

OBJECTIVE

The objective of this paper is to analyse the nature of corporate sustainability concept that is being promoted in the financial markets through the assessment structures developed by socially responsible investment actors. Specifically, the aim is to identify the key criteria used by sustainability indices and rating agencies, both of them belonging to the same market ecosystem, to assess sustainability in companies. The challenge of this paper is to address research questions related to which key criteria are being highlighted by this SRI

metrics over time, and whether the different indices and rating agencies are consistent in the way they are measuring the sustainability of a company.

RESEARCH DESIGN

This process has been developed from a dynamic point of view, analysing the evolution of the criteria considered by a sample of sustainability indices and rating agencies in different time periods. Specifically, six sustainability indices in 2008 and nine in 2015; and ten ESG agencies for the analysis in 2008 and nine in 2015 were selected. These indices and agencies consider social, environmental, and corporate governance factors when making their evaluations.

For the purposes of this study the information is gathered by means of desk study that involved a detailed analysis of public documents supplied by sustainability rating agencies. This information has been analysed through a content analysis method. Content analysis was defined in a corporate sustainability context by Abbott and Monsen [5] as "a technique for gathering data that consists of codifying qualitative information into categories in order to derive quantitative scales of varying levels of complexity"

RESULTS

Results show an evolution of the nature of exclusionary criteria, from the exclusion of specific sectors to the exclusion of specific company's practices. In terms of sustainability pillars, we can highlight that sustainability indices and rating agencies develop a more integral and balanced assessment of the corporate sustainability.

CONCLUSION

The main findings of this paper allow us to understand the integration of corporate sustainability in the financial markets system. This paper contributes to the literature on determinants of corporate sustainability, considering the influence of sustainability rating agencies in its development.

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Interconnecting water distribution and material flow costs accounting systems for efficient municipal water distribution

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Extended abstract: Due to the fact that not all water entering the distribution system arrive at the point of consumption, it has become necessary to achieve high level of efficiency in the water distribution especially in a water scarce country like South Africa. This study proposes a conceptual open systems model that interconnects water distribution systems and material flow cost accounting systems to calculate water losses within the water distribution system for improved water distribution efficiency. A conceptual open systems model was adopted for this study. A graphical representation of the proposed model was made of the interconnections between the water distribution system and material flow cost accounting systems for an improved water distribution efficiency.
Keywords: water distribution system; material flow cost accounting; non-revenue water; open systems model; municipal water; water leakage; inefficiencies.

INTRODUCTION

Municipal water distribution systems have come under heavy criticism in recent times especially in South Africa. This criticism is exacerbated by the effects of climate change which brought about droughts in some parts of South Africa leading to acute water availability to users. Managing water distribution intelligently requires municipal decision-makers to have good understanding of and ability to measure the economic, environmental, and social impacts of their water management decisions. To make informed decisions, municipal decision-makers requires adequate data that is based on conceptual model that interconnects water distribution systems to broader societal goals and an analytical flow system to measure them in both physical and monetary terms. Total water losses from municipal water distribution systems in South Africa are estimated at around 36.8% [13] and 25% which amounted to about 1 080 million m³/a [3]. While it is difficult to generate actual figure for water loss or non-revenue water in developing countries, one main challenge of water distribution systems in developing countries is the huge difference between the amount of water input to the distribution system and the amount of water billed to consumers [21]. Non-revenue water is considered a major obstruction to improve water distribution efficiency. Reduction in the amount of water loss is critical to sustainable water management, though challenging because of the “low opportunity costs of water losses and high repair costs of water losses” [18]. Non-revenue

water does not only include water loss but revenue and energy losses as well [7]. According to [9], “water losses in pipes networks usually represents the biggest ‘water use’ due to the high leakage occurring.” This has probably led to consumers paying for municipal water distribution inefficiencies which is covered mostly through fixed tariffs charged by municipalities.

Inefficiencies arising from municipal water distribution systems has been attributed to a combination of physical leakages and commercial losses such as administrative and metering errors [14]. In order to develop a socially sustainable water distribution system and attain fair pricing, a new approach to adequately capture the cost of water losses needs to adopted. Several authors have made propositions on how to reduce the effect of non-revenue water such as the installation of advance correlating continuous acoustic monitoring (CAM) technology to alert of potential water leaks before they surfaced [4]; the use of Geographical Information System (GIS) to map water networks using hydrological models to compute pipe systems’ pressure [15]; apply the WATERLOSS decision support system (WATERLOSS-DSS) that evaluates water performances levels to propose a NRW reduction measures [8]; and the use of pressure management (PM) to improve customer service, minimise operating expenses, and reduce water leakages and pipes’ bursts [6]. This study proposes a conceptual open systems model that interconnects water distribution systems and material flow cost accounting systems to calculate water losses within the WDS for improved water distribution efficiency.

The next sections are structured as follows: water distribution; non-revenue water; material flow cost accounting; methods; the proposed open systems model; and conclusions.

Water distribution system (WDS)

Both disinfectants and biofilm are been verified to cause corrosion of cast iron pipes in water distribution systems and can also affect the structure, composition, and morphology of corrosion scales [19]. Corrosion occur faster and more rapidly inhibited to form a protective layer in the AR than in the one with UV/Cl₂ than in the one with Cl₂ alone [22]. When corrosion occurs in the

water piping system, it degenerates into leaks which causes water losses, energy losses, as well as other systems losses. Energy costs form a considerable proportion of municipal water distribution costs. If leakages are not contained before it surfaces, it means that the cost of energy input to produce the water is lost in the WDS through these leaks. The environmental, social and economic implications of pollutants emissions emanating from energy consumption at WDS generating plants need to be considered as well [1]. Hence, the benefits of water leakage reduction vis-à-vis the costs of alternative options of fixing the leaks needs to be made available for management decision-making [12].

Non-revenue water (NRW)

NRW is comprised of a considerable portion of water, energy, and revenue losses of the water input in the WDS that is higher than 50% in some instances [7]. These losses comprised of “apparent losses, real losses and the unbilled authorised consumption” (Kanakoudis, et al., 2016). Due to climate change conditions, municipalities are under pressure to apply effective NRW strategies [9]. To apply effective NRW strategies, [2] suggest that municipalities need to determine the actual water losses by distinguishing between physical leakages (real losses) and commercial leakages (apparent losses). The first step in applying effective NRW strategy is to reliably measure and track both the real and apparent losses [11]. The material flow cost accounting (MFCA) systems is developed to capture, measure and track these losses within the water distribution flow system.

Material flow cost accounting (MFCA)

Most organisations are unaware of the full extent of the actual costs of their material losses because it is difficult to extract such detailed cost information from existing environmental management systems and from conventional accounting systems. Due to increasing pressure from climate change and extremely volatile drinkable water scarcity around the world especially in South Africa, municipalities are faced with the challenge to effectively manage this important economic and environmental resource. Municipalities are placed under increasing pressure to achieve a higher productivity in terms of water delivery and to reduce the environmental impact caused by water losses. Material flow cost accounting (MFCA) is well placed under such practical circumstances to meet such pressure. MFCA is an environmental management accounting (EMA) tool to “promote increased transparency of material use practices through the development of a material flow model that traces and quantifies the flows and stocks of

materials within an organisation in physical and monetary units” [10]. MFCA system focuses on efficiency improvements to achieve consistent cost reduction through material flow reduction [16].

METHODS

A conceptual open systems model was adopted for this study. A graphical representation of the proposed model was made of the interconnections between the WDS and MFCA systems for an improved water distribution efficiency.

The proposed open system model of water distribution efficiency

In this section, the study presents a conceptual open systems model for systems interconnection to achieve improved municipal water distribution resource efficiency. This conceptual model is based on a system thinking approach whereby information from the WDS are transferred to the MFCA system for processing. The MFCA system ensures visibility of real losses and commercial losses arising from the WDS in both quantity and monetary units. Such visibility of information will positively improve municipal’s environmental, economic, and social performance with regards to water delivery. Since the focus of this conceptual model is the attainment of resource efficiency, it becomes important to interconnect existing WDS and MFCA system to improve decision-making. This is necessary because information about material, energy and revenue losses becomes transparent in terms of quantity and costs thereby providing opportunity for resource efficiency improvements. Figure 1 describes the WDS-MFCA open systems model for water resource efficiency. The following sections describes the various linkages or interconnections of the model.

Interconnecting WDS using the water balance with Material flow cost accounting

The IWA standard water balance

Table 1 represents a simplified IWA standard water balance (see Appendix A).

Non-Revenue Water is then calculated as the difference between:

- System Input, and Billed Authorised Consumption, or
- Water Supplied, and Billed Metered and Unmetered Consumption by Registered Customers [20].

To have a transparent view of the water balance, the revenue water (RW) and the NRW figures are processed through the MFCA system by including the cost of material losses (input water through the

system); energy costs; and systems costs. System costs are defined as all expenses incurred in the course of in-house handling of material flows except for material, energy, and water loss management costs such labour, maintenance, and transportation (depreciation on pipe) costs [5]; [17]. The open systems model for WDS and MFCA systems is presented in Appendix B.

CONCLUSIONS

A conceptual open system model have been described and presented in this study by interconnecting WDS and MFCA systems for improved water resource efficiency. The importance of capturing detailed water distribution information will not only provide the volume of water loss in the WDS but by interconnecting with the MFCA systems make crucial water-related inefficiencies visible thereby providing a guide to decision-makers to develop efficient water resource distribution strategies along the supply chain. The study used the open systems model because of the interconnection of water systems to external environment.

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APPENDIX A

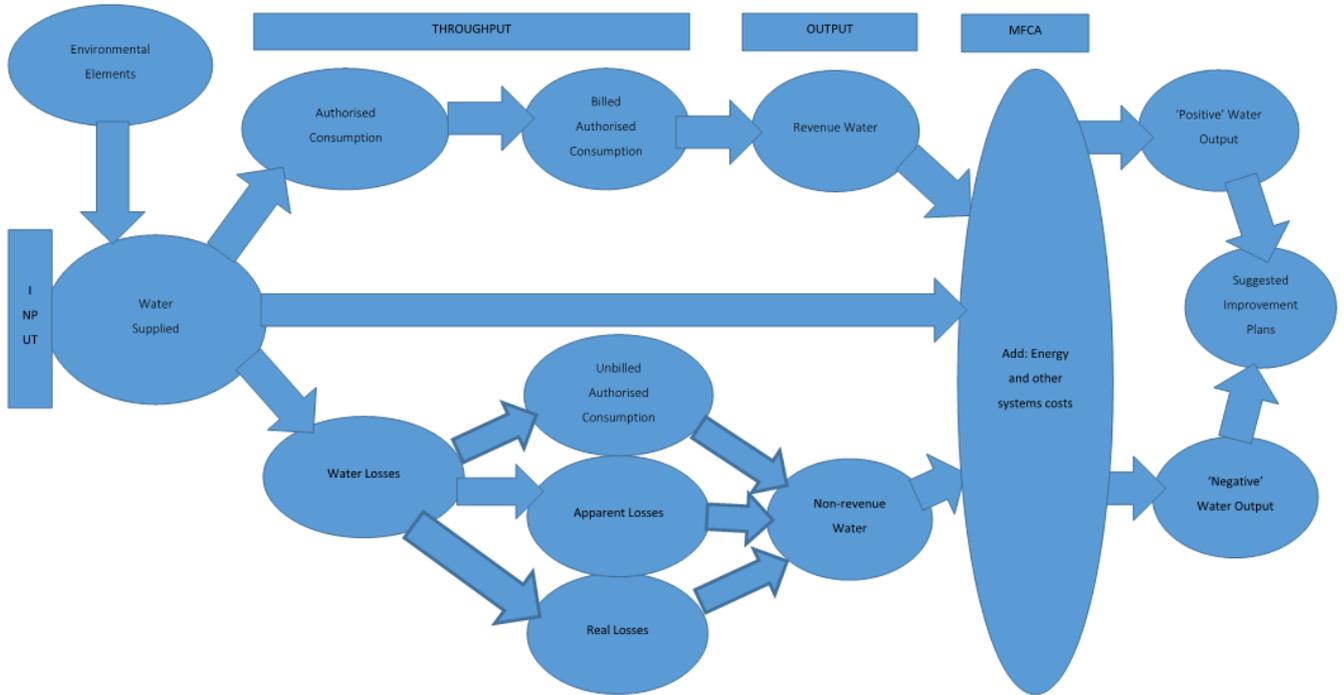
TABLE 1: A SIMPLIFIED IWA STANDARD WATER BALANCE

Source: Water New Zealand (2010).

System input (allow for known errors)	Authorized consumption	Billed authorized consumption	Revenue water
	Water losses	Unbilled authorized consumption	Non-revenue water
		Apparent losses	
		Real losses	

APPENDIX B

FIGURE 1: INTERCONNECTIONS BETWEEN WATER DISTRIBUTION AND MATERIAL FLOW COST ACCOUNTING SYSTEMS



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Summary: The manuscript highlights the role of sustainable finance in supporting sustainable economic development and growth. In a nutshell, the focal points of the work is to present the closely linked points of sustainable finance, and sustainable growth and development. The dependencies and causal relationships between sustainable finance, and sustainable development and growth are examined based on related work, extensive survey and panel regression analysis.

Keywords: sustainability, reporting, finance, growth, development

INTRODUCTION

There are a lot of challenges and perspectives in the economy. Nature, sustainability and environment were challenging issues for the old civilisations (Higgins, 2015). From historical perspective, the concept of sustainability first appeared in print within a comprehensive handbook on forestry *Sylvicultura oeconomica* published in 1713, written by the German nobleman Hanns Carl von Carlowitz. It was a starting point for more comprehensive thinking and developing of ideas in the field of sustainability. In modern time, the Millennium Development Goals (MDGs) were established in 2000. Also, the Rio+20 outcome document *The future we want* called for further mainstream sustainable development at all levels (UN, 2012). Since Rio+20 did not propose a clear and measureable goals and the MDGs were not fully effective, 2015 was the year when countries have shaped and adopted a new development agenda that is built on the top and peak of the Millennium Development Goals. The clock is ticking for creating a sustainable society. In some areas, such as climate change, there are those who believe it has already struck midnight (Eccles and Saltzman, 2011).

There is a general consensus that sustainable development is closely linked to economic

development. The sustainable development paradigm is based on an economic, not ecological, rationality. However, the concept of needs is one of the most complex⁴ in economics, and to imbed it in the definition of sustainability is to make intractable an already complex definition (Enders and Remig, 2015). Accordingly, it is necessary to narrow the definition of sustainable development to refer to an economy in which future growth is not compromised by that of the present (Goldin and Winters, 1995). Sustainable development calls for the integration of environmental and social issues into the decisions that shape economic and social development, regardless of whether they are made by the public or private sector (WCED, 1987; Roome and Louche, 2016).

It is increasingly recognised that the financial system plays a crucial role in the process of economic development⁵. The first signs of public debate on the relationship between finance and growth, and indeed on experiments with free banking, can be located in Rome in 33 AD. In that year, there was probably the first classic case of public panic and bank run. Banks supplied short-term liquidity credit to merchants and traders, corporate transport companies, and manufacturing

⁴ The famous philosopher Diogenes of Sinope asked Alexander the Great for a *more sunlight*.

⁵ It is obviously clear that macroeconomic policy can have important impact on the environment in different ways. For example, easier access to financial services can help the poor avoid intensive degradation or mining of the environment (Taylor, 1996). Moreover, sustainable development has to do with inter-temporal resource allocation. It is therefore very natural to expect a close connection between the interest rate and sustainability (Bojö, Mäler and Unemo, 1992). Without financial sector, it is impossible to reach and attain sustainable development. Expanding access to financial services holds the promise to help reduce poverty and spur development. Economists have long linked the expansion of financial markets to the spread of broader economic activity. By the same token, economists have focused on ways that barriers to financial markets undermine economic efficiency. In other words, the dominant part of the economic thought is dedicated to ensure a soundly financial environment as a prerequisite for development (Karlan and Morduch, 2010).

concerns of all types and that was the main factor determining the economic growth in the United States in the 1780-1850 period (Wright, 2002). Adam Smith delightedly made it very clear that the direct causes of the wealth of nations are free trade, infrastructure improvements, labour specialisation, and economies of scale and scope.

A link between the financial sector's growth and economic development is established when a mechanism is employed to induce saving and to stimulate investment. Financial institutions encourage saving and the acquisition of surplus funds via the creation of a variety of indirect assets (financial intermediaries) best suited to the varying needs and preferences of the savers. The use of these funds to finance those potentially most productive investments thus contributes to economic growth and development. We noted at the outset that finance-growth nexus is very hot and topical research and has a very long-dated historical patterns. On the contrary, some authors in the past have tried to deny the role of finance for growth prospects. First authors and antecedents of the contemporary and substantial analysis of finance-growth nexus were Goldsmith (1969) and McKinnon (1973). In the next period, the financial sector and its role in the process of economic development has attracted notable attention since the early 1990s. In particular, the crucial need for a stable banking system was highlighted in the wake of the Asian financial crisis in the 1990s.

The main goal of this work is to identify the dependencies and causal relationships between sustainability in finance from one side, and sustainable development and growth from other side. Also, authors are very dedicated on systemising of the state of knowledge in those fields.

The manuscript is organised as follows. The first section presents theoretical considerations. The second section is devoted to the school of thoughts and the key findings. The methodology of the research is presented in section three. Finally, the last part discusses the results and their relevance in practice.

SCHOOL OF THOUGHT & KEY RESEARCH FINDINGS

Sustainable finance is a vital part and cornerstone of the whole sustainability concept, because every decision made in the economic, social, or environmental dimension needs financing and requires proper financial policy (Soppe, 2004; Pisano, Martinuzzi, and Bruckner, 2012). In sum, financial regulations, financial instruments, and capital sources are tools that stimulate and ensure the adequate implementation of the sustainability concept. The quality of legal regulation and legislative framework is crucial to ensure the

successful implementation of a sustainable finance concept⁶. In general, corporate sustainability is at the heart of investors and public citizens and are increasingly concerned with potential consequences. As a result, in the wake of the recent financial crisis, they are working on regulation and guidelines to prevent the cost of future social and environmental corporate irresponsibility. The SEC has already taken an active role in environmental-related risk disclosure (Christofi, Christofi and Sisaye, 2012). In addition, Gerster (2012) points out that cost savings, increased revenues, reduced risks, the development of human capital, and the improvement of access to capital are the potential positives listed by providers of financial services in the context of outcomes created by sustainable practices.

It is sometimes argued that companies must, by the very notion of profit seeking, be pursuing all profitable innovations. In the same time, companies must start to recognise the environment as a competitive opportunity -not as an annoying cost or a postponable threat (Porter and Van der Linde, 1995). The good guide about best practices for financial institutions for dealing with the environment are *Equator Principles and the United Nations Principles for Responsible Investment*. Also, sustainable investment funds evaluate firms by their attitude towards environment and social sustainability stance. Following multilateral funds for sustainability, such as Global Environment Facility (GEF), Renewable Energy and Energy Efficiency Fund (REEF), Solar Development Group (SDG), and Prototype Carbon Fund (PCF) were established to address global environmental problems in developing countries (Jeucken, 2001). Sustainable investment funds evaluate firms by their attitude towards environment and social sustainability stance. There is increasing demand of corporate clients for sustainable financial products. Consequently, sustainable building and sustainable energy are two rapidly growing markets. The new energy infrastructure requires large amounts of money to be invested. In this context, the role of sustainable reporting is increasing⁷. For instance,

⁶ Given the inter-temporal character of financial transactions, the high degree of asymmetric information and the resulting agency problems, legal institutions play an especially important role in the financial sector. Among the institutions that financial economists have focused on are those governing agency relationships, such as the rights of secured and unsecured creditors vis-a-vis borrowers in- and outside bankruptcy, and the rights of minority shareholders vis-a-vis management and blockholders, as well as institutions that help overcome information asymmetries, including the quality of accounting and auditing frameworks, and systems of credit information sharing (Beck, 2010).

⁷ Eco-efficiency is a valuable part of corporate strategies and activities. Schaltegger and Sturm, who were among the first to

because social responsible investing (SRI) mutual funds have no common standards, definitions, or codes of practices, many investors express concern and disappointments about their investment. Millions of people and thousands of institutions want their investments to express social values. Public distrust in corporations has increased over the past decade. As a consequence, SRI mutual funds promised that investors' money will avoid companies with distasteful products and track records or reward those companies oriented toward environmental standards, proper governance mechanisms, social justice and sustainable reporting (Hawken, 2004). Street is gradually becoming aware of the importance of measurement and disclosure of nonfinancial elements of a business (Funk, 2003). Why would organisations report the large quantities of diverse nonfinancial information related to economic, operational, social, philanthropic, and environmental objectives to stakeholders? The primary reason relates to the realisation that nonfinancial performance measures often present a leading indication for predicting and improving future financial results. A number of companies (e.g. DuPont, Mobil, Allstate, Gap Inc. and British Petroleum-Amoco) recognise the potential comparative advantages of publicly disclosing their goals related to nonfinancial and financial performance measures and then reporting on how well they achieve them (Ballou et al, 2006). In Europe, more and more individual countries make sustainability reporting mandatory, at least for certain types or sizes of corporations. Before several years, Denmark introduced requirements on sustainability reports for public corporations (Dilling, 2010). Sustainability reporting refers to corporate social responsibility or corporate responsibility and is defined as *a practice of measuring, disclosing, and being liable for organisational performance while working towards the goal of sustainable development* (GRI, 2009; Das 2014). In sum, any kind of non-financial information is given via sustainable reports. Social and environmental accounting, and increasingly, sustainability accounting, offer alternative accountings in which externalities are central and the costs of economic success for the few are expressed in terms of the many and of the environment (Gray, 2006). In response to the changing market, business is being forced to take externalities into account in management behavior (Lo and Sheu, 2007).

Before *The Wealth of Nations*, Adam Smith wrote *The Theory of the Moral Sentiments*, which states that a capitalist system must be based on honesty

use the term, had intended ecoefficiency as one corporate measure among several (Dyllick and Hockerts, 2002).

and integrity, otherwise it will be destroyed (Lo and Sheu, 2007). From the perspective of the companies and investors, sustainable reporting is a direct source of information about non-financial performance. However, financial and non-financial information provides a more complete picture. Additionally, the relation between sustainable development and corporate social responsibility is an important research scope (see more in Ebner and Baumgartner, 2006). Not surprisingly, Elayan et al (2016) suggest that the investors expect from companies to behave ethically. Only if social responsible practices are integrated into the strategic decisions taken in business will positive consequences be achieved (López, Garcia and Rodriguez, 2007). The results are consistent with the economics benefit hypothesis, which posits that investors perceive that the benefits of ethical corporate behavior outweigh its costs. Furthermore, the authors argue that there is a possibility that by adopting corporate policies to promote ethical performance, a company may be able to mitigate wealth expropriation from bondholders to stock holders, reduce agency problems and agency costs between the firm and its creditors. This could potentially lower the cost of capital and enhance firm value. In a situation when corporate activity is sustainable, the cost of capital for the firm is reduced as investors are misled into thinking that the level of risk involved in their investment is lower than it actually is (Aras and Crowther, 2009). There is an ethical side and a profit side to any business, and the two factors have to be balanced. Concretely, companies are rewarded in the market for taking economic as well as environmental and social concerns into their developing strategies (Konar and Cohen, 2001). Taking *Tobin's q* as the proxy for firm market value, Lo and Sheu (2007) found that corporate sustainability is strongly associated with market value. The relation between corporate sustainability and firm value is positively reinforced by the growth of sales.

Undoubtedly, corporate social responsibility, corporate governance, sustainable reporting and their connections seem particularly relevant for multinational enterprises, which, due to their activities in multiple contexts around the world and concomitant visibility, generally face higher demands to be transparent and disclose information about such issues. What is more, multinational enterprises that disclose information on a wider variety of social and environmental issues (e.g. climate change) and thus target a relatively broad audience are more inclined to integrate corporate governance into their corporate social responsibility reporting (Kolk and Pinkse, 2010).

At last, many authors examine relationship between corporate governance and sustainability. Good

governance is of course important in every sphere of the society whether it be the corporate environment or general society (Aras and Crowther, 2008). There is a significant and growing interest in the legal academy in exploring new ways to regulate corporations and, in particular, an interest in a shift from regulation to governance (Hess, 2007). Wider issues such as business ethics through entire value chains, human rights, bribery and corruption, and climate change are among the great issues of our time that increasingly cross-cut the rarefied worlds of corporate boardrooms (Elkington, 2006). In fact, environmental, and sustainability accounting has been the subject of considerable societal, managerial, academic, and policy interest. In the late 1980s, Eastman Kodak and Norsk Hydro have published a sustainable report with a particular focus on environmental issues and with most attention being paid to external, accountability dimensions. However, whereas the number of banks and insurance companies that publish sustainability reports is increasing, traditionally the industrial, more polluting sectors have been most active in this regard. What is interesting with regard to growing reporting in the financial sector, is that these companies have undergone a tremendous *mind shift*⁸ in the past. Over time, however, pressurised by environmental regulations and NGOs on international project finance in particular, they started to realise that more attention to their products was required, and to the environmental, social and also economic (poverty/development) implications of their core activities. Some banks and insurance companies also discovered, relatively early, the risks (and market opportunities) related to climate change.

⁸ Mainstream corporate accounting tends to ignore a wide range of non-market activities which are associated with private sector organisations. Traditional accounting procedures concentrate on quantitative measures of economic transactions and ignore the social costs of environmental pollution or of resource exhaustion. The formal decision analysis invoked in traditional management accounting also typically neglects a wide range of non-market activities (Milne, 1996). From other perspective, integrated reporting provides a broader explanation of performance than the traditional approach, describing the company's dependence on different resources, its relationships and its access to and impact upon them (Frias-Aceituno, Rodríguez-Ariza and García-Sánchez, 2014). On Jan. 25, 2011, at a press conference held at the Johannesburg Stock Exchange, the world's first guidance document for companies practicing integrated reporting was issued. This was precedent-setting, as only a handful of the world's top 30 stock exchanges provide guidance on nonfinancial reporting. At a firm level, the Danish company Novozymes is generally considered as a first company to issue an integrated report, which it did in 2002 (Eccles and Saltzman, 2011). From these practices, we can conclude that comprehensive disclosure relating to sustainability by companies indicates better business behavior, which enhances the transition to a sustainable economy (Ganda and Ngwakwe, 2013).

Behind the overall increase in sustainability reporting in the financial sector in the previous years, lies a strong difference per region. European financial companies (especially those from the UK, the Netherlands and Switzerland) are very active, their US and Japanese counterparts considerably less. Notable is also that among these large banks and insurance companies, verification is an exclusively European phenomenon (with percentages similar to the overall one); no financial companies from other regions have done the same so far. Additionally, it should be noted and stressed that managerial judgment plays a considerable role in the promotion of social and environmental reporting (Kolk, 2005a, 2005b). One study argue that the prime motive for executives to involve their companies in sustainability reporting is to enhance corporate legitimacy (O'Dwyer, 2002). A good corporate governance and sustainability disclosure can be seen as complementary mechanisms of legitimacy that companies may use to dialogue with stakeholders (Michelon and Parbonetti, 2012).

In recent times, some attempts to strengthen corporate governance and accountability following scandals such as Enron, WorldCom, Ahold and Parmalat, embodied most notably in the Sarbanes-Oxley act, have focused mostly on internal mechanisms, regarding boards, managers, auditors, control and risk aspects, particularly to increase shareholder insight in and influence on corporate behaviour on the whole range of business matters. It has included ethical aspects related to remuneration, managerial and employee behaviour, and complaint mechanisms. Many multinationals, particularly in Europe and Japan, have started to pay attention to board supervision and structuring of sustainability responsibilities, to compliance, ethics and external verification (Kolk, 2008). In this regard, a broader notion of corporate governance seems to be emerging. Likewise, sustainable reporting continues to be a lively and challenging area due to its societal, managerial, and policy relevance. Accordingly, sustainability and corporate governance imply accountability efforts that seem to be converging. Sustainability reporting is typically a way in which companies try to address a multitude of audiences. If this becomes integrated with corporate governance, both the company - shareholder and company - society relationships might in principle be fully covered (Kolk, 2005, 2008). Overall, Shrivastava and Addas (2014) famously assume that quality corporate governance itself can engender high sustainability performance.

METHODS AND TOOLS

The study is based on critical literature review. The

quantitative model with panel regression analysis has been developed to identify the dependencies among variables. The research was conducted based on data for the OECD countries in the 2008-2013 period. Countries were selected based on the quality, completeness, and availability of data set. The following representative variables were adopted for each of the pillars of sustainability: economic aspect (Real GDP per capita, Ease of access to loans, Soundness of banks, Misery index); social aspect (Quality of educational system); environmental aspect (Energy intensity).

RELEVANCE TO PRACTICE

It is a cliché, perhaps, to say that there is a strong and perpetuate nexus between finance, and sustainable growth and development. Sustainability is a relevant and vital concept in all kinds of finance as well as in matters from an economic, social, or environmental point of view. Sustainable finance creates the space and framework for dealing with a variety of issues, such as: financial regulation for reducing the problems of financial exclusion, stability and safety of financial markets, protection of consumers rights, public deficit and debt management strategy coherent with social, economic, and environmental issues, redistributive strategies, public investment strategies, public aid in response to the main challenges in the field of income disparities, any kind of inequality and exclusion, etc. From another perspective and point of view, sustainable corporate finance is very important at the micro level for every single corporate policy. For companies, the corporate social responsibility concept is significant and should respect sustainable postulates such as human rights (in the labour market), social issues, and environmental protection in every single decision made by top management authorities.

CONCLUSIONS AND OUTLOOK

Sustainable development, when seen from an economic point of view, along with the research problem has been widely discussed in the literature. The research results show that any sustainable finance policy has a strong impact on sustainable economic development and growth. The key role played by state regulation and the legal framework creates space for the development of the sustainable finance concept. This study argues that countries with comprehensive and high-quality regulation in banking sector, energy sector and technological improvements are much more prone to create effective conditions for sustainable economic development.

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Overview of sustainability accounting and reporting developments in Africa from 1995 to 2015

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ABSTRACT

The purpose of this study was to implement an overview of sustainability accounting and reporting developments in Africa. Data were sourced through a review of both empirical research and developments on sustainability accounting and reporting in Africa over a period of 20 years (1995 to 2015) through an exploratory research. The research findings indicate that websites, stand-alone sustainability reports and integrated reports were the main forms of disclosure implemented by the companies. In addition, the GRI, IIRC, UNGC along with adoption of organisational self-developed organisational standards represent the major providers of sustainability accounting and reporting. The study also substantiates that only the JSE- South Africa has implemented sustainability listing requirements in Africa whilst stock exchanges in Zimbabwe, Mauritius, Nigeria and Ghana demonstrate strong intentions. Firm reputation protection issues, environmental awareness concerns, good firm governance and attractiveness to investors represented the main drivers of sustainability within corporate settings when compared to government specific legislation (minor driver).

Key words: Sustainability Accounting; Sustainability Reporting; Africa; Corporations; Stock Exchange.

(I) INTRODUCTION

Sustainability accounting and reporting has been identified as a significant issue that promotes corporate sustainability. In light of growing stakeholder sustainability demands it therefore confirm that corporate sustainability accounting and disclosure is one imperative corporate strategic policy which enhances the firm to acquire sustainable earnings, maintain a positive reputation, enhance competitiveness, improve product value and support corporate transparency [13; 14]. Therefore, traditional corporate financial reporting systems are now perceived a business as usual practice as a result of the emergence of voluntary

benchmark-setting through amongst others the Global Reporting Initiative (GRI) viewed as the worldwide standard for sustainability disclosure. In the same vein, the global economic crisis of 2008-2009 is also largely associated with climate change, natural resource shortages, water security challenges, food security and loss of biodiversity which inevitably has called for present day heightening of stakeholder interests for advancement of green economies that promote zero-carbon, resource efficient and low-waste economies [1; 4; 9; 6; 14]. The existing environmental crisis that is intertwined with the economic crisis has shown that firm disclosure activities are inadequate, lack transparency and therefore require increased adoption of new forms of sustainability through integrating environmental, social and governance issues in corporate accounting and disclosure processes [1;15]. This paper investigates sustainability accounting and reporting developments in Africa from 1995 to 2015.

Hence, the main research question of this study is: What are the sustainability accounting and reporting developments in Africa from 1995 to 2015? Therefore, the objective of the paper is to determine the sustainability accounting and reporting developments in Africa from 1995 to 2015. The paper is organised as follows: The following section discusses the concept of sustainability accounting and reporting. A review of empirical studies about sustainability accounting and reporting in Africa from 1995 to 2015 will then be presented. A review on the developments is also discussed. The sections on the study's research methodology along with study results and findings are then examined. Lastly, the conclusion of the paper is discussed.

(II) LITERATURE REVIEW

TABLE 1: SHOWING EMPIRICAL RESEARCH ON SUSTAINABILITY ACCOUNTING AND REPORTING WITHIN THE CORPORATE IN AFRICA FROM 1995 TO 2015.

AUTHOR	METHODS USED	FINDINGS	PRACTICAL/RESEARCH IMPLICATION
[8]	Surveyed 140 South African firms' annual reports over a 9 year period using content analysis.	Environmental reporting declined after it had initially increased. Disclosure of both general and specific information increased between 1994 and 1999, then reporting of specific information decreased 5 times more when compared to general information.	Legitimising corporate objectives can be achieved by using different information; that is general or specific and minimising quantity of reported environmental information.
[4]	Explored 10 Nigerian oil and gas firms' environmental accounting reporting practices.	Highlights that absence of standardised reporting frameworks, lack of regulations and inability to account for environmental costs negatively impacted corporate environmental disclosure.	An integrated firm environmental policy that is supported by a legislation is imperative to improve disclosure of environmental information.
[14]	Examined environmental and social reporting practices of 60 Egyptian polluting companies from various industries (utilities, food, pharmaceuticals, mills and storage, textiles, chemicals, beverage and tobacco, ceramics, cement, building materials and construction) for year 2002. Used a 34-item disclosure index that identified various sustainability items.	Noted significant variances in disclosure practices of the companies which were also highly descriptive and lacking credibility owing to absence of legislative instruments.	Longitudinal surveys that embrace non-industrial sector investigation is important. In depth-case studies are also important to acquire a comprehensive understanding of reporting.
[5]	Investigated sustainability disclosure and board representation of 40 Kenyan financial entities. Employed multiple regression techniques.	Explains that on average 15% of studied companies engage in sustainability reporting. There was a complete absence of reporting on employee turnover and productivity, recruitments, employment of special persons and assistance to retiring workers.	Board representation is significant to improve communication of sustainability issues. The presence of more women and more independent directors also enhance sustainability reporting.

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[9]	Scrutinised sustainability disclosure of 16 Ghanaian banks. Used qualitative research of firm websites.	Firms that won sustainability reporting awards showed poor presentation and organisation of data on websites whilst firms that did not win the awards showed better presentation and organisation of sustainability data on websites.	Companies experience challenges in transferring and reporting their practical operations to online environments. Online sustainability disclosure in emerging economies is non-existent.
[13]	Evaluated sustainability reporting of Mauritian companies by questionnaire survey to 300 qualified accountants.	Sustainability disclosure was implemented to sustain corporate image, attract investors and counteract bad media publicity.	Sustainability reporting should be monitored so that all stakeholder demands are addressed, and experts should be permitted to draft sustainability disclosure guidelines.

TABLE 2: DEVELOPMENTS ON SUSTAINABILITY ACCOUNTING AND REPORTING WITHIN THE CORPORATE IN AFRICA FROM 1995 TO 2015.

AUTHOR	METHODS USED	FINDINGS
[10]	Survey	Highlights that sustainability disclosure among Johannesburg Stock Exchange (JSE) listed companies has continued to heighten as evidenced by 82 companies which met the JSE Socially Responsible Index (SRI) standards with regards to environmental, social and governance (ESG) issues in 2014, when compared to only 72 companies as of 2013.
[15]	Survey	Highlights that the Zimbabwean Stock Exchange (ZSE) is extensively considering adopting sustainability and integrated reporting as the 61 listed companies did not manage to produce annual sustainability reports, a situation which can result in failure to attract investment prospects.
[12]	Survey	Adds that Zimbabwe is capable of attracting sustainable investments once the ZSE considers sustainability disclosure and environmental accounting reporting as a listing requirement.
[1]	Survey	Substantiates that African countries which have indicated strong intent in supporting sustainability reporting of listed firms are Zimbabwe, Nigeria, Ghana and Mauritius.
[11]	Survey	Concludes that JSE has the most advanced sustainability regulations in Africa. Ghana Stock Exchange has developed plans to initiate sustainability disclosure for listed companies. The Stock Exchange of Mauritius developed a Sustainability Index in September 2015, and the ZSE is consulting with relevant stakeholders on issues relating to sustainability listing requirements.
[3]	Survey	Indicates that evidence in Nigeria illustrates that most corporations in Nigeria have not adopted the standard format of sustainability reporting which is accepted globally owing to lack of transparency along with lack of adequate knowledge by the listed companies. The

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		author added that Nigeria accounts for only 2% in relation to compliance to Global Reporting Initiative (GRI) sustainability practice, a high 96% by South Africa and the rest of African countries make up 2%.
[2]	Survey	Having identified bad corporate governance in public entities expressed that modern Ghanaian corporate managers should begin integrating sustainability reporting as a business strategy since it is a mechanism that enhances business transparency and improves corporate accountability.
[6]	Survey	Adds that, although Mauritius' environment has been identified to be one of the best on the Sub-Saharan African continent, there is still need to motivate hotel owners to participate in greening initiatives such as waste management and recycling as the environment is progressively deteriorating.

(III) METHODOLOGY

This study is based on exploratory research. An exploratory research is implemented in relation to a research problem when there are few or no prior studies to consider [7]. Thus, exploratory research is a survey implemented when the research problem is not clearly defined. In this regard, scrutiny into the research problem is expected to provide viable insights to the researcher given the minute details of information available. Hence, exploratory research intends to determine if what has been observed is related to present existing events. Exploratory research also creates the initial groundwork for future studies. This study is exploratory in the sense that there has not been another study conducted on developments of sustainability accounting and reporting in Africa from 1995 to 2015.

(IV) RESULTS AND FINDINGS

TABLE 3: SHOWING THE FORM OF SUSTAINABILITY ACCOUNTING AND REPORTING ADOPTED BY AFRICAN COMPANIES FROM 1995 TO 2015

NATURE	FORM
Mandatory, Voluntary	Websites only
Mandatory, Voluntary	Stand-alone sustainability reports only
Mandatory, Voluntary	Integrated Reports only
Mandatory, Voluntary	Websites and Stand-alone sustainability reports
Mandatory, Voluntary	Stand-alone sustainability reports and Integrated Report
Mandatory, Voluntary	Websites and Integrated Reports

TABLE 4: SHOWING THE PROVIDERS OF SUSTAINABILITY ACCOUNTING AND REPORTING GUIDANCE ADOPTED BY AFRICAN CORPORATIONS FROM 1995 TO 2015

PROVIDERS FREQUENTLY ADOPTED	PROVIDERS LESS FREQUENTLY ADOPTED
Global Reporting Initiative (GRI) Sustainability Reporting Standards	The International Organisation for Standardisation (ISO 26000, International Standard for social responsibility)
The United Nation's Global Compact (UNGC) guidelines	The Organisation for Economic Co-operation and Development (OECD Guidelines for Multinational Enterprises)
Internally developed	Nationally developed

organisational standards	sustainability standards.
International Reporting (IIRC) guidelines	International Labour Organization (ILO) Tripartite Declaration.
	United Nations Guiding Principles on Business and Human Rights

TABLE 5: SHOWING THE DRIVERS OF SUSTAINABILITY ACCOUNTING AND REPORTING IN AFRICAN COMPANIES FROM 1995 TO 2015

MAJOR DRIVER	MINOR DRIVER
Corporate preservation	Image Government developed specific regulatory instruments
Social legitimacy issues	
Environmental consciousness concerns	
Good corporate governance and transparency concerns	
Improve attractiveness to investor groups	

TABLE 6: SHOWING THE MAIN STOCK EXCHANGES WHICH HAVE IMPLEMENTED OR UNDERTAKEN STEPS TO PROMOTE SUSTAINABILITY ACCOUNTING AND REPORTING IN AFRICAN COMPANIES FROM 1995 TO 2015

COUNTRY	EXCHANGE	YEAR ESTABLISHED	REGULATOR
South Africa	Johannesburg Stock Exchange (JSE)	1887	Financial Services Board (FSB)
Zimbabwe	Zimbabwe Stock Exchange (ZSE)	1993	Securities Commission (SeC) of Zimbabwe
Nigeria	Nigerian Stock Exchange (NSE)	1960	Securities and Exchange Commission (SEC) Nigeria
Ghana	Ghana Stock Exchange (GSE)	1989	Securities and Exchange Commission (SEC) Ghana

Mauritius	Securities Exchange of Mauritius (SEM)	1989	Financial Services Commission (FSC) Mauritius
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TABLE 7: SHOWING THE TYPE OF SUSTAINABILITY ACCOUNTING AND REPORTING MATERIAL DISCLOSED BY AFRICAN CORPORATIONS FROM 1995 TO 2015.

TYPE OF MATERIAL	COMPANIES REPORTING
Good sustainability news	Most African companies report on such issues.
Bad sustainability news	Few African companies report on such issues

(V) CONCLUSION

This study investigated corporate sustainability accounting and reporting developments in Africa over the last 20 years (from 1995 to 2015). Data were gathered through a review of empirical research and practical developments on sustainability accounting and reporting within the African corporate setting. Adopting exploratory research techniques, the findings from the analysis showed that most African companies reported their sustainability practices through the use of websites; stand-alone sustainability reports and integrated reports. Some companies also deployed any two of these forms on a mandatory or voluntary basis. The findings also add that global sustainability standards such as GRI, IIRC, UNGC along with adoption of organisational self-developed organisational standards represented the major providers of sustainability accounting and reporting guidance within African corporate settings. On the other hand, the minor providers were perceived as amongst others, the International Organisation for Standardisation (ISO 26000, International Standard for social responsibility), OECD Guidelines, ILO Tripartite Declaration, United Nations Guiding Principles on Business and Human Rights and, the still at the infancy stage, nationally developed sustainability standards. The study also substantiates that only the JSE- South Africa has implemented sustainability listing requirements in Africa whilst stock exchanges in Zimbabwe, Mauritius, Nigeria and Ghana show strong intentions. The research also contributes that corporate image preservation; social legitimacy issues; environmental consciousness concerns; good corporate governance and transparency concerns; and the desire to improve corporate attractiveness to investors are the main motivators that explain corporate sustainability participation in Africa. Government specific legislation still remains a minor driver since most African governments lack a direct legislation which

regulates corporate sustainability issues. Therefore, whilst there are significant developments with respect to sustainability accounting and reporting in Africa, significant stimulators such as availability of government support and availability of sustainability experts are imperative for long-term success.

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Materiality matrices: any incidences of impression management?

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SHORT ABSTRACT SUMMARY

Materiality matrices are a relatively new tool largely developed by professional bodies to identify the economic, social and environmental issues that matter to stakeholders. Through a preliminary empirical study, this paper aims to examine whether firms use these matrices as a new impression management technique to project a more favorable image of their social and environmental performance. Our findings indicate conspicuous incidences of impression management from a high materiality convergence level to issue selection bias.

Keywords: Sustainability Accounting, Impression Management

MAIN CONTENTS

The pivotal role of reporting material issues is confirmed in both GRI's Sustainability Reporting Guidelines (2013) and in its Implementation Manual (2013). According to the former, "materiality is the threshold at which the sustainability subjects covered by the Guidelines - known as 'Aspects' - become sufficiently important that they should be reported. G4-based reports should cover Aspects that reflect the organization's significant economic, environmental and social impacts; or substantively influence the assessments and decisions of stakeholders. Key stakeholders - such as investors, market regulators, civil society, suppliers, employees or customers - have a vital role to play in informing an organization's materiality assessment. Taking stakeholders' views into account is central to developing a robust understanding of a company's economic, environmental and social impacts, and of how these relate to business value and resilience". The Implementation Manual includes a figure called "visual representation of prioritization of Aspects" which is referred to in the following as "the materiality matrix" and comprises an X-axis labeled "Significance of economic, environmental and social impacts" and a Y-axis labeled "Influence on stakeholder assessments and decisions".

Through a preliminary empirical study, this paper examines materiality matrices from an impression management perspective to determine whether firms use such matrices as a new impression management technique. In other words, just as corporations appear to manipulate the narratives, visuals and graphs in their financial reports, they may also use impression management techniques in their sustainability reports to project a more favorable image of their social and environmental performance.

We investigate a sample of firms to determine their use of materiality matrices and whether this leads to presenting their firms in a more favorable light; our sample comprises all companies included in the GRI dataset "Sustainability Disclosure Database" (last accessed 1 December 2015) that simultaneously:

- a) are Incorporated in Europe;
- b) are Large companies;
- c) follow the G4 Guidelines;
- d) operate in the financial industry (according to the GRI wording, they develop "financial services");
- e) released their report in 2015 (for reasons of incontrovertible language interpretations, we only selected reports published either in English or in our mother tongue).

Point a) was chosen for comparability reasons, so as to exclude companies incorporated in countries well ahead in the field of sustainability accounting (South Africa and Australia, for instance), while point b) includes the largest companies, which - *ceteris paribus* - are expected to produce well-prepared financial and non-financial reports.

As a preliminary field of study, our paper deals with the financial industry, according to point d) above, since this plays a central role in the current European economy and yet, rather surprisingly, is not widely considered in accounting research on issues of sustainability, despite the paramount relevance of financial institutions with reference to environmental and social issues.

Our research question seeks to identify in our sample of financial institutions the current practice of using materiality matrices and the possible exploitation of these matrices as a new impression management technique.

In more detail, moving from the work of Eccles in 2014, we develop the following research (sub)questions:

- 1) *Stakeholder identification*: Are the specific stakeholders identified when developing the materiality matrix?
- 2) *Stakeholder engagement*: What engagement methods are adopted? To what extent do the companies pursue this engagement?
- 3) *Issue identification*: Which issues are included in the materiality matrix?
- 4) *Issue description*: How are the different issues described in terms of color and size?
- 5) *Dimension definition*: How have the X-axis and Y-axis been labeled? Do they relate to the current or the future state? If so, is there an explicit time dimension?
- 6) *Issue scoring*: Are the items measured? If so, is there a numeric approach (e.g., 1 to 5) or a word label definition (e.g., low, medium and high)?
- 7) *Use of the matrix*: Is the degree to which the company uses the stakeholder engagement and resource commitment matrix mentioned?
- 8) *Issue Coherence Level*: How are the same issues scored by different companies?
- 9) *Materiality Convergence*: Do the issues among companies and stakeholders converge in terms of the importance of a given issue?

10) *Selection bias*: Are there any impression management mechanisms in selecting items to be disclosed in the materiality matrix?

11) *Explicit approval*: Is there formal approval of the materiality matrix?

The main results of our work (in particular, the generic definition of relevant stakeholders, the combination of measures for stakeholder engagement activities, the scarcity of measures in materiality matrices and anomalies in the coherence level) lead us to conclude that materiality matrices practices are still in their infancy.

Moreover, conspicuous incidences of impression management are already visible from the high materiality convergence level to issue selection bias.

In this sense, our paper contributes to the advancement of knowledge in the field of sustainability accounting/integrated reporting and disclosure, since it confirms the use of materiality matrices as a new and potential area of impression management.

The significance of our results and their implications are closely related to the increasing impact of sustainability and integrated reporting for (especially) larger companies: these reports could be biased as financials could be, so they have to be carefully wielded.

That said, the results of our paper are still preliminary, due to a number of important limitations: the small number of reports examined (in terms of both the sample and the time-series) and the current methodology should be fostered with a more robust research for the future.

In this sense, fruitful streams of future research could expand our preliminary results using both time-series matrices and different industries.

Another avenue would be to apply the legitimacy approach, for instance, verifying if companies that perform poorly with regard to sustainability issues present matrices to elicit, *ceteris paribus*, more favorable stakeholder perceptions.

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Environmental Management Control Systems: A Construct Validation Study on Dimensions and Measures

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Environmental management control systems (EMCS) enjoy growing attention both in management research and in practice. In this paper we present the results of a construct validation approach using an exploratory and a confirmatory factor analysis in order to identify eminent dimensions and measures of EMCS and to mainstream research in this area. We base our analysis on a survey conducted among the 2,287 largest German companies.

INTRODUCTION

Guenther et al. 2016 [1] defined a framework for positioning EMCS within the topic of sustainability and relating its different controls to other subsystems such as environmental management accounting and environmental management systems. Following the framework we define EMCS as “a package that allows an organization to ground its future-oriented, operational and strategic management decisions on the collection and evaluation of environmental information covering all company functions and the entire value and supply chain.” Moreover Guenther et al. 2016 [1] identified 35 empirical studies that analysed different elements of EMCS. This analysis reveals that there is not yet a convergence observable towards a generally accepted construct measurement approach of how to measure EMCS. Drawing on a survey among the 2,287 largest German companies we conduct a construct validation study by applying factor analytic methodology. We split our analysis in an exploratory and a confirmatory part and mirror our results against existing approaches of measuring EMCS used in prior studies as well as against different concepts from general MCS research.

MCS AND EMCS

In general MCS research we find different conceptualizations approaching MCS. Strauss and Zecher [2] identify the concepts of the levers of control of Simons [3], the object-of-control framework of Merchant and van der Stede [4] and the MCS package of Malmi and Brown [5] to be the most prominent MCS conceptualisations, with the concepts of Simons and Merchant and van der Stede having been tested empirically so far. In EMCS research literature trying to capture the EMCS concept is still sparse. The 35 studies identified in Guenther et al. [1] only partially test one or several frameworks, moreover the authors compose their studies based on their own deliberations. Among those studies are the articles of Perego and Hartmann 2009 [6], Henri and Journeault 2010 [7] and Pondeville et al. 2013 [8]. As it is generally believed that EMCS must be considered a multidimensional construct, it is important to know, of which dimensions EMCS consists and how

the different dimensions relate to each other. We also do not yet know how to measure EMCS within each dimension. From the construct validity study we strive to learn about eminent elements of EMCS through identifying distinct dimensions by means of an exploratory and confirmatory factor analysis. Moreover we are eager to learn whether these dimensions can be merged for a package or even a system of EMCS.

METHOD

As EMCS is not yet explained by one generally accepted theoretical concept, we follow the methodological steps as applied in a construct validity study on corporate environmental performance [9]. We base our study on propositions provided by Edwards (2003) [10] and Schwab (1980) [11] and focus on the perspective of trait validity. We analyse the three components of such a study, i.e. reliability (What part of the total variance can be explained by the systematic variance?), convergent validity (In how far do the identified indicators express the same construct and converge to a common factor?) and discriminant validity (In how far do the identified indicators express different constructs?).

DATA

We base our analysis on a survey conducted among the largest German companies as registered in the AMADEUS database. We selected all companies that will have to report along the EU-directive 2014/95/EU, i.e. which have at least 500 employees. We excluded the financial sector, inactive companies and pure holding companies. Our final sample comprised 2,287 companies, out of which 297 sent back usable questionnaires. In order to retrieve the aspired information we designed a standardized questionnaire based on the total design method of Dillman et al. (2014) [12], in order to allow a structured collection of information on EMCS. The questions comprise all concepts identified in the 35 studies on EMCS using the original items.

CONCLUSION

Based on a representative sample of German companies we identify different dimensions of EMCS. Thus, this study contributes towards a better understanding of the concept of EMCS. The most prominent benefit of our study for research is that the use of the construct and its dimensions can mainstream future studies. Practice can draw on those dimensions for designing an overarching EMCS.

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Drivers of adoption of material flow cost accounting and control

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Extended abstract: MFCA (Material Flow Cost Accounting) is part of the EMA (Environmental Management Accounting) framework. Its concept and its application in practice are well documented in literature but it is not clear what drives its adoption. We conducted an extensive survey asking 2,287 big German companies to what extent they use MFCA and what kind of environmental management activities they undertake. In our analysis we want to find out which factors of environmental management influence the adoption of MFCA.

INTRODUCTION

The application of MFCA (Material Flow Cost Accounting) allows the analysis of material flows in a company in terms of both physical and monetary units at the same time. It helps managers to uncover inefficiencies of material use and shows costs which are hidden in the overhead costs of their traditional management systems. MFCA perfectly matches Esty and Porter's [1] description of a discovery tool, as MFCA discovers material losses and improves material and energy efficiency [2]. MFCA can help to increase resource efficiency and may supplement other environmental management tools, systems, and practices [3], [4]. Gathering the necessary data for a LCA (life cycle assessment) or for a MFA (material flow analysis) is sometimes an expensive task and the results should pay off this investment. Companies can benefit from the effort of conducting MFCA as lots of the data about flow structures, quantities and cost calculations is also used for LCA and MFA [3]. Hence, managers can use MFCA as a starting point for further analyses [5]. MFCA was developed over the past 20 years mainly in Germany and Japan [6] and became DIN ISO Standard No. 14051 in 2011. Although MFCA is recognized as a promising method to depict production costs and costs of waste [7], MFCA is not widely applied in practice [8]. Little is known about the factors what drives the adoption of MFCA. By understanding why some companies use MFCA, other companies can learn what requirements are necessary in order to gain benefits through the application of MFCA, namely a better environmental performance and a better financial performance.

METHOD

We designed a structured questionnaire and include important aspects of environmental management based on constructs introduced in previous works comprised in Guenther et al. (2016) [9]. Items referring to MFCA were specifically developed for this study. For our specific research question we select all questions connected to material flows. We then do a factor analysis for all items connected to material flows and interpret the factors.

By examining theories of adoption [10], [11] we gather all possible drivers (antecedents) of MFCA and control. We then take the items in our questionnaire associated to antecedents derived from theory and do a factor analysis for all items connected to antecedents.

DATA

Our sample comprises the biggest German companies in terms of turnover with more than 500 employees (sample size 2,287). We included all industries besides the financial sector due to potential distortions which may arise when calculating financial and non-financial performance indicators. The questionnaires were addressed to the environmental manager and could be answered in a printed format or online. Until December 2015 we received 287 valuable questionnaires.

EXPECTED OUTCOME

By applying an exploratory factor analysis (EFA) we examine two management dimensions of MFCA. One dimension is the management manifestation and the other is the operational management. When examining the management manifestation of MFCA we look at items concerning various efficiency parameters such as eco-efficiency indicators, material-efficiency analysis in physical units and material-efficiency analysis in monetary units and the usage of material flow analyses and the usage of MFCA. We subsume these items as relevant for the corporate environmental performance (CEP) [12] and - from a MFCA perspective - as material driven concerning the input of a manufacturing process.

In a second factor analysis we take items referring to costs and income due to the arising of waste and the management of waste. These items affect the operational management and - from a MFCA perspective - relate to the non-product output.

As a result we identify which of the factors influence the dimension MFCA management manifestation and which the dimension MFCA operational management. By this distinction we expect to get a clearer picture of the factors which drive the adoption of MFCA.

CONCLUSION

With this comprehensive study we get evidence about the adoption of MFCA in German companies and can draw conclusions about the factors which influence the adoption of MFCA. By considering these factors companies can facilitate the introduction of MFCA and benefit from using MFCA. Research can use the findings and test them in further studies.

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Implementation of environmental management accounting in hotel sector: challenges and barriers

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Abstract: *Despite the burgeoning number of studies on different aspects of Environmental Management Accounting (EMA), so far, little has been discussed empirically on the roadblocks/barriers in EMA implementations that could limit its potential. This paper therefore presents how the interaction of various contingent factors, and institutional and stakeholder pressures help organizations overcome the EMA barriers.*

INTRODUCTION

Due to the growing interest in the natural environment, there is a heightened interest from organizations internationally to adopt corporate environmental management strategies. In order to support these strategies, a growing body of accounting tools and techniques as a decision support tool, known as environmental management accounting (EMA), has emerged as an interface between environmental management and management reporting [1] [2] [3]. Reflecting the growing popularity of EMA is the growing number of studies on EMA in different context covering various aspects [2]. These studies reveal, among others, a fragmented adoption of EMA that inhibits its true potential for corporate sustainable development. Yet, so far, little has been studied empirically about how organizations overcome these roadblocks/barriers to EMA implementation potential [4]. This paper identifies how the interaction between various contingent factors and institutional and stakeholder pressures help organizations overcome EMA barriers.

LITERATURE REVIEW

Many companies make claims to some adoption of EMA activities. However, these practices often represent a few isolated experimental projects rather than systematic and comprehensive implementation [5] [6] [7]. Thus, opportunities exist for many companies for both business and environmental reasons to become more active in EMA, and the pressures on them to do so will increase [5].

As stated previously, despite the increasing number of empirical studies in the field, there are a few barriers that have been empirically identified. The limitations of conventional management accounting practices have been identified as the main force that impedes the better use of EMA practices. In explaining this, it is suggested that current accounting practice and the present accounting frameworks both hinder environmental initiatives and positively encourage environmentally harmful activities [8]. The key problems with conventional management accounting include the following: inadequate communication links between the accounting department

and other departments that collect environmental data, lumping/hiding environmental costs under general overheads, inadequate tracking of materials usage, flow and cost information, exclusion of external considerations in investment appraisal, assumption of immateriality of environmental costs, too narrow and short-term oriented performance appraisal techniques, absence of accounting for externalities and dominance of financial accounting [4] [9] [10]. It has further been identified that the scattered and incomplete data with regard to economic value of environmental impacts, lack of information on environmental cost items, insufficient knowledge and changes in working teams are impediments to EMA [11]. In addition, management awareness has been identified as an important determinant of management accounting practices [12] [13].

METHOD

This study was conducted between April, 2013 and May, 2014 in the hotels listed in the stock exchange in Sri Lanka. The Sri Lankan hotel industry was selected owing to the sector's noteworthy adoption of environmental management strategies and the significant influence of stakeholders and institutional forces in shaping these practices. These noteworthy practices have been often internationally recognized. The data was mainly collected through 34 semi-structured interviews covering 18 hotels with hotel managers, engineers, naturalists/environmentalists, accountants and regulators. In addition, we used on-site observations made in various facility centres of hotels. As a means of triangulation we used document analysis.

FINDINGS AND DISCUSSION

In explaining the EMA barriers, the inadequate link between the accounting and other departments has been suggested as a principal barrier [8] [10]. The study shows that this situation does not exist in many of the hotels studied. This is mainly due to the fact that the fragmentation of information does not exist in many hotels due to the way the hotels are structured and geographically located. Further, the management reporting systems prevalent in hotels also contribute to this. All the hotel sites have a separate accounting, housekeeping, kitchen and engineering department at the site level. The information required for the implementation of EMA is often collected by these departments at various facility levels such as the kitchen, laundry, plant, etc. As a practice, they meet every day with the accountants and discuss various issues pertaining to their departments. Further, the information collected at different facility levels by the various departments is sent to the accounting departments for the preparation of reports for the top level management. As these hotels are

located in different areas of the country, the top level management exercises control through these reports. Therefore, to cater to the top level management information needs, the data including the environmental information to be collected daily and shared with the accounting department that has the final responsibility for preparing these reports. Thus, inadequate communication links between accounting and other departments in retarding the adoption of EMA is not an impeding factor in the hotel sector.

In explaining another limitation in conventional management accounting, it is suggested that much environment-related cost information is often 'hidden' in overhead accounts [4] [9] [10]. In this backdrop, the study finds that all the collected environment-related costs are not assigned to the products/services a hotel offers. However, it is difficult to say that these costs are hidden in the overheads due to the reporting structure prevailing in the hotels. The hotels have established separate cost centres. The significant environment-related costs such as materials, energy and water are separately recorded by a majority of organizations for every cost centre. The establishment of separate cost centres and accumulation of costs for these centres has been largely influenced by the requirements set out in ISO 14000. As these costs represent a significant proportion of the cost for the hotels, they are anyway compelled to identify and monitor them separately and more stringently. They have various recording systems such as Green Books, daily and weekly energy and waste meetings, energy, waste and water reports, all of which track environment-related costs. Thus, in the Sri Lankan hotels most of the environmental costs are separately tracked and monitored due to their materiality.

Moreover, in explaining another limitation in conventional management accounting, it has been identified that the materials use, flow and cost information are often not tracked adequately in traditional cost accounting [4] [6] [10]. However, this argument is not exactly applicable to the hotels as far as their operations are concerned. As they are into the service sector there is no material loss as outlined by [10] except in the cost centres such as kitchen and laundry which are anyway monitored through other mechanisms mentioned. On the other hand, the hotels have separate management information systems at the site level. Hence most of these flows such as energy, materials, water, etc. are often tracked adequately. As stated previously, their reporting structure is such that most of these costs are carefully monitored and recorded for the purpose of reporting to the top-level management. Further, in generating a green image for the hotels, the reporting of these flows and savings of environment-related costs is of paramount importance. Thus, their reporting structure tracks these items adequately due to these reporting pressures from internal management and external stakeholders. Hence, inadequate tracking of materials use, flow and cost information are not a limitation of traditional management accounting in the hotels sector in Sri Lanka.

Investment decisions which are often made on the basis of incomplete environmental information have been further identified as a limitation of conventional management accounting [4] [9] [10]. However, once again, the study finds that this limitation is not very relevant in the context of hotels mainly due to the regulations that govern the tourism sector. For any investment, hotels have to obtain environmental licences from different authorities when a project is initiated and when a hotel is in operation. These licenses require a comprehensive analysis of the impact on the environment. Furthermore, there are certain projects aimed at promoting the green concerns in the tourism sector such as the 'Greening Sri Lankan Hotels Project'. These projects also promote the concerns of the environment when capital budgeting decisions are made. Hence, the study identifies that most of the limitations of incomplete information are not relevant as barriers to the practice of EMA in the Sri Lankan hotel sector.

The study finds that management awareness of the practice of EMA techniques does not decide the EMA practice despite the findings of [12] [13] [14]. We found that management awareness of the practice of EMA techniques is at a low level in the selected hotels. But this has not retarded the adoption of EMA among the hotels. This is mainly because despite their awareness, they carry out various EMA practices/techniques at their hotels for various reasons such as internal and external reporting pressure, regulatory pressures, marketing, etc. This phenomenon once again highlights that EMA has been developed in the hotel sector in response to various institutional and stakeholder pressures [15] [16]. Moreover, we identified that many contextual factors as described in contingency theory [17] also shape the hotel sector's EMA adoption. However, a systematic and holistic approach has not been developed to reap the full potential that EMA offers. This necessitates a comprehensive framework to guide the adoption of EMA. It should be noted here that none of the professional accounting bodies or any professional association connected to the tourism sector in Sri Lanka has issued any guidelines/manual pertaining to EMA as is witnessed elsewhere in the world. The lack of specific guidance in the practice of EMA has been identified as a barrier to the diffusion and adoption of EMA [6] [18] [19].

CONCLUSION

This study demonstrates how the listed hotel sector in Sri Lanka overcomes EMA barriers in adoption and implementation due to contextual factors and various institutional and stakeholder pressures. It suggests some mechanisms that various actors such as corporate management, professional accounting bodies and regulators could initiate to achieve in better EMA adoption.

However, the findings of this study have their limitations owing to the limited number of interviews undertaken, the specific sector and the country chosen, and time period in which the study was conducted (particularly at a time when there is a tourism boom in Sri Lanka). In future studies, these findings can be further explored by

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way of case studies or surveys covering different industries and contexts.

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Theoretical and Practical Issues of Material Flow Cost Accounting in Forestry and Wood Production

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Extended abstract: Forestry and wood-based industries are two different sectors that are directly linked and form a closed production chain. From the perspective of wood mass production, forestry is the first link of this production chain. In the other part of the chain where the wood mass is converted, we can find sawmill operations, furniture industry or paper mills. Decisive at using the material flow cost accounting in this production chain is particularly the approach to the valuation of forestry. The aim of this paper is to evaluate material flow cost accounting of supply chain in forestry and wood industry.

INTRODUCTION

The practical application of material flow cost accounting (MFCA) is generally possible in all industries [1]. As to forestry, however, one has to take into account specific features of the sector [2]. In relation to the MFCA application, this concerns especially the long production period, simultaneous outputs, non-monetary goods, etc. In terms of the long-term character of the production process, it is necessary to choose such an area size of cultivated forests for MFCA, in which all stages of production process alternate within a year and a relatively stable annual profit (self-sufficiency) is achieved [3]. Forests have simultaneous outputs, many of which are not easily marketable. Most important in terms of costs is the wood-producing ecosystem function of the forest [4]. Intended for the other ecosystem functions is a so-called wake theory, which assumes that non-timber products and services of forests are provided in the wake of regular forestry for timber production [5]. This theory declares that a properly managed forest simultaneously fulfils all expectations of the public.

METHODOLOGY AND RESULTS

For wood production, a standing tree is both the factory and the final product. In cultural operations, standing tree is a product in the long-term work process [6, 7]. In the course of work process, forest is a working object. When it is not a working object, biological processes (process of growth) take place therein. In the case of natural regeneration of the forest, forest is a working object. In the course of the production period, material flows can be identified, with one of main materials being the seed of forest trees, and the product being a tree (assortment). The production process takes place during the entire rotation period, not so the working process though [8].

The production process in forestry starts with the collection of forest tree seeds. This is followed by the treatment of seeds and their storage, and by operations in the forest nursery, which represent sowing, transplanting and lifting of young plants. The young

plants are used in reforestation, which is followed by the tending of young trees. A long-lasting stage of production is represented by cleaning, thinning and by the final operation – timber harvesting with timber being hauled to the roadside landing. Timber haulage can be placed in the production process between forestry and timber industry. Quantitative centres in forestry can be graphically represented as follows (see Figure 1).

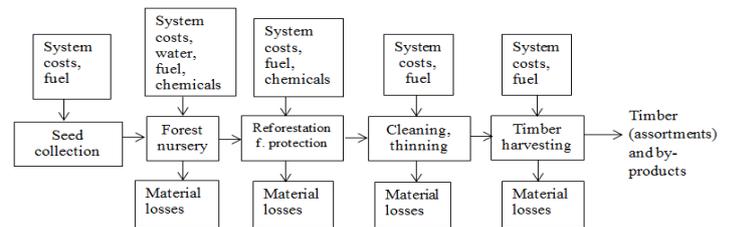


FIGURE 1: QUANTITATIVE CENTRES IN FORESTRY.

Material inputs in forestry relate mainly to labour force and to the means of mechanization employed. Common inputs are fuels and chemicals. An important input in the case of forest nursery as a quantitative centre is water. Material losses in the forest nursery as a quantitative centre are insignificant. Seedlings that failed to take roots are material losses in the third quantitative centre (< 15 %). Small wood (logging residues), which is processed in the Czech Republic in the last 15 years for fuel chips at the stages of thinning and felling and represent therefore a by-product depending on demand in specific localities. Nature conservation authorities prescribe according to actual conditions amounts of logging residues that are to be left in the stand as a source of nutrients. Here, a question arises whether this is a material loss or an input for the subsequent forest stand. The procedure of allocating costs to individual outputs is based on physical units (m^3).

Consequently, sawmill production, furniture manufacture and other methods of timber conversion can be included in the second part of the production process. The most significant operation in sawmill production is the breakdown of logs. The main material entering the quantitative centre is round wood. As such, it passes through the production process, yielding individual outputs (sawn timber, chips, bark, and sawdust). The procedure of allocating costs to individual outputs is based on physical units (m^3), see Figure 2.

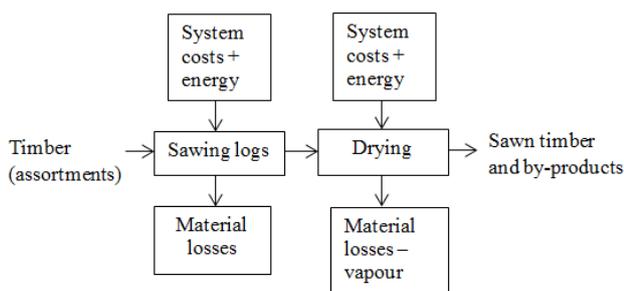


FIGURE 2: QUANTITATIVE CENTRES AT SAWMILLS.

Sawn timber is a product, which finds most applications in building industries. There the production chain ends with the building industries being the final consumer of the sawn timber. By-products are chips, bark and sawdust [9]. Some twenty years ago, these outputs were considered material losses. At the present time, however, they represent important by-products increasingly demanded, bark in particular, which is used in gardening for mulching. Thus, material losses are incurred mainly in the second quantitative centre – at drying out where a loss can be considered the evaporated water.

MFCA was used in practice at the Training Forest Enterprise in Kostelec nad Černými lesy. Advantage of this enterprise is that its orientation covers the whole production chain from seed collection through nursery management, tending of forest stands and timber harvesting up to conversion at a sawmill and sales of final products. Benefits in forest management can be seen not only in the above-mentioned general areas of activities but also in the costs related to material losses and sales of logging residues (Figure 3).

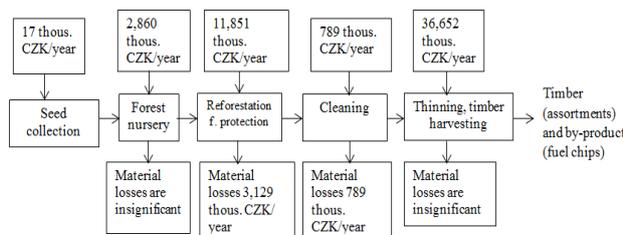


FIGURE 3: COSTS AND MATERIAL LOSSES OF QUANTITATIVE CENTRES IN FORESTRY AT THE TRAINING FOREST ENTERPRISE IN KOSTELEK NAD ČERNÝMI LESY IN YEARS 2010–2015

At the same time, the advantage is obvious of the assessment of the complete production chain and accommodation of the assortment in timber logging to the customers purchasing the timber at sawmills (Figure 4).

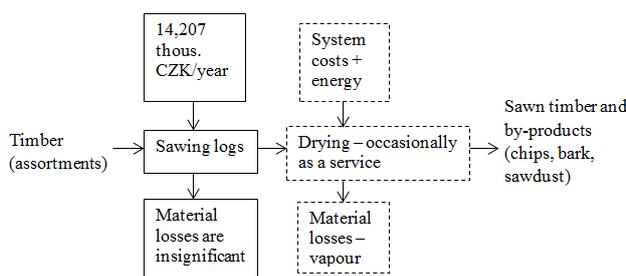


FIGURE 4: COSTS AND MATERIAL LOSSES OF QUANTITATIVE CENTRES AT THE TRAINING FOREST ENTERPRISE IN

KOSTELEK NAD ČERNÝMI LESY – SAWMILL IN YEARS 2010–2015

The final sawmill product cannot be affected at the beginning of its life cycle, i.e. in the forest nursery and during the rotation period, the reason being long rotation. Moreover, reforestation is governed by the Forest Law, namely by forest management plans, and also by the forest management certification (PEFC), which is crucial for sustainable forestry [10]. Aggregate data for the whole production chain are presented in Table 1.

TABLE 1: BENEFITS AND MATERIAL LOSSES AT THE TRAINING FOREST ENTERPRISE IN KOSTELEK NAD ČERNÝMI LESY

Year	2010	2011	2012	2013	2014	2015
Sales of raw timber (CZK/m ³)	1,107	1,233	1,464	1,487	1,581	1,545
Thinning, timber harvesting by-products (CZK/m ³)	×	×	×	1,763	1,704	1,773
Wood production (products and by-products CZK/m ³)	2,373	2,630	2,687	2,716	2,825	2,830
Material losses in supply chain (thous. CZK)	2,475	2,914	2,837	5,565	5,966	3,749

CONCLUSION

With the introduction of MFCA, benefits can be expected in the production process optimization. In forestry, however, this optimization is hampered by the long production process since the demand for specific assortments cannot be predicted ahead for ca. 100 years. This is why the optimization is focused primarily on the species composition, methods of reforestation and thinning, and on grading at timber logging. Reduction of corporate costs concerns in particular the stages of reforestation and thinning where the costs are the highest (reforestation) and can be affected by different methods of thinning. Reduced environmental impact can be expected in the production process optimization with respect to technological procedures and choice of technology. Similarly as in the other sectors of industry, the application of MFCA influences innovation activities, improvement of decision-making processes and labour organization also in forestry and timber industries. Taking into account a considerable decentralization of working sites, enhanced work organization is one of important contributions.

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Resource efficiency in action – compilation and evaluation of 100 case studies in German manufacturing industries

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Extended abstract: The German federal state of Baden-Württemberg has commissioned the Institute for Industrial Ecology (INEC) at Pforzheim University and further partners to compile and evaluate 100 company case studies on resource efficiency in the state's manufacturing industry. Intermediate results reveal a huge range of resource efficiency applications that cover various aspects of industrial ecology including closed material loops, zero waste strategies, energy efficiency, and design for environment. This contribution explains project and case study design and procedures and highlights preliminary results from single case studies as well as from the overall evaluation. The results affirm previous observations on the huge resource efficiency potentials within manufacturing and reveal barriers to and success factors for resource efficiency measures.

INTRODUCTION

A secure and commercially viable supply of critical raw materials is essential for industry, especially for the production of high-tech goods. As a matter of fact, the efficient utilisation of raw materials is a crucial topic for more and more companies. Therefore, a wise resource policy has to secure access to raw materials and promotes measures for using materials and energy in a resource efficient manner. In this instance, resource efficiency means either to produce the same amount of goods with fewer resources or to produce more goods with the same amount of resources.

There are many ways to increase resource efficiency, e.g. by

- avoiding or decreasing rejects, defects or remnants in production,
- reduction of operating supplies or energy,
- light-weight design or miniaturization,
- substitution of critical raw materials,
- recycling and intensified supply chain collaboration
- using share economy principles in manufacturing and
- lean management

The German federal state of Baden-Württemberg is highly industrialised and features innovative high-tech industries and competitive manufacturing companies in a broad range of industries. Resource efficiency is a top priority for many companies in Baden-Württemberg and hence the federal ministry for the environment, the federal state's associations of general industries, chemical industries, mechanical engineering, electronic industries, and the chambers of commerce founded the "Baden-Württemberg Alliance for Resource Efficiency".

PROJECT DESIGN

The Alliance for Resource Efficiency commissioned Pforzheim University's Institute for Industrial Ecology, the University of Stuttgart and the state-owned environmental technology agency "Umwelttechnik BW" to identify 100 best practice case studies on resource efficiency at industrial sites in Baden-Württemberg in order to provide inspiring examples and thereby motivate companies to increase their efforts in material and energy efficiency. To achieve these objectives the three research partners set up a project called "100 Betriebe für Ressourceneffizienz" (100 companies for resource efficiency) and requested applications for case studies. As a first step, applying companies had to submit a questionnaire. Subsequently, case studies were verified, and selected by an interdisciplinary jury. The main selection criteria were the degree of innovation, the transferability and the magnitude and significance of resource savings. At current, case studies are written up in a consistent format and will then be published in a compendium. Accompanying and follow-up research comprises the valuation and elaboration of case study details, publication of single case study results, and a comparative evaluation and assessment of all cases.

RESEARCH CONTEXT

Many studies on energy efficiency in industries have been published [1]. Energy audit is a well-established instrument to enhance energy efficiency, and energy intensive industries show a large saving potential. On average, more than 10 % of energy end-use could be saved by energy efficiency measures over all industries [2]. At the same time, the material side of resource efficiency is by far less well documented and published. Material efficiency is discussed on the conceptual level [3],[4] and policy instruments for promoting material efficiency were examined [5]. Empirical studies on material efficiency and expectable saving potentials are scarce.

The research design within the project is predetermined by the fact that the project aims at the dissemination of best practice examples. It combines individual case studies within each of the 100 companies and a comparative case study design to compare the outcomes of the individual studies. This allows for the in-depth analysis of the specific, perhaps even unique settings within a particular business as well as the generalisation of results and identification of common patterns and success factors (cp. [7] for case study research in general; and [8] for a comparative case study approach in the field of EMA).

PRELIMINARY RESULTS

This section highlights preliminary results from evaluating and comparing the 100 case studies. It starts by highlighting some individual case study results in Table 1 in order to demonstrate the variety and heterogeneity of companies involved as well as the variety of resource efficiency applications.

TABLE 1: EXAMPLES OF COMPANY CASE STUDY OUTCOMES

Company	Resource efficiency application
Felss Shortcut Technologies	The company invented a rotary swaging machine to replace shape cutting based manufacturing of steering shafts. This led to 59 % reduction of overall material consumption and annual savings of 136 t of steel, 42 MWh electricity, and 25 t CO ₂ -emissions.
Lorenz GmbH & Co. KG	The company has started to remanufacture their water meter products resulting in a 30 % demand reduction for primary material and energy savings of 150 MWh p.a.
Eduard Merkle GmbH & Co. KG	By investing in a drying and sieving device for its stone quarry, former waste is now processed into a valuable by-product, which reduces annual resource depletion by 60,000 t and brings along saving of energy and explosives, too.
Gebrüder Otto GmbH & Co. KG	The company has developed a new spinning technique, which enables the production of high quality yarn using up to 50 % of recycled fibres and hence reduces the huge environmental pressures caused by growing cotton.
Rhein Chemie Additives	A comprehensive reassessment of material flows and process engineering helped to close the phenol cycle, has reduced the demand for phenols by 150 t per year, and lowered waste water treatment cost substantially.
Emil Frei GmbH & Co. KG	Redesigning the cleaning process of varnish production facilitated the introduction of a degradable and less harmful solvent that led to VOC emission reductions of 98 % as well as financial savings.

At current, evaluation and comparison of the 100 case studies is work in progress. Nevertheless, some general observations can be derived.

Resource efficiency has proven useful and beneficial regardless of industry type and company size. Chosen measures, level of sophistication, and consequent management processes vary substantially, though.

In almost all cases, resource efficiency is driven by competitive advantages such as productivity increase or innovation leadership. Environmental benefits and improved working conditions are either additional drivers or highly appreciated side-effects.

The case studies reveal the strong interlinkage of energy and material usage, or more precisely, material efficiency increase as precondition for various energy efficiency improvements.

In practice, resource efficiency comprises a rather huge set of applications covering many aspects of industrial ecology and life cycle thinking, e.g., closing material cycles, supply chain collaboration, remanufacturing, reuse of machinery, recycling instead of downcycling, or better use of by-products. Also it supports zero waste and green productivity strategies by by innovation of high-tech and low-tech solutions, improved monitoring and management, and increased material and energy flow transparency.

A common scheme within the case studies is the observation that successful resource efficiency requires cross-functional and interdisciplinary teams within and beyond the companies.

The before mentioned preliminary observations reaffirm various studies in the field, including [8],[9],[10].

CONCLUSION

The project “100 Betriebe für Ressourceneffizienz” shows a variety of different case studies on the topic of resource efficiency. The case studies represent a wide range of industries from mining and quarrying over almost all manufacturing industries to utilities. Companies use different efficiency strategies for their operations: Tool, process, and product innovation, energy planning, recycling, re-manufacturing, or green supply chain management. Most of the case study companies apply a set of strategies resulting in multiple measures concerning the whole company. Furthermore, it seems that it is easier for larger companies to put resource efficiency in practice. Small and medium companies often lack personnel resources for comprehensive efficiency projects. Therefore, it is crucial for smaller to cooperate with companies in the supply chain or to take advice from consultants.

The selected case studies show a large transferability potential, in times where companies are eager to find ways to reduce their costs or to increase their output. For this reason, the project “100 Betriebe für Ressourceneffizienz” meets the interest of many stakeholders and its impact is expected to go far beyond the state of Baden-Württemberg.

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Control theory for sustainability

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Abstract: The present work presents the fundamentals of the Control theory, proposes a methodology for sustainability based on the Control theory and the Feedback to follow up and tell a tool of continuous operation and process improvement. Shows how the control can be the basis of eco-design, which plays a central role in balancing technical, economic, environmental to achieve optimized sustainability performance throughout the product lifecycle as one of its applications. Finally, they are briefly presented in the conclusions the scope that has a focus for sustainability from the Control Engineering and what are the steps to be followed for the implementation of a modelling and design of a control system based on sustainability for improve the sustainability.

INTRODUCTION

Sustainability is a concept strongly linked to efficiency. When one speaks of a sustainable operation is expected with power consumption reasonable in the operation, proportional to the expected results. An optimal use of materials is hoped, and the smallest number of waste. It is certainly impossible to know that there is optimum consumption of energy, materials, and waste generation without comparison to other similar processes, without implementing a continuous improvement, and if not it is continuously rethinking alternative ways to the realization of the tasks required. For sustainable operation it is essential to measuring and managing data, and this in turn requires the implementation of instruments that provide the necessary data. The data require mathematical methods for analysis, statistical analysis to generate. With models it is possible predict and correct behaviour, therefore, redesign the operation and return to the source of the data and handle that can be manipulated with the aim of improving the results.

CONTROL THEORY

The principle of the Control theory is the feedback. The studied system should be considered as a whole. Usually the control starts from a model to be able to predict and correct the system's behaviour, which can come from mathematical rules or an identification method. To apply feedback, graphically the system closes with a loop, which takes the measurement of the output and compares it with the desired state. The controller is the element that receives the comparison and performs them changes necessary in the input of the system to get the output desired. The controller may have different configurations. In machines, the most common is to apply a PID controller, which has calculated constants to act on the system in a desired way. In a economic system, the controller is a set of rules, to the style of a system diffuse, which performs

different actions on the system depending on the current state in comparison with the desired output.

In the Figure 1 it is possible to observe the main control system elements: Reference, Control system, Manipulated signal or input, controlled system, Observed output and Sensor or measurement element [4].

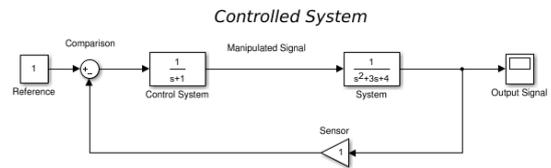


FIGURE 1: REPRESENTATION CONTROLLED SYSTEM.

This representation has great utility for the treatment of sustainability systems, since is possible design them strategies corrective to keep a sustainable growth in concordance with the management of those natural resources.

THE ROLE OF CONTROL THEORY

Applying automation, systems of monitoring and improvements, for example in the cities, the largest source of pollution, it is possible to have a direct impact on the generation of greenhouse gases getting sustainable development.

As aforementioned elements: Instrumentation, analysis and design; that makes immediate reference to the pillars of the Control theory, which is aimed at the comparison of data with a desired state of the behaviour of certain phenomenon and makes the changes that can be applied depending on the model of the system to achieve the desired state of affairs. In practically all the phenomena of nature and man there is measurement and correction. In the heart of the Control is feedback. In nature there is an example of feedback such as: Homeostasis, Earth's Hydro-cycle, prey-predator behaviour. Feedback leads to a reaction to a behaviour that is wrong. The block diagram of input-output is the compression and based upon preparation of a specific problem for the implementation of an analysis and reaction to erroneous behaviour policies [3].

SUSTAINABILITY AND ENERGY EFFICIENCY, EXAMPLES

Taking for example the energy consumption, since 1980 the total consumption has risen 45 %, and it will double in 2030. The carbon dioxide in the atmosphere has risen more than 33% since the industrial revolution. Implementing an energy efficiency action can be achieved till 30%, that means, only applying an efficiency program it is possible to obtain an

improvement cheaper, cleaner, quicker, sustainable than other solution. Energy efficiency does not mean reduced production, but implementation of energy conservation and actions to obtain the saving. With passive energy efficiency a company can save between 10 to 15%, with further automation could be other 5 to 15%, with monitoring program by noticing deviations and allowing to correct them quickly could be 2 to 8% for example in an electrical generation system: The magnetic energy harvesting (MEH), presented in 2014 in the National Science Council, Taiwan, was obtained a 120% improvement in the system by applying a control loop and by means of a collection system [1][2].

CONCLUSION

In this extended abstract is presented briefly the main elements of this proposal: An introduction to Control theory and its potential use in efficiency and sustainability. The presentation will show how it is possible to integrate the Control theory as a method of sustainable management, monitoring and correction. In particular, as a method for projecting a sustainable economic growth that takes into account the intelligent use of natural resources, and as a tool to track the management of materials and waste generation.

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Carbon management in logistics and transportation: identifying gaps in the literature

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Extended abstract: While many studies have addressed the issue of environmental sustainability within the supply chain as a whole, no attempt so far has been made to investigate specifically the current status of carbon management related literature in logistics and freight transportation. This paper aims to fill this gap by providing a systematic literature on carbon management in logistics and transportation to categorise the research according to key topics in order to identify gaps in the literature.

INTRODUCTION

Carbon management or carbon mitigation has recently become an increasing concern among both academics and practitioners [8], [15]. On the one hand, the growing importance can mainly be attributed to environmental concerns, such as global warming or climate change [9], increasing levels of pollution [10] and rising societal and stakeholder awareness and pressures [1]. Additionally, other key factors such as the regulatory risks through changes in government policies, change of customer demands and the increasing adoption of international certification standards have gradually led companies to look at carbon management practices with increasing attention [2], [13].

LITERATURE REVIEW

Many contributions on these topics have been made in the extant literature, sometimes under the environmental sustainability area or under the 'green supply chain management' label [14], [16]. However, little attention has been given specifically to carbon management in the logistics and transportation sector despite that fact that logistics accounts for around 5.5 per cent of global carbon emissions and can thus be regarded as a significant contributor to global warming [3]. Moreover, papers dealing with carbon management from a perspective of third-party logistics providers (3PL) are still limited [4], [20], [21]. It is nonetheless interesting to note that research on these topics has gradually increased, thereby exposing the need to investigate carbon management and its practices within companies that are involved in logistics and transportation, either in-house or 3PL providers. As such, an initial attempt to categorise and review carbon management in logistics and transportation may prove particularly beneficial.

As far as the authors are aware, no literature review in peer-reviewed journals has specifically examined carbon management practices by adopting the viewpoint of companies performing logistics or transportation activities. From a broader (i.e. environmental sustainability) perspective, we found a review of environmental sustainability practices in the logistics service industry by Evangelista [5]. Using a case study in Italy, Perotti et al. [21] provided also a comprehensive

overview about environmental sustainability practices in logistics, similar to Marchet et al. [18]. However, all these papers address carbon issues only partly and did not focus specifically on carbon management or carbon reduction initiatives, revealing a gap in the literature.

METHODOLOGY / ANALYSIS

To close this gap, this paper has the objective to offer a review of the contributions on the topic of carbon management from the perspective of companies involved in logistics and transportation. In particular, an overview about the main characteristics of the literature will be provided, followed by a content analysis of the key topics in carbon management to identify gaps in the literature. As a consequence, the analysis is divided into two parts. The first part analyses the main characteristics of the literature, i.e. publication year, journal title, countries and research methodology. In the second part, the content of the articles will be analysed. The definition of the key topics for the content analysis had the aim of opening a discussion on the key topics that emerged from the literature analysis. For the purpose of this review, five key topics were identified to group the carbon management literature in the logistics and transportation sector. Two of them are derived from the classification framework proposed by McKinnon [6] and Tang and Luo [11], namely carbon strategy and carbon risk assessment. Moreover, two other main topics were identified: carbon target setting [11], [19] as well as carbon performance and reporting [12], [15], [17]. In order to reflect the importance of the logistics area, carbon reduction initiatives has also been included as a main topic [1], [7], resulting in five key topics: carbon strategy, carbon risk assessment, carbon target setting, carbon reduction initiatives and carbon performance and reporting.

Within these groups, 15 critical elements (or 'sub-groups') have been identified. Each of these elements represent a unique feature or dimension in the key topics of carbon management and was identified according to its role in facilitating management planning and in assessing, monitoring and evaluating climate-change issues in the logistics sector. The allocation of the papers according to the key topics and elements provides a solid foundation to identify gaps and to propose directions for future research.

CONTRIBUTION

The literature review in this paper involves 66 peer-reviewed journal articles on carbon-related management issues in logistics and transportation published between 1996 and 2015. It needs to be emphasized that our search deals with content only related to carbon management practices specifically in the logistics and transportation.

This included the manual screening process of all abstracts as well as the main body to validate the relevance of the respective journal articles. Relevant journal articles had to demonstrate a specific and narrow focus on carbon management practices. Consequently, all journal articles which did not fulfil this criterion were excluded from this study. The papers were analysed in terms of their main characteristics and their content.

The contribution of this paper is twofold: First, this paper is the first study that reviews and categorises carbon management issues in the logistics and transportation sector. Second, our study identifies research gaps of carbon management issues for the logistics and transportation sector and provides a theoretical foundation for future research.

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Strategizing Sustainability through Management Control: Insights into Barriers and Enablers from Two Case Studies

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Extended abstract: Our paper examines factors influencing the strategizing of sustainability through management control within companies. We build on the management control and organizational theory literatures to investigate the cognitive, organizational and technical inhibitors and facilitators for sustainability strategy implementation. Drawing upon qualitative analysis of interview, focus group and documentary evidence, we compare two UK corporate contexts: a successful sustainability strategy implementation with an unsuccessful one. Our results reveal distinct factors which can facilitate or prevent the “strategizing of sustainability” through management control, and enhance our understanding on how inhibitors and facilitators interact with each other to shape the process of sustainable strategy-making.

INTRODUCTION

Organizations that genuinely seek to achieve sustainability need to pursue a set of non-financial objectives in addition to financial ones. ‘Managing’ sustainability thus requires the design of new patterns of incentives to shape behaviors within the organization [1, 2] as well as the development of calculative tools aiming at ‘governing’ the non-financial domain [3, 4] and ‘controlling’ progress in the search for sustainability performance and compliance with stakeholder expectations [5]. Such calculative practices in form of control systems which ensure sustainability compliance and trigger and shape emerging moves toward sustainability have been explored in a growing number of studies in recent years [6, 7, 8 9]. In this context, particular attention has been paid to the enabling and constraining role of controls – often referred to as the ‘dual roles of controls’. In our paper we aim at clarifying what factors influence the enabling and constraining roles of controls and how these factors interact with each other in the process of sustainability strategy-making. Following Gond et al.’s [8] conceptualization of strategic sustainability integration through management control we distinguish between cognitive, organizational and technical factors and aim to shed light on the role and relationship of these factors by analysing and comparing two UK corporate contexts, a case of successful integration of sustainability and a case of failure in which sustainability is progressively marginalized.

BACKGROUND

The role of management control systems for sustainability strategy

How can management control systems advance sustainability? Recent research on management control for sustainability has acknowledged the strategic role of control systems for creating enabling and constraining forces needed to strategize sustainability (*dual role of*

controls) and organizational capabilities to implement and formulate corporate strategy [6, 8, 9, 10]. The integration of sustainability into management control systems can motivate employees to perform and align their behaviour with sustainability goals of the organisation and, by creating feedback loops, controls can be used for monitoring performance on critical success factors, identifying exceptions and deviations from initial plans, and initiating corrective action. Thus, the development of systems can be crucial for consolidating organizational changes and ‘freezing’ what has been learned [11]. However, previous research has shown that control systems not only constrain employee behaviours in setting precise goals and targets (*constraining role*), they also help managers create motivational forces for driving sustainability by providing incentives for the search of sustainability (*enabling role*) [see, for example, 6, 7, 12, 13]. As sustainability remains for many organizations a new challenge and is still perceived as a moving target surrounded by numerous uncertainties, control systems can be used to attract managers’ and employees’ attention for sustainability, and, consequently, support open discussions and dialogue of underlying assumptions and action plans that drive related organizational activities [8]. Hence, control systems can be crucial for triggering and shaping emerging moves toward sustainability within organizations, and to enable top managers to facilitate strategic renewal through sustainability.

This *dual role of controls*, a design attribute of control systems, needs to be distinguished from the *objectives of controls*, namely compliance and performance [14]. *Compliance* involves the use of controls to support management in meeting regulatory requirements [15]. In the context of sustainability, the notion of compliance is applied not only to applicable laws and regulations but also to different types of stakeholder pressures. Various studies [e.g. 16, 17] have illustrated that environmental and sustainability control systems are used to respond to legal and/or stakeholder pressures and to ensure that organizational members will respect the law and business codes of conduct. Strategic control for sustainability *performance* aims at increasing awareness among organizational members for drivers of value and promoting integration of sustainability through improved information for decision-making [18]. Here, sustainability control measures are relevant for value creation and associated with a company’s future performance. Perhaps most illustrative is the phrase “triple bottom line” [19] in which ecological, social and economic criteria of performance are expected to be

integrated.

It has to be noted that individual controls can have more than one objective and that the dual roles of controls (enabling and constraining) can be applied to both compliance-related controls and controls which are used as a performance management tool [14]. Moreover, not only the way in which control systems are designed but also presented and perceived by different organizational members may lead to resistance.

Factors influencing sustainability strategy making through management control

Prior research has shown that different sources of resistance in controlling sustainability issues inside organizations do exist and various enablers can positively influence strategy making within organizations. We know from prior research that the implementation of new ideas and control practices is associated with high rates of failure and that the potential of new control systems or amendments to existing sets of controls often do not reach their full potential [e.g. 20]. These studies are mainly concerned with the nature and sources of resistance to change and are increasingly based upon organizational and psychological theories literature. For example, Hofmann and Bazerman's [21] work on individual and social resistance to change in the context of sustainability implementation suggests that psychological and organizational sources of resistance can influence sustainable transformation and that alterations in organizational structures and individual interests and biases are required to overcome obstacles to sustainability implementation [see also 22]. Building upon on their work, Gond et al. [8] conceptualize the integration of sustainability and strategy through management controls as a socio-technical process and suggest considering cognitive, organizational and technical dimensions for the analysis of intra-organizational accounting and control practices in relation to sustainability strategy. Their approach to theorizing the roles and uses of control systems for sustainability strategy appears beneficial for future studies into sustainability integration as its broad notion of integration potentially captures a large diversity of relevant factors as well as their relationships. A too narrow account for and analysis of possible factors influencing the implementation process might overlook critical and subliminal barriers or enablers [23]. We consider and present in our paper key contributions and insights gained from research on the implementation and change of management controls along these three dimensions. Following other scholars [e.g. 24, 25, 26, 27] we differentiate between individual and collective cognitions, a distinction only implicitly made by Gond et al. [8], and discuss organizational and technical factors together.

RESEARCH DESIGN

We combined individual interviews and focus groups in a three-stage data collection process that we scrupulously replicated for each of the two cases.

At stage 1, we conducted a set of exploratory individual interviews with three to four respondents at the executive level from sustainability/CSR department and the finance and/or accounting department. These individual interviews aimed at obtaining information on the various control systems deployed within each organization and their intended use as enabling or constraining forces by top managers to comply with external expectations and drive organizational performance. The discussions lasted on average 57 minutes and provided us with the perspective 'from the top' on the intended use of control systems. These interviews were transcribed and read by the researchers in order to gain knowledge of the organization within which the focus groups were to be conducted.

At stage 2, we conducted within each organization two separate focus groups, one with middle managers and employees from the sustainability/CSR department, the other with middle managers and employees from the finance/accounting department (average length: 110 min). We used the data collected from the focus groups to compare and contrast perceptions of both groups about the role and use of control systems and, together with data from individual interviews, this provided rich material to help determine barriers and enablers at play. We relied on these data and those from prior interviews to describe how the control systems identified were used and for which purpose, and to analyse which barriers and enablers were prevalent. These findings were compiled in the form of an interim report and sent to the participants from both groups for further discussion and validation. The interim report served as a basis for discussions during stage 3 of data collection.

At stage 3, we conducted a third focus group at each organization with the purpose of discussing, refining, and validating our prior findings within the organizational context (average length: 89 min). These final focus groups were composed of participants from both sustainability/CSR and accounting/finance who participated in the prior focus groups. We completed our primary data collection at stage 3 with group discussions at the executive levels with the respondents initially interviewed at stage 1 when possible, in order to collect their views on our findings and to refine and validate our findings.

We complemented the process of primary data collection with the collection of secondary data for the two corporate cases. Externally, we collected press releases about each case study company; information about their ranking in various sustainability league tables and ratings; and company sustainability reports, published accounts and financial reports. These data were mainly used at the exploratory stage and facilitated the selection of organizations in revealing their self-perception in the sustainability domain. Internally, we collected all relevant accounting, accountability and control systems data that were made available to us by organizational members. In particular, we accessed internal and confidential documents describing the organization and design of the control systems as well as reflecting the ways of presenting data. The research

design is described in Figure 1.

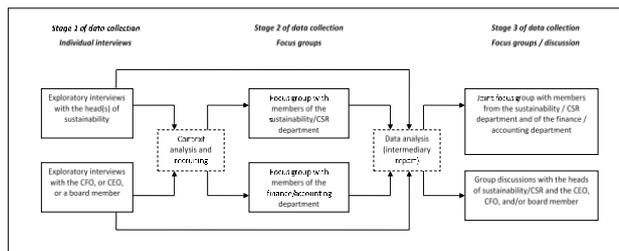


FIGURE 1: DESCRIPTION OF THE RESEARCH DESIGN

INITIAL RESULTS

Overall, our findings have revealed distinct factors for the integration of sustainability and strategy and enhance our understanding of sources of acceptance and resistances in controlling sustainability issues inside organizations. The analysis is currently on-going, in particular with regard to the combined effects of inhibitors and facilitators in influencing management control systems and the strategic approach to sustainability.

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Online CSR communication by listed companies: a factor for enthusiasm or disappointment?

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Extended abstract: The purpose of this study is to analyse the online CSR communication of the 70 largest listed companies in the so-called “DACH region” (Germany, Austria and Switzerland). The research question is how online CSR communication is currently executed by the companies and which aspects of this kind of CSR communication tend to influence stakeholders to perceive the CSR information either positively or negatively. Its findings show that the Austrian companies are most likely to disappoint their stakeholders, while the Swiss companies perform slightly better, which suggests that their stakeholders are less disappointed or even more satisfied by their online CSR communication, and German companies perform best as they have some of the results which were most likely to satisfy stakeholder expectations. The practical value of this study is that it can help CSR communication practitioners reflect on their current practices if they wish to improve or design better online CSR communications to ensure stakeholder satisfaction.

INTRODUCTION

Studies on the online CSR reporting by the DAX30 companies were conducted at Leuphana University of Lüneburg three times from 2004 to 2012 [1]-[3]. Their results show that the overall amount of online CSR reporting has increased over time. However, it is possible to distinguish between three groups of companies: (1) Those companies which have either always achieved good results or increased their reporting gradually over time, (2) those companies which started as one of the best companies but then decreased reporting over time and (3) the companies that were part of the sample from 2004 but only started their online CSR reporting at a later stage.

Necessarily, the study itself adapted over time. While issues like CSR communication on social media or linkages from the product website to the CSR area on the corporate website were not yet relevant in 2004 and 2007, they were covered at a later stage once they became relevant. The current study defines online CSR communication as communication on the corporate website and on different corporate channels such as the product website or social media channels.

The study distinguishes between how well the companies fulfil stakeholder expectations by analysing criteria in four categories: provision of information, accessibility of information, comprehensibility of information and dialogue. A comparison of the three previous studies shows that there was increased coverage for some of the criteria over time, while others were unchanged. This is especially true for the results in the category ‘dialogue’ which saw the least development over time.

The purpose of this study is three-fold. First, it aims to continue the study of online CSR communication which has already been done on the German listed companies. Second, it analyses the online CSR communication of the

40 largest listed companies in Austria and Switzerland which allows comparisons amongst the online CSR communication practices of listed companies in the so-called “DACH region” (Germany, Austria and Switzerland). By doing so, the study contributes to filling a gap in the research on cross-national differences in CSR communication that have been identified in the literature. Here, Furrer et al. (2010, 393) described such research with regard to CSR as being in an “embryonic state.” The third purpose is to analyse, for the first time, the relevance of online CSR communication for stakeholders. In order to predict stakeholders’ reactions to online CSR communication, the criteria assessed are classified using the Kano model of satisfaction. According to this model, the fulfilment of some criteria is likely to be perceived as dissatisfactory or satisfactory but somehow expected, while the fulfilment of others can lead to stakeholder enthusiasm just because they were unexpected functions. Although the research tool predicts stakeholders’ expected reactions to communication criteria using levels of dissatisfaction versus satisfaction or enthusiasm, in practice the reactions are understood to result from the positive or negative mediating influence of the criteria on how stakeholders process the information provided. The research thus questions whether, with this framing effect, the companies’ online CSR communication practices activates a positive or a negative mood for the further perception and evaluation of their CSR information.

METHODOLOGY

The corporate websites and further corporate online communication channels were systematically analysed to determine their use of the internet’s potential for CSR communication. In the first step, data was collected using a set of criteria divided into four different categories: provision of information, accessibility of information, comprehensibility of information and dialogue. The total set includes 28 criteria with four levels each. In order to increase the reliability of the collected data, first results were presented to and discussed with company representatives of the DAX. In the second step, the collected data was analysed to assess its potential to disappoint or enthuse the company stakeholders. For this purpose, the Kano model of satisfaction was used in order to demonstrate which criteria, related to provision, accessibility and comprehensibility of information or dialogue, would lead to stakeholder disappointment, indifference, satisfaction or even enthusiasm.

FINDINGS

First results with regard to the differences between the three countries show that Austrian companies are most

likely to disappoint their stakeholders because their online CSR communication only provides information but does not fulfil potential stakeholder expectations for the other clusters of criteria, i.e. the Austrian results are disappointing because not enough of the relevant criteria were identified for the three categories accessibility, comprehensibility and dialogue. Swiss companies perform slightly better, which suggests that their stakeholders are less disappointed or even more satisfied by their online CSR communication, but they may be disappointed by the lack of opportunity for dialogue. However, stakeholders of the Swiss companies are probably not enthusiastic about the overall amount of online CSR communication in the four categories. In this regard, German companies perform best – even though they tend to neglect the categories information accessibility and comprehensibility – and especially dialogue.

The Kano model of satisfaction can be used to predict whether stakeholders in all three countries will be more enthusiastic when they find criteria which they had not expected, such as an archive function for online information, links from different parts of the corporate website to the CSR section, and criteria that facilitate the comprehensibility of information. Enthusiasm increases because these tools exceed the basic expectation to find mere information; instead stakeholders are helped to access and understand the communications.

CONCLUSION: ORIGINALITY & LIMITATIONS

The criteria set was taken and adapted from previous studies of online CSR communication in Germany, and its reliability was checked. For the first time the study was enlarged to include the two German-speaking countries Austria and Switzerland, which allows a comparison of the national results. Furthermore, the data was analysed for the first time with regard to its potential for stakeholder disappointment or enthusiasm according to the Kano model. This discussion could assist CSR communication practitioners in their reflection on current

online CSR communication practices and how to design them better to ensure stakeholder satisfaction.

The classification of criteria according to its potential for raising enthusiasm could be seen as subjective because not every stakeholder will be dissatisfied, satisfied or feel enthusiastic due to the same online CSR communication tools such as archives, links etc. Additionally, it can be argued that good (online) CSR communication practices do not guarantee a good overall CSR perception by stakeholders. In reality, companies which obtain good results in this study may nevertheless be criticised for bad business or CSR behaviour.

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Overcoming current challenges in sustainability reporting: Insights from a Swiss study

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The sustainability reporting of companies currently faces several challenges caused by the recent publication of new reporting guidelines. A current research project examines possibilities for overcoming these challenges. Based on practical consultancy knowledge and two case studies, in banking and in tourism, a tool set has been developed that meets the most pressing needs in the fields of value chain analysis, materiality assessment, stakeholder engagement and target-group-oriented reporting. The tool set is being empirically tested to validate its usability and benefits in a company setting. Results can help companies worldwide to optimize their sustainability reporting.

INTRODUCTION

Sustainability reporting is used increasingly by companies as an instrument to communicate, in a systematic manner, any relevant impact of their business activities on nature, society and the economy [1, 2].

Two regulatory documents have recently been published, the Guidelines of the Global Reporting Initiative (GRI G4) and the Integrated Reporting (IR) Framework of the International Integrated Reporting Council. As a consequence, companies worldwide are confronted with a changing reporting landscape which forces them to address, among other things, the following challenges: (i) choosing the most suitable guidelines to adopt, (ii) incorporating the changes of GRI G4 and the new requirements of IR in their reporting and deciding on (iii) the degree of integration (of sustainability topics in the financial report) and (iv) how to customize their reporting in accordance with the different needs of specific target audiences [3]. There is currently no approach that assists companies in handling these issues.

This study aims to fill this gap by investigating possibilities for overcoming current challenges in sustainability reporting based on practical consultancy knowledge and two case studies in the banking and tourism industries. The project team for the study consists of researchers from two Swiss universities of applied sciences, consultants from a Swiss sustainability consultancy and the sustainability managers of the two case study companies.

This extended abstract describes the methodology used before presenting the findings and conclusion and discussing the originality and limitations of the study.

METHODOLOGY

After conducting a literature review and a science-practice dialogue with a sustainability consulting company and the two case study companies, the currently relevant challenges of sustainability reporting were defined. Next, the sustainability reporting practices of the two case study companies were analysed. This was done

using a gap analysis comparing the companies' current reporting practices with the new reporting guidelines. Together with the sustainability consulting company, methodological tools based on this analysis were developed to address the challenges that had been identified. This tool set is currently being tested together with the two case study companies.

FINDINGS

The most relevant challenges of current sustainability reporting according to sustainability consultancy practice concern value chain analysis (i.e. describing the most relevant sustainability topics and impacts along the value chain), materiality assessment (i.e. deciding on what topics to include in a sustainability report and what to leave out), stakeholder engagement (i.e. deciding on how to best integrate stakeholders' knowledge and expectations) and target-group-oriented reporting (i.e. deciding on how to tailor the report to the needs of the target audiences that have been defined). The gap analysis for both case study companies showed weaknesses in all four areas, which supports the information provided by the consultancy.

Accordingly, the tool set developed to address these issues comprises the following elements:

- for the value chain analysis, (i) a best practice collection and criteria to achieve a suitable graphical representation of the value chain and (ii) an analysis tool to identify the most important topics and impacts along the value chain;
- for the materiality assessment, (i) a multi-criteria evaluation tool to more precisely measure the materiality of sustainability topics based on criteria of both GRI G4 and IR, (ii) a tool to more effectively decide on the threshold level in the materiality assessment (i.e. where to draw the line between topics that are reported and topics that are not reported) and (iii) a tool to consistently define topics for the materiality assessment at the same degree of resolution;
- for the stakeholder orientation, (i) a database which assists companies in analysing their sustainability context more closely; and,
- for the target-group-orientation, a tool set (i) to define the target groups of a sustainability report, (ii) to define the communication goals, (iii) to decide on the reporting format (e.g. stand-alone sustainability report or integrated report), (iv) to identify best practices and design elements to best address target audiences and (v) to evaluate the impact of target group-oriented reporting.

DISCUSSION AND CONCLUSION

Currently, the tools are being empirically tested in the two case study companies to validate their usability and benefits in a company setting.

As this study is based on consultancy knowledge from various industries and the tools are developed in a general manner (not specifically for a certain industry), it can be tentatively assumed that research findings will be useful in helping companies all over the world to improve their reporting practices and master current challenges in sustainability reporting.

ORIGINALITY AND LIMITATIONS

The strength of the study lies in its practical orientation. The project is done in cooperation with a Swiss-based consultancy for corporate responsibility management and reporting. The tool set was designed with input from both the consultancy and the case study companies on how to best address corporate needs. The case studies suggest that companies can benefit from

using the tools to optimise their sustainability reporting processes. At the same time, the study contributes to the scientific knowledge on sustainability reporting and on how current challenges might be overcome.

The scope of the study is limited to one country and two case study companies with sector-specific characteristics. It might, therefore, be queried to what degree the case study findings can be generalised to a wider sample of companies from different industries.

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Environmental performance indicators for carbon management: Evidence from Japanese companies

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Abstract: The aim of this exploratory study is to examine the importance and use of environmental performance indicators (EPIs) for carbon management. This research focuses on the association of carbon strategy, involvement of the top management, duration of the environmental management system (EMS), and company size with the importance and use of EPIs for carbon management by Japanese manufacturing companies.

INTRODUCTION

The governments of many countries have been discussing climate change management for over two decades now. Accordingly, countries have set goals to reduce their greenhouse gas (GHG) emissions, and companies play a vital role in this process. Some companies focus on technological innovation as environmental strategy. In recent years, researchers have studied how environmental or sustainable management systems support companies' carbon strategies [1, 2] or integrate carbon management with their economic activities [3]. The aim of this study is to identify the environmental performance indicators (EPIs) used by companies to support their carbon management initiatives.

THEORY

This study focuses on the importance and use of EPIs for carbon management. In this study, EPIs for carbon management are based on the GHG Protocol [4]. This standard asks companies to report GHG information, some of which is required, and the rest, optional. Required information includes separate reporting of company and inventory boundaries and emissions data for Scope 1, 2, and 3. Optional information includes relevant ratio performance indicators (e.g. emissions per sales). Accordingly, we focus on companies' absolute emissions as required information in the questionnaire. These indicators are classified by company and inventory boundaries. In addition to EPIs connected to GHG emissions, we add two indices: energy expense and volume of energy input. Energy expense is a financial EPI. Volume of energy input is the input indicator that must be disclosed as part of sustainability reporting under the Global Reporting Initiative (GRI).

Regarding the use of management accounting information, Ferreira and Otley show feedback and feed-forward use of information as one mechanism of a performance management system. Feedback information is 'used to enable the undertaking of corrective and/or adaptive courses of action', and feed-forward information is 'used to enable the organization to learn from its experience, to generate new ideas and to recreate strategies and plans' [5]. Companies need to reconsider

the given strategies and plans in an attempt to fulfil stakeholders' requirements and remain competitive [6]. Therefore, to gain a competitive edge, companies working actively in carbon management use EPIs for feed-forward control. The first two and the last two items in Table 1 under 'Uses of EPIs' refer to feedback use and feed-forward use, respectively.

The contextual factors used in this study are carbon strategy, involvement of the top management, duration of the environmental management system (EMS), and size of the company. Three of the four variables are based on Henri and Journeault [7]. Additionally, involvement of the top management has been indicated as an important factor for carbon management [1].

RESEARCH METHODOLOGY

The data were collected using a survey design. The purpose of this survey was to investigate carbon management in Japanese manufacturing companies. The sample comprised 891 manufacturing companies listed in the first section of the Tokyo Stock Exchange. The survey was conducted in February 2015. A questionnaire was sent to the environmental departments or top management of the companies. In total, 121 questionnaires were received, indicating a response rate of 13.6%.

Respondents were asked about the use of EPIs at their companies and their strategy for carbon management. Answers were recorded using a seven-point Likert-type scale.

This study used the Paired *t*-test to verify whether there were differences between the extent of importance and usage of EPIs for carbon management and each contextual factor: active or passive carbon strategy, the duration of the EMS at the company, and the size of the company. As carbon strategies comprise a variety of actions, it is difficult to classify them [8]. Twelve of the items in the questionnaire referred to carbon strategies. Companies with a mean score for carbon practices that was above the average compared with the corresponding score of all respondents were considered active, whereas companies with a mean score below the average were considered passive.

The duration of the company's EMS was counted from the first year of its introduction. The size of the company was based on the number of employees. Like the carbon strategy criterion, both variables were categorised into two groups: companies that introduced the EMS early or late, and small and large companies. Although Henri and Journeault [7] referred to compliance with the ISO 14001 EMS, this study adopts the duration of the EMS (such as ISO 14001) as a variable because almost all respondent

companies have established an EMS already. We categorized companies as those that introduced the EMS between 1995 and 1999 (early) and those that introduced it after 2000 (late) because the median year is 1999.

RESULTS AND DISCUSSION

We use the results of the *t*-test in order to explain the association of the companies' carbon strategies, involvement of the top management, duration of the EMS, and sizes on the importance and use of EPIs for carbon management.

Carbon strategy

The results of the *t*-test suggest that carbon strategy is associated with the importance and use of EPIs, which is in agreement with Henri and Journeault [7]. Table 1 suggests that companies that adopt an active carbon strategy attach more importance to the measurement of EPIs than those that use a passive carbon strategy, regardless of the type of EPI.

Regarding the use of EPIs, Table 1 suggests that companies that adopt an active carbon strategy use EPIs more significantly in both the feedback and feed-forward process than companies with a passive carbon strategy.

Involvement of the top management

The results of the *t*-test suggest that companies with higher involvement of the top management attach more importance to the measurement and use of EPIs than those with less involvement. However, there is no significant difference in the energy expense between the two types of companies. This result indicates that EPIs measured in terms of a physical unit are not easily accepted by companies' staff, and the involvement of the top management is needed. However, a financial performance indicator such as energy expense does not need the additional support of the top management to be accepted by the staff.

Duration of the EMS

Regarding the importance of EPIs, the results show that companies that introduced the EMS early or late differ with regard to the application of EPIs by their respective consolidated subsidiaries. The scope also indicates significant differences between the two groups.

Regarding the use of EPIs, the results of the *t*-test suggest that companies that introduced the EMS early tend to use EPIs as feed-forward control to a greater extent than those that introduced the EMS late. This is because the feedback process is a basic component for all companies that implement the EMS. Moreover, the feed-forward use is useful for companies that use it strategically. Companies that implement an EMS over a long time period may strategically adopt it toward carbon management.

Size

Larger companies attach more significance to EPIs than smaller companies. However, there are no significant differences in terms of energy expense and volume of total energy input between the smaller and larger companies. The descriptive statistics show that smaller companies place more importance on these two EPIs and that the averages of these two EPIs are higher for smaller companies (e.g., 5.16 and 5.38 under the column titled 'Small' in Table 1). Moreover, there are significant differences in terms of the scopes of the indicators between the smaller companies and their larger counterparts.

Regarding the use of EPIs, larger companies place more importance on feedback and feed-forward control.

CONCLUSION

The results of this study suggest that the importance and use of EPIs for carbon management are basically associated with carbon strategy, involvement of the top management, duration of the EMS, and company size. However, the importance given to energy expense, which constitutes financial information, is not associated with involvement of the top management and company size. The duration of the EMS is positively associated with EPIs aggregated across consolidated subsidiaries and not with EPIs aggregated in a domestic business. Finally, companies that introduce the EMS early tend to use EPIs as feed-forward control. While these findings provide important insights, a more detailed study is necessary to fine-tune them.

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Table 1 appears on the next page.

Table 1: Results of the paired *t*-test

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	Carbon strategy			Involvement of top management			Duration of EMS			Size		Sig.
	Active	Passive	Sig.	High	Low	Sig.	Early	Late	Sig.	Large	Small	
Importance of measuring												
GHG emissions (domestic)	6.02	4.38	**	5.86	4.69	**	5.59	5.02	n.s.	5.82	4.66	**
GHG emissions (including subsidiaries)	5.00	2.96	**	4.90	3.22	**	4.77	3.27	**	5.18	2.93	**
Scope 1	6.46	5.11	**	6.45	5.25	**	6.30	5.47	**	6.55	5.08	**
Scope 2	6.08	4.71	**	5.88	5.05	*	5.91	5.04	**	6.25	4.63	**
Scope 3	4.69	2.65	**	4.40	3.13	**	4.30	3.22	**	4.28	3.20	**
energy expense	6.00	4.98	**	5.71	5.33	n.s.	5.80	5.18	*	5.68	5.38	n.s.
total energy input	5.90	4.81	**	5.74	5.03	n.s.	5.59	5.16	n.s.	5.62	5.16	n.s.
Uses of EPIs												
to confirm whether the goals have been	5.65	4.30	**	5.48	4.61	**	5.40	4.80	*	5.54	4.48	**
improvement in order to attain the goals	5.61	4.09	**	5.41	4.44	**	5.27	4.70	n.s.	5.34	4.42	**
to reflect to goals before knowing results	5.15	3.38	**	4.95	3.76	**	4.86	3.88	**	4.92	3.75	**
to reflect the carbon strategy	5.37	3.25	**	5.14	3.69	**	4.90	3.94	**	5.18	3.60	**

* and ** indicates significance at $p < 0.05$ and $p < 0.01$ respectively.

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Measuring and communicating sustainable business progress Unilever Bright Future Index

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ABSTRACT:

The Bright Future Index is a measurement tool developed to track the progress that Unilever DACH (Germany, Austria and Switzerland) makes in becoming a sustainable business. It aims at strengthening the sustainability culture of the organisation and further embedding its sustainability strategy as a key performance driver for all business operations to make it an integral part of decision making and employee behaviour. It visualises how sustainability is integrated as a key metric defining business goals and achievements on project/initiative level. It is thus a decision and communications tool.

Keywords: sustainable business strategy, innovation, measurement & communication tool, sustainable business progress, change management, organizational culture

1. INTRODUCTION

Unilever's global strategy is built to achieve the purpose of "making sustainable living commonplace". Social and environmental ambitions are defined through the Sustainable Living Plan (USLP), which helps the business to de-couple growth from environmental impact while increasing positive social impact, driving profitable growth for brands, saving costs and fueling innovation. The USLP sets three ambitious goals for 2020: to help more than 1 billion people improve their health and well-being; to half the environmental impact of our products; and to enhance the livelihoods of millions of people through all elements of the value chain.

We use a simple framework to show the impact of sustainability on the business by delivering more growth, lower costs, reduce risk and generate trust. It provides employees with further strategic guidance across all categories and brands.

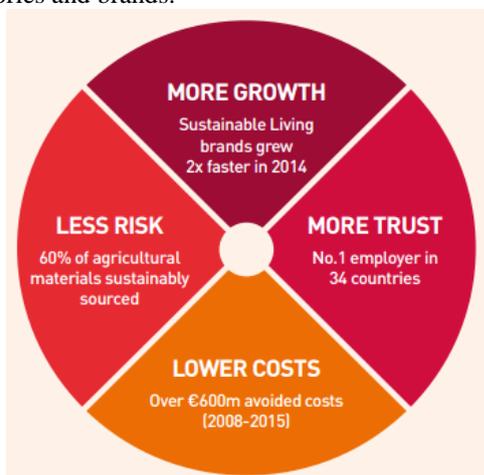


FIGURE 1: SUSTAINABILITY BUSINESS IMPACT FRAMEWORK
1. MORE GROWTH

Consumers are responding to campaigns by brands such as Ben & Jerry's and Omo on issues ranging from sustainable sourcing to water scarcity. Their interest and engagement are translating into sales growth and greater brand awareness. In fact, the Sustainable Living brands delivered nearly half of the growth (46%) and grew significantly faster than the rest of the business (30%). Sustainability creates innovation opportunities, pushing Unilever to rethink product design in a world of finite resources. It opens up new markets and allows brands to connect with consumers in different ways to meet their changing needs.

2. LOWER COSTS

By cutting waste and reducing the use of energy, raw materials and natural resources, the business creates efficiencies and cut costs, while becoming less exposed to the volatility of resource prices. Cost avoidance and savings help to improve margins. Unilever has achieved cumulative cost avoidance of over €600 million through eco-efficiency in factories since 2008.

3. LESS RISK

Sustainable ways of doing business help the business to mitigate risk across all operations. Operating sustainably helps to future-proof the supply chain against the risks associated with climate change and long-term sourcing of raw materials. By 2015, 60% of all agricultural raw materials were sustainably sourced.

4. MORE TRUST

Placing sustainability at the heart of the business model strengthens relationships with stakeholders and helps succeed as a business. It helps to maintain value and relevance to consumers, while inspiring Unilever's current and future employees. In 2015, the business maintained its status as the Graduate Employer of Choice in the fast-moving consumer goods sector among our target universities across 34 countries.

2. CHALLENGES & DECISION MAKING

The Unilever DACH organisation is on a journey, from one where sustainability is treated as an "add-on" (because business performance and sustainability is managed separately) to one where sustainability is deeply embedded and institutionalised amongst leadership and employees.

Currently, the business is dealing with three key challenges that the Bright Future Index addresses and thus, tries to overcome:

1. **Sustainability business case:** Business performance is measured through three main indicators - turnover, market share and profitability. To date, the biggest challenge is to demonstrate how sustainability has a

measurable impact on performance. Available data only shows correlations between performance and sustainability but we cannot claim causality between the two. One of the reasons for this phenomenon is the fact that sustainability-related information is managed separately from business performance, thus resulting into conflicts of targets from time to time.

Sustainable business decision making requires informed management decisions, which in turn requires a robust set of information provided by adequate information systems that can be fed by different functions throughout the organisation in a pragmatic way.

2. **Leadership:** The leadership team does recognize that sustainability is not yet sufficiently operationalized and does not play a big enough part in daily decision making or internal communication. It is understood, that the organisation misses the opportunity to leverage the USLP as an integral part of the ‘lived culture’ where it is fully embedded into the operations and communications and thus an enabler for equitable, sustainable growth. There is a lack of data that can be integrated in regular performance updates from the leadership team addressing the progress on sustainability.
3. **Employees** do know the USLP and its relevance for the overall corporate strategy. They understand the global vision and feel motivated to work for a company which has a purpose “to make sustainability commonplace“. However, it is not clear enough how each employee in Unilever DACH can contribute to that vision and how contribution is linked to business performance, like equitable growth. There is a need of a constant reminder in every day operations for employees regarding the Unilever purpose and benefit that comes from living it.

The Bright Future Index helps to overcome the three key challenges by making the business case for sustainability tangible. The business case can thus be communicated by the leadership team in a meaningful and consistent way. Employees in turn, identify with the visible progress towards becoming a sustainable business and actively contribute and engage with the USLP.

3. DESCRIPTION OF THE CASE

Projects and initiatives across all brands and departments within Unilever DACH are collected according to “Gold”, “Silver” and “Bronze” criteria to feed the tool with data. Criteria is based on specific targets, that respond to the four value drivers - more growth, lower costs, less risk and more trust. The relation between value drivers and matching targets is visualized in the Sustainable Growth Wheel (see Figure 2).

To be mapped in the Index as a Bronze Project, at a minimum, the project or initiative must:

- a. Contribute to one or more of the USLP targets
- b. Respond to those external issues and opportunities that are most relevant in the DACH market.

To be mapped as a Silver project, or be upgraded from Bronze to Silver, the project must additionally deliver significant business impact through either sales growth, cost reduction risk avoidance or trust building. The sustainable growth wheel helps to identify opportunities and gives guidance on target and KPI setting.

To be mapped as a Gold project, or be upgraded from Silver to Gold, the project must additionally:

- a. Be within the circle of influence of the local DACH organisation (i.e. no projects that merely executed due to orders from the head office)
- b. Deliver significant quantifiable business value through either sales growth or cost reduction
- c. The sustainability aspect of the project must be communicated to relevant stakeholders (consumers, customers, media, etc.) in a timely fashion.

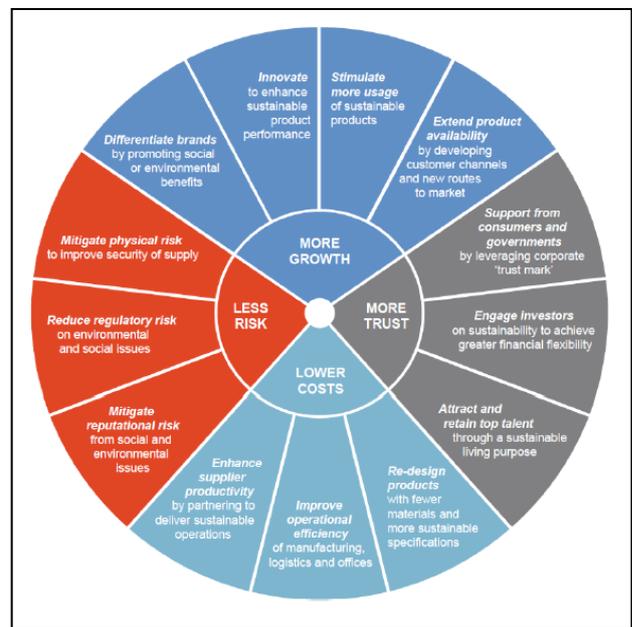


FIGURE 2: SUSTAINABLE GROWTH WHEEL

4. FUNCTIONALITY

The backend of the index is managed in Excel, whereby information needs to be manually entered by project owners. Required information includes for example, project name, description, owner, goals, KPIs or target comments. To facilitate the collection and categorization of the data, a variety of input is managed by pre-set dropdown selections, project start/end date, USLP target, global/local project, country, brand and product category and stakeholders addressed.

One of the four primary value drivers (see figure 1) need to be selected. The choice of the value driver dictates a selection of possible targets KPIs, which the project owner need to input. The value driver descriptions and corresponding target KPIs can be seen in Table 1.

Value driver	Possible target
More growth	--> financial target Volume/Turnover/Market Share/Purchase intent/Distribution/SPS/VPS/Wiederkaufraten.
More trust	--> support from stakeholders, Market share, brand equity, top talent acquisition
Less Risk	--> avoided losses to the business, avoided reputational risks, risk of security of supply
Lower cost	--> financial target Gross Profit/GM improvement

TABLE 1: TARGET ALLOCATION TO VALUE DRIVERS

In its current guise, the value drivers are not fully accounted for in possible target setting. Allocating each value driver with a corresponding and relevant target framework is a major short term goal.

The KPI ‘more growth’, for example, focuses on the ability that projects with a sustainability element have in contributing to the growth through the respective project. It is assumed, that the most effective measurement of growth is underlying sales growth (USG). USG reflects the change of revenue at a constant rate of exchange. In this case, the change of revenue would be the incremental turnover generated by a project (iTO). The value driver ‘lower costs’ is measured in absolute terms or in percent of turnover. Because costs are reduced throughout the value chain. Therefore, it is possible quantify the impact of sustainability in business goals.

For ‘more trust’, the key question remains as to how brand equity is improving due to activating sustainable brand purpose. To support the quantification, it is assumed that the best available option are the data trackers provided by market research firms like Nielsen or Millward Brown. They are able to track consumer confidence in a number of markets simultaneously. It allows understanding the reasoning for consumer purchase power and gives an indication of how effectively a sustainability centric project increases trust, and therefore equity. The downside to this approach are the costs associated in tracking data through external service providers long-term.

The project classification “Bronze”, “Silver” or “Gold” as well as its delivery against targets dictates how it is scored and weighted in the index. A “Gold” project receives the highest score because it has the highest possible positive impact on business and USLP. Project owners should thus feel incentivised to focus their time and resources on those priority projects. A summary of the scoring system can be seen in Table 2.

		Project status on deliverables		
		Fully on track/achieved	WIP/can still be achieved	Off track/target achievement less likely
Classification	Gold project	30	15	0
	Silver project	10	5	0
	Bronze project	5	3	0

TABLE 2: SCORING SYSTEM OVERVIEW

5. GOVERNANCE

The transformation of the organisation to a sustainable business where sustainability targets and business targets are inseparable, employees and especially decision makers need to receive information that includes both – business performance and sustainability efforts of the organisation. The Sustainable Business Board (SBB), is a cross-functional strategic steering group that has developed the Bright Future Index facilitate the transformation by the means of managing and communicating sustainability.

The SBB is a steering group that catalysts sustainable growth through the USLP in DACH through providing strategic advice for the leadership team and business partnering project managers in including sustainability elements in their work. The Vice President DACH leads the Sustainable Business Board with the coordinating support of the Sustainable Business Manager. Core members consist of one representative per function. The SBB has a gatekeeper role to ensure quality management of the data entered into the index.

Supporting members of the SBB, so called ‘Sustainable Business Champions’ represent all countries, functions and work levels. They are the backbone to the SBB by bridging between the management board, the SBB and functions throughout the business. They have a key role in gathering information and proactively entering data into the Index.



FIGURE 3: SUSTAINABLE BUSINESS BOARD STRUCTURE

6. LIMITATIONS & FURTHER DEVELOPEMT

The transformation of Unilever DACH will not be successful without a sustainable business mind-set and a culture of sustainability embraced by the leadership and employees. To progress outstanding business results and delivery against USLP targets hand-in-hand, the USLP must be embedded into the corporate DNA of business operations and communications as a driver for sustainable growth. The Bright Future Index is one of the key thrusts that helps the business to achieve this.

However, further development is needed to overcome limitations and make it a tool that adds value in overall sustainable development.

To date, there is still a disconnect between the scoring system of the DACH business and the USLP measurement methodology, which is tracked and aggregated globally.

Further more, most KPIs are focused around qualitative metrics. To improve the Index further, specific financials metrics should be linked to business goals. In the future, all four value drivers need a corresponding and relevant target framework.

In terms of design, there is also room for improvement. The backend document of the index automatically populates user-friendly information based on pre-set KPIs. Functions like VLOOKUP, INDEX MATCH and SELECTION make this possible. As project owners need to manually enter information into the excel file, it needs to be ensured that the process is user friendly and the data is validated. For the future, a more appropriate system for collecting data would be desirable.

7. CONCLUSIONS AND OUTLOOK

The Bright Future Index is one of the key elements on the journey to become a sustainable business across all operations and all brands. It is an attempt to implement a consistent and tangible scoring model that informs and

empowers leadership and employees across all work levels to consider sustainability as a value driver for the business on all levels in their day to day decision making – economical, ecological and social.

One of the key learnings throughout the development phase of the index was that there is already significant engagement for the sustainability strategy throughout the organisation.

- 97% of employees understand how the USLP is part of how Unilever does business and drives growth.*
- 96% of employees agree that the DACH leadership team clearly communicates how sustainability drives growth in DACH*
- However, only 67% of employees understand how their job contributes to sustainable growth.*

* *Employee survey in Unilever Germany. May 2016. N = 291*

It is important, that this engagement is also leveraged. More and more companies will have similar engagement scores by now where leadership as well as the workforce understand sustainability as a driver for long-term business success (doing well by doing good).

Tools such as the Bright Future Index are means of internal integrated reporting, in which both, financial and non-financial information, is included. It connects strategy, risk and performance, and encompasses financial measures, value drivers, and sustainability impacts.

Classifications and scoring models could easily be adapted to fit all kinds of needs. Sharing experiences and developing those tools further across stakeholder groups like industry and science could be a major facilitator for sustainable development.

FIGURES

- [1] SUSTAINABILITY BUSINESS IMPACT FRAMEWORK
- [2] SUSTAINABLE GROWTH WHEEL
- [3] SUSTAINABLE BUSINESS BOARD STRUCTURE

TABLES

- [1] TABLE 1: TARGET ALLOCATION TO VALUE DRIVERS
- [2] TABLE 2: SCORING SYSTEM OVERVIEW

8. APPENDIX: ABOUT UNILEVER

Unilever is one of the world's leading suppliers of Food, Home and Personal Care products with sales in over 190 countries and reaching 2 billion consumers a day. It has 169,000 employees and generated sales of €53.3 billion in 2015. Over half of the company's footprint is in developing and emerging markets. Unilever has more than 400 brands found in homes around the world, including Rama, Knorr, Becel, Bertolli, Lätta, Lipton, Dove, Duschdas, Axe, Rexona, Coral, Langnese and Ben & Jerry's.

Unilever was ranked number one in its sector in the 2015 Dow Jones Sustainability Index. In the FTSE4Good Index, it achieved the highest environmental score of 5. It led the list of Global Corporate Sustainability Leaders in the 2016 GlobeScan/SustainAbility annual survey for the sixth year running. Unilever was ranked the most sustainable food and beverage company in Oxfam's Behind the Brands Scorecard in 2016 for the second year. For more information about Unilever and its brands, please

For more information about Unilever and its brands, please visit www.unilever.com. For more information on the USLP: www.unilever.com/sustainable-living/

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Accounting and Language. An empirical investigation how language influences environmental and social decision-making

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ABSTRACT

Drawing on performance theory, this paper examines the relevance of language design within the field of accounting. For this task, the effects of language in accounting systems on the willingness to invest and on the ability to recognize social aspects in different economic decision scenarios were analyzed with a quantitative approach. The findings of a survey-based experiment indicate that in the field of accounting, “value-oriented” wording supports the willingness to make (environmental and social) investments whereas a conventional wording supports the willingness to save money. Findings suggest that the language of accounting systems should be used more carefully due to its far-reaching consequences for social and environmental aspects.

INTRODUCTION

Often enterprises consciously use a specific wording and language to describe internal and external process and events. Among many other possible effects, previous studies demonstrate that the used language does have an impact on external and internal communication as well as on the perceived trustworthiness of a company [1]. However, the debate about language in economic contexts focuses almost exclusively on the effects of direct communication between humans, while paying little attention to the effects of the language of accounting systems (for exceptions, see e.g. [2]).

Various environmental management accounting frameworks and tools for analysis have been proposed and some evidence has been gathered about current practice (e.g. [3]). This paper adds a new sustainable management tool, called “Wertbildungsrechnung” (calculation for value creation), of the German trading company Alnatura Produktions- und Handels GmbH. Compared to other accounting management tools, this specific tool uses a different, more “value-oriented” language. This paper presents first results in terms of its importance for the social dimension of sustainability.

THEORETICAL BACKGROUND

There is extensive linguistic, philosophical and psychological research on the effects of language on human behavior and attitude (e.g. [1]).

This research has been conducted in a variety of ways and in a wide range of settings. Several studies considered the biasing effects of the expression of moral intentions or the effect of language on trustworthiness of an organization. Especially the concept of performativity as described by John L. Austin [4] has become one of the most influential scientific works within this area of

research. The concept explains how language influences and performs its own reality: “A ‘performative utterance’ is one that makes itself true, that brings into being that of which it speaks, as when an absolute monarch designates someone an outlaw (...).” [5]

Michel Callon [6] and Donald MacKenzie [5] introduced this concept to the field of accounting. They argue that the measured objects of accounting perform their own reality and that in this way a result of conventions becomes reality.

Taking this into account Chiapello [2] pointed out that the objects of accounting perform a reality that “disembeds” economics from social and political perspectives. In the field of accounting it is only important and “real” what can be measured in an economic way. The perspective of environmental and social impacts like the satisfaction of employees are not taken into consideration nor mentioned.

However, the effects of language in the field of accounting have not yet been measured sufficiently, particularly for the context of sustainability and accounting. In connection with the findings from other research areas I assume that language effects measured in direct (economic) communication can also be measured in connection with accounting calculations. Motivated by this research gap, the aim of this paper is to advance our understanding of language in the field of accounting or more specifically, which consequences language in accounting has on environmental and social decision making. Employees are an important factor of the social dimension of corporate sustainability [7], which is why this research investigates the influence of accounting language especially in that area.

Vormbusch [8] points out, that conventional accounting tools limit the perspective of the observer through a unilateral emphasis on results. This research suggests that the language of accounting systems influences the willingness to invest and to pay attention to terms of quality. Therefore, we postulate the following hypothesis:

Hypothesis 1: Using a „value-oriented“ language in accounting systems increases the willingness to invest, whereas a conventional accounting language increases the willingness to reduce investments and save money.

Further, Chiapello’s [2] argument of embedding the economic perspective by accounting systems suggests that the ability to take a wider perspective and to recognize social aspects is influenced by the language of

accounting systems. Therefore, we propose the following hypothesis:

Hypothesis 2: A “value-oriented” language of accounting systems increases the ability to take the perspective of the employees into account.

METHOD

Procedure

A survey-based experiment was carried out to test the hypotheses proposed. For this task, two different scenarios were created and distributed to the participants. In order to avoid any bias due to questionnaire allocation the scenarios were randomly assigned to the participants. In each scenario, information about a fictive trading company and a management accounting calculation for one supermarket of that company were provided to the participants. In the experiment the participants take the roll of the store manager of this supermarket. The numbers of the calculations of both scenarios were the same as well as the description of the company and the store. However, the evaluation of scenario 1 was phrased using a “value-oriented” wording whilst the scenario 2 used a conventional wording. In several tasks the participants had to make decisions of investing or saving money.

Table 1 provides an overview of the two different scenarios used. After reading the scenarios and solving the tasks, the participants were asked to complete a questionnaire.

TABLE 1: OVERVIEW OF SCENARIOS

Scenario	Language	Count	%
1	“value-oriented”	83	48,50 %
2	“conventional”	88	51,50 %

Participants

The participants in this survey-based experiment were bachelor students in the area of business at a German University. The students were informed that participation was voluntary and that no sanctions would be applied in case of nonparticipation. Of the 179 responses, 8 were excluded due to missing data in the questionnaires. Thus, the final sample consists of 171 participants. The main characteristics of the final sample are summarized in Table 2.

TABLE 2: DESCRIPTIVE STATISTICS OF THE SAMPLE

	Mean	Med.	Mode	SD	Min.	Max.
Age	23,01	22	22	4,2	18	50
No. of semesters studied	2,92	3	3	1,4	1	7
Count						%
Gender						
Female	81					47,40 %

Male	90	52,60 %
Nationality		
German	164	95,90 %
Other	7	4,10 %

Measures

The information on the independent variables was derived from the accounting calculation. To distinguish “value-oriented” from conventional accounting wording I used words from the “Wertbildungsrechnung”.

The willingness to invest was measured by the height of investing or saving money in the first task. The ability to take the perspective of the employees was measured by the reduced employee income in the second task.

To ensure that standard errors and the data for the interval-scaled variables are normally distributed, normal distribution of the variables “willingness to invest” and “perspective taking” as well as of the standard errors was confirmed using histograms and QQ-Plots.

FINDINGS

To test the hypotheses, t-tests were performed using IBM SPSS 24. First, effects of language on willingness to invest (hypothesis 1) were tested. The analysis shows that participants using scenario 1 saved less money (M = 1629, SD = 3174), than participants using scenario 2 (M = 3266, SD = 4083). As expected in hypothesis 1, the significant t-test for „saved money“ ($t(163) = -2,936, p = .004 < .01$) confirms that the use of conventional accounting terms promotes the willingness to save money.

Furthermore a significant interaction between the scenario and the gender of the participant was found, $F(1,167) = 2.878, p = .092 < .1$ ($\eta^2 p = .017$). Figure 1 illustrates that female participants showed a stronger reaction to the changed language than male participants.

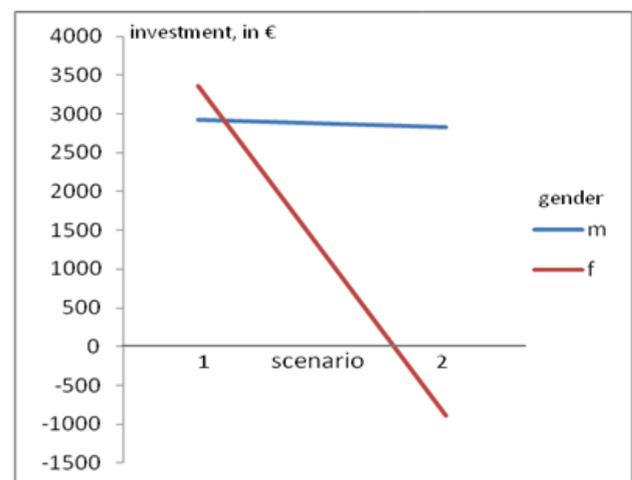


FIGURE 3: INTERACTION BETWEEN GENDER, SCENARIO AND INVESTMENT

To test hypothesis 2, another t-test was conducted to test the differences in reducing employee income among the participants. As expected in hypothesis 2, the significant t-test for „reducing employee income“ ($t(141) = 4,719, p =$

.000 < .001) confirms that conventional language in accounting systems promotes the willingness to reduce employee income. The analysis shows that participants using scenario 1 reduced less employee income in the experiment ($M = -559$, $SD = 1039$), than participants using scenario 2 ($M = -1616$, $SD = 1800$).

CONCLUSION AND RECOMMENDATION

The findings indicate that in the field of accounting, language can influence decision finding processes in various ways. “Value-oriented” wording supports the willingness to make investments whereas the conventional wording supports the willingness to save money.

The findings suggest that conventional accounting wording supports a rational and profit-oriented perspective on economic processes. The finding, that female participants showed a stronger reaction to a changed language than male participants supports the assumption of Kring and Gordon [9] that men are more likely to mask their emotional feelings than women do. The study of Costa et al. [10] confirms the affect of language on economic decisions, whilst they show how language can affect the rationality and emotionality of decision-making.

The study’s findings suggest that the specific language of an accounting calculation should be used more carefully and with awareness for the possible effects on human behaviour.

As with all studies, the present contribution has some limitations. First, the sample size used for the statistical analysis was relatively low. Since the examination of interaction effects requires very large samples [11], the small sample size limits the likelihood of supporting interaction hypotheses based on inferential statistics. Second, the data were collected in a student survey, and therefore, the study is not based on a representative sample. However, this methodology is frequently chosen in experimental research because homogeneity within a sample maximizes control and internal validity of the findings [12]. Third, this type of experiments only point

out short-time effects on behaviour and attitude.

The limitations of this study provide potentially fruitful avenues for future research. Most notably, future research should empirically examine the long-term effects of language in the field of accounting. In this experiment we focused on social effects of accounting language. Future research should also address how language effects ecological decision situations.

Altogether, the present contribution indicates that language is a relevant issue for the field of accounting. Accordingly, it seems to be valuable to discuss the effects of language not only in the field of direct communication but also in accounting literature and practice.

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Corporate social responsibility and earnings management: the moderating role of analysts' following

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ABSTRACT

In this study we examine that whether socially responsible firms behave differently in their financial reporting compared to firms which are less engaged in corporate social responsibility (CSR). Specifically, we analyse whether firms that exhibit CSR and are followed by more (less) analysts are more (less) likely to behave in a responsible manner to constrain earnings management, thereby delivering more transparent and reliable financial information to investors. To achieve these objectives, we draw our sample from 33 countries. We first investigate whether there is a negative relationship between CSR and earnings management then, we test whether combined effect of CSR and analysts' following become stronger. We find significant support for hypotheses in the countries with better governance quality and higher accountability.

Key Words: Corporate Social Responsibility, Earnings Management, Information Intermediaries, Agency Theory

INTRODUCTION

Corporate governance literature unanimously agrees that effective monitoring prevents managers from opportunistic behavior. Along with various corporate governance mechanisms, CSR is considered as internal governance mechanism which induces responsible corporate behavior [1]. Similarly, financial analysts are considered as monitoring agent for firms reporting behavior. Recently, many researchers try to establish a link between CSR and accounting accounting; see e.g. [2],[3],[4], [5]. Likewise, [6] show that governance improves in the firms which are followed by more financial analysts. [7] argue analysts monitor firms' reporting behavior and help reduce information asymmetry. There are few systematic as well as anecdotal evidences available in the literature showing the role of analysts as monitoring agents, so far very few attempts have been carried out to provide explicit empirical evidences about how and to what extent this monitoring process is effective. Similarly, the studies focusing on the relationship between corporate governance board characteristics and reporting behaviour are also enormous [8], [9]. However, the research linking other CSR and Analysts' following jointly to firm's reporting behavior is scarce. In this study we try to fill this gap by providing theoretical rationale and analytical results about how CSR and analysts' following impact firms reporting behavior.

In this study we try to fill this gap by providing fact-based results about how CSR disclosure and analyst following influence firms' reporting behavior. For this reason, we use different measure of EM as proxies for transparency to analyze the influence of CSR and AF

individually as well as their interaction effects on EM. We first investigate whether there is a negative relationship between CSR, AF and EM. Then, we test whether the interaction effect of CSR and AF is more pronounced than the individual effects; our results significantly support the hypothesized relationships. We also find that, firms which are more (less) engaged in CSR are followed by more (less) analysts and are more likely to deliver transparent financial information.

Our study compliments existing literature in following ways: first, our study contributes towards agency theory by providing discussion about how CSR engagement and analysts coverage positively impact the earnings quality and improve transparency. Second, we compliment the results of [6], [10], and [11] by providing novel evidence on the direct and combined effect of CSR and analysts coverage on earnings quality. Differently from the existing studies, we utilize international sample from 33 countries and find that CSR and AF complement each other in monitoring the behavior of managers. These results are significant in countries with greater public accountability. Third, our study contributes to the governance literature by showing that CSR and AF are two important governance mechanisms that help reducing management opportunism. Our results show that both these governance mechanisms are important to improve the transparency in financial markets. Our research has important implication for standard setters who want to incentivize the firms for fostering citizenship behavior among corporations.

THEORY & HYPOTHESIS DEVELOPMENT

Accounting as well as CSR literature suggests that transparent and reliable information disclosure leads to a reduction of information asymmetry and higher firm value. At the same time, exceeding market expectation is one of the strong motives to manipulate earnings [12]. [13, p. 368] define EM as alteration of accounting numbers to 'mislead the external stakeholder' or to 'influence contractual outcomes'. There are two types of EM i.e. accrual and real earnings management. [6, p. 131] define accrual earnings management as a selection of 'accounting policies' and 'estimation procedures' in accrual process to 'distort the reported earnings'. Real EM occurs when managers change the timing of normal operations [14]. Distorting the earnings is an unethical act of management and against the philosophy of corporate citizenship [15] this gives rationale for linking CSR and EM.

The research linking corporate governance including CSR and external monitoring with EM mainly takes three theoretical perspectives i.e. agency theory, stakeholder theory and legitimacy theory. [16] and [17] consider EM as agency cost. Others like [18] apply stakeholder theory to explain the transparency issues. [19] take a legitimacy perspective for linking CSR with EM. The review of literature in the CSR shows that agency theory and stakeholder theory are the two dominant theoretical paradigms which can provide a rationale for a relationship between CSR, analysts following and EM. The agency theory contends that modern firms operate with separation of ownership and control of firm resources. The resources belong to the stockholders and managers are the agents who by definition, are supposed to work for the maximization of wealth of shareholders [20]. In this principle-agent relationship, there exists information asymmetry which provides opportunity to agents to pursue their own goals [21] which gives birth to the agency problems [17]. EM is considered as one of the tactics managers use to pursue their own goals [15]. According to the traditional argument of stakeholder theory, managers are considered not only agents of shareholders but also of other stakeholders [22]. This implies that managers should act in a way which is also in the betterment of not only shareholders but also for the stakeholders. Deriving from the review of extant literature we believe that these theories are better fit for underlying research questions.

CSR and EM

The research in the given CSR-EM nexus has so far yielded mixed results. Some researchers argue that CSR positively affects earnings quality; see e.g. [11] and [10]. On the other hand, [4] and [23] are of the view that managers use CSR as a tool to camouflage their corporate misconduct. Similarly, [24] argue that managers often invest in CSR in pursuit of their personal goals. Likewise, [21] maintain that investment in CSR helps corporate insiders to hide their pursuit of private interests. Consistent with the argument of [10] and [25] relate CSR performance to three measures of EM i.e. real, accrual EM and accounting and auditing enforcement releases. They document a significant negative relationship between CSR and all the three measures of EM. Taking the ethical perspective of social responsibility, they conjecture that if managers are investing in CSR and are involved in EM to pursue their private goals then both these activities are unethical. [26] study the relationship between CSR and earnings persistence and note a positive impact of CSR commitment on earnings persistence among French companies. [27] take the perspective of stakeholder theory and argue that providing reliable information to the stakeholders is a social contribution of the organization. Similarly, [15] take perspective of institutional stakeholder theory and argue that commitment towards CSR is a mean to reduce agency conflicts. [28] note a negative impact of CSR and governance on real EM in Korean listed firms. Similarly, [11] note a significant negative impact of CSR on earnings smoothing. Likewise, [3] find a negative relationship between CSR and all the three measures of EM. Conversely, [4] provide evidence of a positive relationship between EM and CSR. They utilize an

international sample from 26 countries and conjecture that manager involved in earnings manipulation use CSR as tool to restore their image and neutralize the negative impacts of their earnings distortion. Similarly, [19] take perspective of legitimacy theory and study the bi-directional relationship between CSR and EM amongst US banks. They note that banks which manipulate their earnings demonstrate high CSR performance.

The extant research taking legitimacy and signaling theory perspectives supports a positive link between CSR and EM [4] and [19]. On the other hand, research in the domain of agency and stakeholder theory which takes ethical perspective supports a negative relationship between CSR and EM [10], [11], and [28]. The above discussion clearly shows empirical and theoretical competition for the same research question. This fragmentation and competition in calls for more in-depth analysis and derive the theory with fact based evidences. In this research we take consider CSR and analysts following as two governance mechanisms and agency and stakeholder theory perspectives and hypothesize following relationship:

Hypothesis 1: *Firms exhibiting more (less) CSR engagement are less (more) likely to engage in EM.*

AF and EM

Despite the availability of information regarding firm's financial performance in credible sources, such information is not easily understandable by the general investors [29] hence; investors are highly dependent on analysts' recommendations for their investment decisions [30]. In this sense, stock analysts are more and more likely to be catalysts that help materialize the link between shareholder investment returns and firms' activities. From pure economic perspective, full and transparent disclosure helps firms reducing information asymmetry [31] which increases investors' awareness about firm's existence and increases investor base [32]. Superior quality disclosure and precise information about firm's financial performance smoothens its cash flows [33] which as a result decreases cost of financing [34]. Recently, some research efforts have been made to analyze the impact of analysts' coverage on firms' reporting behavior [35] as well as on their ethical behavior [36]. [37] find that analysts are the information catalysts and heed the CSR information for making investment recommendations. They further note that if firms are not transparent in their information provision then analysts make pessimistic recommendations and vice versa. Analysts exert pressure on the management to provide reliable and transparent information [35]. [29] note that firm which demonstrate greater CSR orientation enjoy higher confidence of analysts.

The analysts can directly influence the firms reporting behavior as analysts have opportunity to question about the firms reported earnings and any changes in their financial ratios during earnings conference calls [35]. In addition to this, analysts have access to the private information as well as expertise to detect the distortions in reported earnings [7]. [38] advocating transparency argument argue that financial analysts and rating agencies are in a better position to detect the misconduct of management. Additionally, [39] note that analysts are the

most influential group of accounting information user who monitor the firms reporting behavior.

As compared to the other internal governance mechanisms analysts are in a better position to monitor the reporting behavior of covered firms, as they are external to the organization therefore they are less subject to management's pressure. Moreover, the analysts work for present and future shareholder of the firms therefore they protect the interests of current as well as future shareholders. Analysts possess resources and time to analyze and scrutinize the management behavior and irregularities [7]. Recent research shows that CSR information helps analysts reduce their forecast errors [46]. Theoretically, [20, p. 353] argue that analysts are "socially productive" because they help reduce agency conflict by monitoring agents' behavior.

The above discussion shows that analysts' coverage interacts with firm's reporting behavior. Therefore, we hypothesize following relationship:

Hypothesis 2: *CSR firms followed by more (less) analysts are less (more) likely to engage in EM*

RESEARCH METHOD

Sample, Data, and measurement

Our study sample consists of 500 firms from the Global Fortune list issued in 2013. The purpose of using this list is straight forward. All the firms are multinational with availability of resources to invest in CSR which makes data availability easy. Furthermore, each firm is followed by reasonable number of financial analysts. This helps drawing useful conclusion from intended analysis. To address our research question we collected longitudinal data of selected firms from year 2006 to 2014. We build our sample data by combining different data sources. The data for calculation of EM and AF have been collected from Institutional Brokers Estimate System (I/B/E/S) database. We use different proxies for EM. The accrual based proxies have been calculated by using [49] model and the method of [40]. We calculate real EM proxies using method of [41]. We use three proxies for real EM; abnormal levels of cash flow from operations, abnormal levels of production costs and abnormal levels of discretionary expenses. We calculated AF as average of 12 month total estimates.

The data for CSR is based on environmental, social, and (ESG) scores and have been collected from Bloomberg. This score is based on the extent of a company's ESG performance disclosure. The ESG performance information is a superior form of information regarding company's risks and opportunities associated with social expectations [42]. The score is based on 219 raw data points. Each data point is given weight in terms of its importance in given industry to which firm belongs. In this sense the evaluation of each firm is based on its industry and sector [43].

Estimations Model

To analyze our data, we fitted the following general panel data regression model:

$$EM = \beta_0 + \beta_1 ESG + \beta_2 AF + \beta_3 ESG * AF + \beta_4 INDUSTRY_CONTROL + \beta_5 FIRM_CONTROL + \beta_6 COUNTRY_CONTROL + \beta_7 YEAR_CONTROL + \varepsilon \quad (1)$$

Where, the dependent variable is a proxy for accrual-based and real EM. ESG measures the CSR score which we consider as level of CSR engagement, AF is the number of analysts following a firm. A number of company, industry and country-specific variables were included as control variables. In addition, year dummies were added to control for omitted variables that vary over time but are constant between the firms. To address the fact that the relationship between EM and CSR may differ depending on the analysts following, we included the interactions between the variable ESG and AF.

RESULTS AND DISCUSSION

In this research we analyze whether firms that exhibit greater CSR engagement and are followed by more (less) analysts are more (less) likely to behave in a responsible manner to constrain EM, thereby delivering more transparent and reliable financial reports. Our analyses show that CSR has a significant positive relationship with earnings quality. These results provide support for (H1) indicating that firms which demonstrate high CSR engagement are less involved in manipulating their earnings, thereby delivering high quality financial reports. In addition to this we note that CSR engagement positively impact AF. These results are in line with the findings of [29] and corroborate their claim that responsible firms enjoy higher confidence of analysts. These results also provide support for the exiting findings of [44] who find that "sin" firms are less attractive for analysts as compared to responsible firms.

We also observe a significant negative joint effect of CSR and AF (H2). We find strong support for our hypothesized relationship based upon accrual EM measures and partial support from real EM proxies. The revealed results are more prominent in countries where the overall governance is more effective and the accountability is high. These results imply that CSR and AF are effective internal [1], [45] and external [6] governance mechanisms respectively which monitor the firms reporting behavior [7].

Taking ethical and agency perspective this research contributes towards stakeholder and agency theory. The findings regarding CSR and analysts following imply that responsible firms are more attractive for analysts. This means that firms which demonstrate commitment towards stakeholders are better able to grab attention of financial market participants [46]. Similarly, findings of our research imply that the governance of firms improves with the social inclination as it makes firms favorite for analysts and investors [37] which helps reducing cost of capital [47] and improving access to finance [48]. Our research has important implication for standard setters who want to incentivise the firms for fostering citizenship behaviour among corporations.

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Bridging the practitioner-academic gap in sustainability accounting and reporting

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Extended abstract: Scientific knowledge in the field of management often lacks relevance for practical applications in the field. In this chapter, we discuss why the gap exists and solutions for bridging the divide. The illustrative case of Action2020 and the Redefining Value programme aims to bridge the practitioner-academic gap.

INTRODUCTION

Management scholars investigate the reason why practice fails to find research relevant, and if it is possible to bridge the gap between academic rigor and practical relevance [1]-[3]. Given that science is the “pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence” [4], it is important that scientific knowledge is converted into practical action. Research appears to fail in the eyes of the managers due to lack of practicability [5].

Academics do not require input from business and management to develop research questions or areas for research. Likewise, it is rare to find executives seeking academics to develop organisational strategies [6]-[7]. We explore the research debates as to why this gap occurs and whether the gap can be truly eliminated. Using the case of Action2020 we illustrate the gap faced when trying to bridge the practitioner and academic divide.

ACTION2020 CASE STUDY

The World Business Council for Sustainable Development (WBCSD) is a convening organization that brings together 200 multi-national corporate members to create a sustainable future. Action2020 was launched in 2013 to set short term action goals that set businesses on the path for achieving a sustainable future. Action2020 was developed through a multi-stakeholder process built on insights from earth systems dynamics and social science resulting in 9 priority areas. Dozens of innovative business solutions were then developed, aimed at solving the natural and social capital issues identified in these areas [8]. To achieve consensus on the priority areas, scientific knowledge from the planetary boundaries framework [9] and social science [10] was translated into practice to set the sustainability agenda for business.

The Redefining Value program is an integral and crosscutting part of the Action2020. The program aims to integrate natural and social capital measurement and valuation into the decision-making, performance management, reporting and disclosure of companies. By

recognizing true cost, true value and true profit, progress towards a sustainable world can be accelerated.

WHY THE GAP?

1) Knowledge Transfer Problem

Michael [11] alleges that some academic researchers pay limited attention to how specialist knowledge can be conveyed to a practitioner audience as their focus is on ‘theoretical understanding and sophistication’. Academics are required to comply with academic conventions and more often than not, this has been ascribed to a complex style of writing [5], [12]. From a practitioner’s perspective, these are not convenient for solutions to problems they require quick responses to. Shapiro et al. [13] refer to this as knowledge ‘lost in translation’ where the “academic research fails to resonate with managers primarily on the issues of style, not on substance” [12]. Therefore, even if practitioners are consulted for their opinions during the research process, documentation in these academic journals fail to reach the field of practice.

In the case of sustainability accounting and reporting, the WBCSD has attempted to fill the void through their WBCSD Leadership Programme. The Leadership Programme builds on a solid academic foundation but goes beyond theory by exposing participants to experiential learning, bringing theoretical discussions to life.

2) Knowledge Production Problem

Knowledge in academia is often produced with no awareness for how it may be utilised and focus more on enquiry. Where researchers engage in long deliberations on defined research problems to provide accurate results, practitioners are interested in simple immediate solutions to real problems [6], [12].

Most management scholars focus on “operationalisations of single theories” which end up not being applicable to the situations managers face. Instead they seek “analytical categorizations, typologies and metaphors” which are easily understood [14]. The rigorous characteristic of academia is what makes it acceptable by peers to be reviewed and added to top journals; hence, the term rigour-relevance gap.

In the case of Action2020, natural and social scientists were pushed out of their comfort zone when their corporate partners asked for hard numbers. The numbers presented by the scientists were not accepted by all of the corporate members and space was given to argue against

the numbers. Long discussions were held before arriving at a consensus on the numbers that would guide the Action2020 strategy. The final outcome has been translated for business but can be traced back to science.

3) Philosophical Problem

Van de Ven and Johnson [15] explain that the theory-practice gap results from the differences in what research and practice classify to be knowledge. Differences in their epistemology (research method) and ontology (truth claim) contribute to the reasons why researchers and practitioners cannot communicate effectively with each other in business and management [11]. According to Michael [11], “In the more extreme versions of this view, the researcher and practitioner communities are seen to be locked into incommensurable philosophical paradigms that present very substantial, if not insurmountable, barriers to cross-communication – much less collaboration”.

SOLUTIONS TO THE DIVIDE

1) Improved Communication of Scientific Knowledge

Research suggest that if findings are communicated through channels that are accessible and can be easily understood by managers, the gap between academia and practice can be closed [16]. The Harvard Business Review is a typical example of semi-journalistic avenues to the managerial community [17].

For practitioners calling for specified ways in which theory can be employed in practice [18], visual representation of practical steps can assist in transferring research findings to practice. In the case of Action2020, the planetary boundaries framework is a visually compelling and easily digestible scientific framework [8]. The framework is published in the scientific journal, *Ecology and Society* [19], [9] but also in a more accessible style in the journal, *Nature* [20]. Key actors in the process regularly cross the practitioner-academic gap.

Actors can adopt the role of translator to ensure improved communication. Kieser and Leiner [21] call these individuals “‘bi-competent’ facilitators” who can “apply scientific knowledge in flexible ways to problem situations in practice – and practical knowledge to the context of theory production”. Several individuals acted as interpreters in the process of developing Action2020 to facilitate the transfer of knowledge. One of the leading scientists of the planetary boundaries framework is known for his ability to effectively communicate outside of the scientific community. The WBCSD staffs a professor-in-residence with experience in boundary spanning and speaking with corporate executives [8].

2) Collaboration

To ensure rigour meets relevance, research findings should be produced in collaboration with practitioners [26]-[28]. At a conference in October 2015, hosted by the WBCSD and EMAN aimed to bridge academic and practitioner contributions, participants suggested that organizations such as the WBCSD could in the future further connect the two communities. This “requires [a] trans-disciplinarily [approach] in which team working among academics and practitioners, and across different

academic disciplines...becomes the established norm” to produce relevant results [29].

3) The Gap Is Unbridgeable

Several scholars have critically discussed why this gap still perseveres. This viewpoint shows that indeed academia and practice are products of dissimilar logics and philosophies. From a rigour-relevance perspective, Daft and Lewin, [30] argue that “... journals that serve as a source of academic knowledge should have a fundamental mission to publish diverse new ideas of high quality without regard to relevance to the world of practice, even though diffusion to practice may happen... Academic relevance is a sufficient and realistic criterion for publishing research in an academic journal...”

Bartunek and Rynes [2] also illustrated that while practitioners rarely found research questions from literature, academics cannot do without it. Practitioners can be seen as inductive while academics are deductive in their approach to knowledge acquisition. The points highlighted above show how the academic world differs from the world of practice in retrospect even if both parties seek one thing – knowledge.

CONCLUSION

We have described the literature that explores the gap between management academics and practitioners. We believe the lessons learnt can be replicated to sustainability accounting and reporting.

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Jancso, L.

Assessing the sustainability performance of Bio Partner Schweiz AG using the SMART method

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Summary: The sustainability performance of Bio Partner Schweiz AG (BPS), the leading food wholesale company in the organic food and non-food market in Switzerland, was assessed using the Sustainability Monitoring and Assessment RouTine (SMART). SMART is a scientifically sound and pragmatic method for analyzing and measuring sustainability in the agro-food sector across all sustainability dimensions (environment, social, economic, governance) and for the entire supply chain. SMART provided BPS with an encompassing analysis of the status quo of the sustainability performance of the company itself as well as its value chain – from producers to customers. Based on the results, BPS was able to identify sustainability hot spots and areas with the potential for optimizing. Additionally, BPS gained valuable information for a transparent and credible sustainability communication to internal and external stakeholders.

INTRODUCTION

In recent years, the usage of the term “sustainability” has gained considerable impetus – not least because of the adoption of the Sustainable Development Goals on 25 September 2015. Alongside this trend, the demand for sustainably produced agro-food products rapidly grew over the last years leading to a strong increase in the number of sustainability labels and claims on the market [1]. Yet, most of these instruments aim only at specific aspects of sustainability (e.g. organic labels on environmental or Fairtrade labels on social sustainability), and do not make use of a concerted and holistic approach. Due to the lack of a common definition of sustainability, existing approaches cannot provide comparable results of sustainability performances, leading to a considerable risk of green washing and preventing a collective sector-wide development towards more sustainability [2].

Consequently, companies and associations find it difficult to assess their sustainability performance and to compare it with others. As a result, confusion is rife among consumers and purchasing managers, who find themselves unable to judge how sustainable a given agricultural commodity or food product really is.

To resolve this dilemma, the Research Institute for Organic Agriculture (FiBL) developed the Sustainability Monitoring and Assessment RouTine (SMART) method. SMART makes it possible for food companies and agricultural producers to assess their sustainability performance in a transparent and comparable manner [3]. It builds upon the SAFA Guidelines (Sustainability Assessment of Food and Agriculture Systems), published by the UN-FAO in December 2013, which provide a holistic and globally applicable framework for assessing the sustainability performance of food and agriculture

systems (e.g. farms, companies) and thus a common understanding of sustainability [4].

METHOD

In accordance with the SAFA Guidelines, SMART analyses 58 sustainability sub-themes making use of a thorough set of indicators (see Figure 4) [3]. Existing certificates and standards (e.g. Organic, BSCI, ISO26000, SA8000 etc.) can be seamlessly integrated in the analysis. Results of a SMART assessment are presented in an easy-to-read graphical depiction of the actual sustainability performance of the company or farm for all 58 sustainability sub-themes including detailed explanatory statements (see Figure 6 and Figure 7).

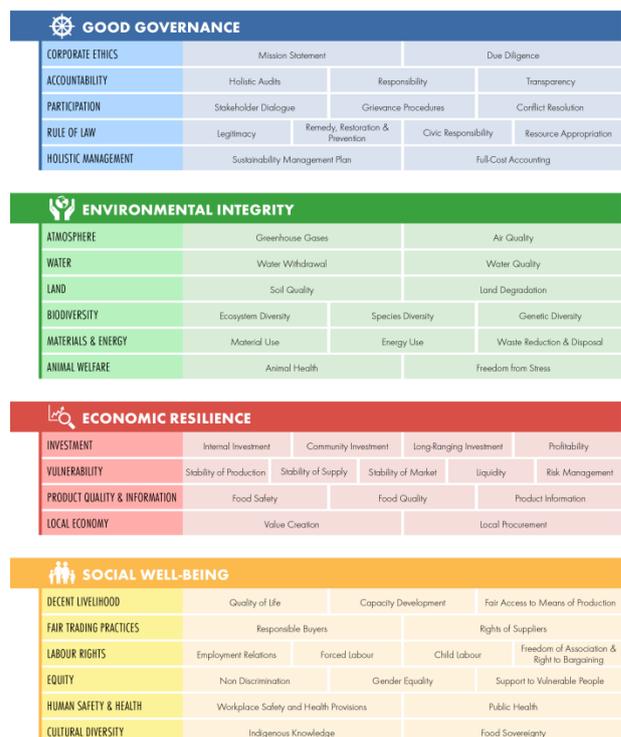


FIGURE 4: OVERVIEW OF SUSTAINABILITY DIMENSIONS, THEMES AND SUB-THEMES AS DEFINED IN THE UN-FAO SAFA GUIDELINES (SUSTAINABILITY ASSESSMENT OF FOOD AND AGRICULTURE SYSTEMS).

In order to account for the varying complexity when it comes to conduct an analysis on production level (i.e. farm) or corporate level (i.e. processor, distributor, retail), SMART consists of two tailor-made tools complementing each other and thus allowing for an efficient way of assessing the sustainability of complete value chains:

1. SMART Farm Tool

With the SMART Farm Tool the sustainability performance of agricultural producers can be assessed. It is mainly used for the monitoring of suppliers, in the

context of research and development projects as well as for sustainability benchmarking of different production systems and the assessment and development of new standards or labels (see the extended abstract by Blockeel et al. 2016 for more details).

2. SMART Company Tool

Following a clearly defined and standardized procedure, SMART experts assess the corporate sustainability performance in all four SAFA sustainability dimensions – including the entire corporate value chain. In doing so, SMART can be used for supply chain sustainability analyses, risk management and identification of sustainability hot spots, development of a corporate sustainability management, benchmarking against competitors as well as the communication of corporate sustainability performance (e.g. in sustainability reporting).

The following best practice case will focus exclusively on the SMART Company Tool. Because of a large range of products, individual supplier assessments were beyond the scope of the project and thus sustainability performance on production level was analyzed based on available data, such as labels and place of origin.

BEST PRACTICE CASE: SMART ASSESSMENT OF BIO PARTNER SCHWEIZ AG

Introduction

Bio Partner Schweiz AG (BPS) is the leading wholesale company in the organic food and non-food market in Switzerland. With a large and exclusively organic range of more than 10'000 products, from fresh fruit and vegetables to drinks, convenience products, natural cosmetics and non-food products, BPS supplies retailers, specialist stores, gastronomy, food processors as well as consumers. BPS has a complex supply chain and buys its products from a wide variety of suppliers, regional as well as overseas, directly from producers as well as from processors, small as well as large enterprises.

In 2015, BPS decided to analyse its sustainability performance according to the SMART method. The rationale of BPS for this project was to get an independent and externally verified analysis of the corporate sustainability performance for the company including its supply chain. BPS aimed for:

- Identifying sustainability hot spots in order to enhance its internal risk management.
- Identifying potential for optimizing its sustainability management practices.
- Benchmarking its sustainability performance against competitors.
- Communicating its sustainability performance to internal and external stakeholders.

SMART Company Tool: Workflow

1. Definition of System Boundaries, Sphere of Influence and Relevance factors

In a kick-off workshop, all staff involved in the SMART assessment on the part of BPS were introduced to the

SMART method and its aims. The supply chain of BPS was analyzed and different levels defined (agricultural producers, processors & traders, BPS, customers) (see Figure 5). Additionally the system boundaries for the assessment were defined and a stakeholder analysis, a materiality analysis as well as a factory tour were conducted.

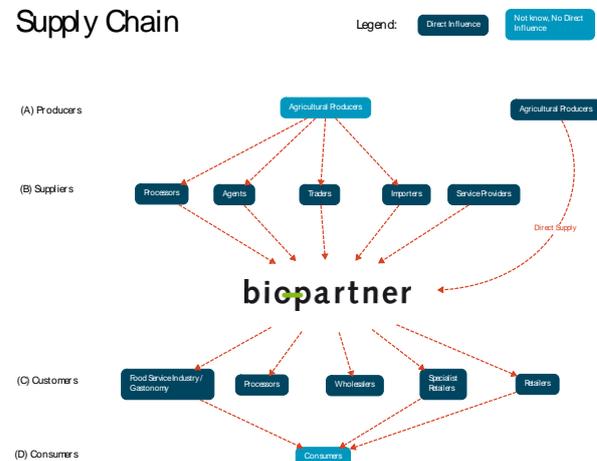


FIGURE 5: SCHEMATIC DIAGRAM OF THE SUPPLY CHAIN OF BIO PARTNER SCHWEIZ AG AND ITS DIFFERENT LEVELS AS DEFINED IN THE KICK-OFF WORKSHOP.

In order to be able to rate the sustainability performance of BPS within its supply chain, (a) the potential influence of BPS on each supply chain level and (b) the relevance of each level regarding each of the 58 SAFA sub-themes were defined by the SMART experts. The former (a) is necessary, as the influence of BPS on the sustainability performance on other supply chain levels varies greatly. Generally, the impact of BPS is higher on direct suppliers (i.e. processors) than on indirect suppliers (i.e. agricultural producers). Yet, there is still some potential influence of BPS on the stage of agricultural production, such as by purchasing products with specific sustainability labels. The latter (b) is due to the fact, that the agricultural production level often accounts for a much larger impact on environmental sustainability issues (e.g. biodiversity, land degradation, water quality) than levels further down the value chain.

2. Data gathering

Following a preliminary document query (e.g. annual report, assortment list, communication material), essential internal information on the various sustainability sub-themes was collected using structured, standardized and easy-to-use questionnaires – tailor-made for each business unit of BPS (e.g. finance, HR, management, purchasing).

3. Survey & Interviews

Additionally, both external (e.g. suppliers, competitors, NGOs) as well as internal stakeholders (employees) were consulted in order to obtain further information on certain sustainability themes. While the former were interviewed individually, the latter were asked in a comprehensive employee survey. Results of both surveys were used anonymously.

4. SMART Assessment

With internal and external data at hand, three SMART experts rated the sustainability performance of BPS. The assessment procedure is clearly structured within the SMART Company Tool and functions hierarchically: For each of the 58 SAFA sub-themes there is a standardized set of indicators. These indicators have been weighted according to their relevance regarding each sub-theme. Based on the gathered information and data, each expert rates each indicator individually. Subsequently, individual ratings were discussed jointly by all three experts and a final score was assigned for each sub-theme and supply chain level.

5. SMART sustainability report

The results of the SMART assessment comprise a comparable score for each of the 58 sub-themes both for the entire BPS supply chain as well as for each level of the supply chain. Additionally, to give an easy-to-grasp overview, the sub-themes are aggregated into 21 sustainability themes. The results are finally compiled in a thorough report containing not only graphical depictions of the sustainability performance of BPS but also detailed explanatory statements for each score (see Figure 6).

6. Final Workshop

Preliminary to the final workshop, BPS was given the chance to review the results of the SMART assessments in order to amend critical aspects. Finally, the results as well as the final SMART report were presented to BPS in a workshop.

combination with the explanatory statements in the SMART report, thus the polygon gives an overview of sustainability hot spots and potential for optimizing the sustainability performance of BPS in a plain and succinct manner.

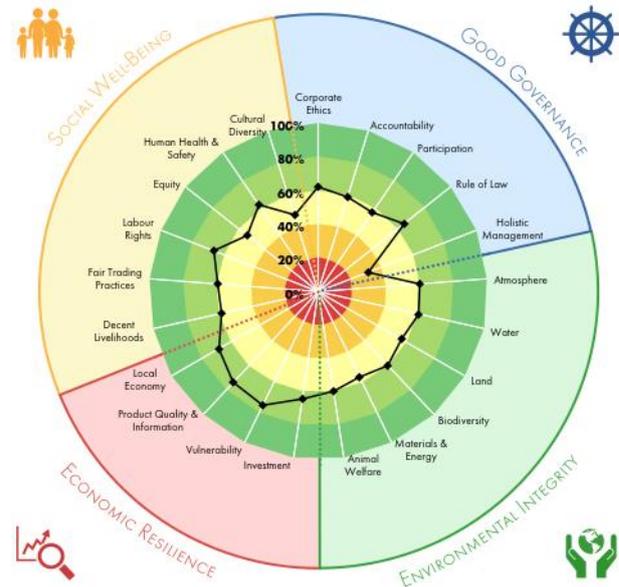


FIGURE 7: THE POLYGON SHOWS THE ACHIEVEMENT OF THE SUSTAINABILITY OBJECTIVE FROM 0% (SUSTAINABILITY OBJECTIVE NOT FULFILLED / RED) TO 100% (THE SUSTAINABILITY OBJECTIVE FULLY FULFILLED / GREEN) FOR EACH OF THE 21 SUSTAINABILITY THEMES FOR THE ENTIRE SUPPLY CHAIN.

Unterthema: Lebensmittelqualität
(Dimension: Ökonomische Resilienz, Thema: Produktinformation und Qualität)

Ziel: Die Qualität von Lebensmittelprodukten erfüllt die höchstmöglichen Nährwertnormen für die jeweilige Art des Produktes.

	Gesamter Einflussbereich	Produzenten	Lieferanten	Unternehmen	Kunden
Bewertung	74%	80%	70%	75%	
Hotspot	-	33%	33%	33%	0%
Datenlage	-	Mittel	Mittel	Gut	

Begründung der Bewertung:

<ul style="list-style-type: none"> • Bio Partner verpflichtet sich in seiner Unternehmenspolitik und relevanten Dokumenten dem Handel und Vertrieb von "Bio-Produkten von bester Qualität". • Aufgrund der Ursprungsidee der traditionellen Bio Branche enthält das Produktsortiment von Bio Partner einen im Vergleich mit konventionellen Mitbewerbern hohen Anteil als gesund eingestufte Produkte. • Der hohe Anteil bio-zertifizierter Erzeugnisse ermöglicht, die Gefährdung durch gesundheitlich kritisch eingestufte Pestizide und Schwermetalle, GVO-Bestandteile, etc. zu minimieren. 	<ul style="list-style-type: none"> - Obwohl Bio Partner in seiner Unternehmensstrategie den Stellenwert von qualitativ hochwertigen Produkten definiert, gibt es keine Vorgaben im Sinne der SAFA Richtlinien zu Nährwerten und der aus ernährungsphysiologischer Sicht zu beschränkenden Inhaltsstoffen (Zucker, Salz, etc.) sowie zur Vermeidung von gesundheitsschädlichen Bestandteilen wie Transfetten. - Zwar ist eine schonende Verarbeitung von Lebensmitteln und die Vermeidung von Zusatzstoffen in den Sortimentsrichtlinien erwähnt, jedoch kein Bestandteil der
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FIGURE 6: EXCERPT OF THE SMART REPORT WITH SUSTAINABILITY PERFORMANCE SCORES FOR EACH SUPPLY CHAIN LEVEL AND EXPLANATORY STATEMENTS (POSITIVE & NEGATIVE).

RESULTS

Results of the SMART assessment of BPS are presented in Figure 7. It is important to note, that sustainability performance of BPS is measured against the sustainability objectives defined in the SAFA Guidelines. Due to the idealistic character of these objectives, scores and ratings in the lower range are not unusual. Hence, they are not to be considered as "bad" performance but rather indicate where the sustainability objectives according to SAFA are only partially fulfilled. In

As can be derived from Figure 7, BPS has already been active in all sustainability themes leading to a rather homogeneous assessment with no theme score below 30%. Considering the fact, that this was the first SMART assessment of BPS, it is a considerably good result with most of performance scores around 60% or higher. The only negative outlier (Holistic Management / 30%) has to be looked at in more detail to be interpreted correctly. This SAFA theme, amongst others, comprises the sub-theme full-cost accounting. As up to now, scientifically sound and practicable methods for full-cost accounting do not exist, hardly any company or organization is able to score good results for this sub-theme.

In addition to the polygon shown in Figure 7, there is a polygon for each supply chain level of BPS showing the respective results for this level. Potential hot spots within the supply chain thus can easily be detected by comparing these polygons.

DISCUSSION

The SMART assessment proved to be a detailed status-quo analysis of all sustainability dimensions of BPS and hence allowed BPS to pinpoint sustainability hot spots in its supply chain or the company itself. Due to the encompassing but at the same time detailed analysis, BPS was able to verify and – if necessary – amend its risk management actively in all sustainability dimensions. Additionally, the detailed statements on each sustainability sub-theme in the SMART report enabled

BPS to spot areas of high potential for optimizing its performance and outlined concrete measures for exploiting this potential. Moreover, BPS can use the results of the SMART assessment for internal and external communication in order to present its sustainability performance in a transparent and comparable manner.

Yet, the SMART assessment of BPS has shown, that there is an inherent trade-off when trying to combine both a thorough sustainability hot spot analysis and the communication of results to stakeholders in one go. The former aims for a precise and transparent identification of sustainability “weaknesses” in order to reduce related risks and thus focuses on rather negative sustainability performances. On the other hand, particularly when it comes to communicate sustainability performance to external stakeholders, corporates are usually interested in reporting positive results while working internally to improve the weaknesses. The SMART assessment and report tries to bridge the gap by integrating both positive and negative sustainability performances. Yet, particularly because of partially confidential content, it needs some further adjustments in order to fulfill both aspects – risk management and communication – at the same time. Additionally, the complexity and the multi-dimensional character of the analysis make it a challenge for companies to communicate the results in easy-to-grasp statements.

Furthermore, the fact that the sustainability objectives (according to which the performance of a company is rated) are explicitly defined in the SAFA Guidelines, constitutes an advantage and disadvantage at the same time. On the one hand, objectives need to be standardized in order to make results comparable and transparent. Hence, BPS can use the results for benchmarking against the sustainability performances of competitors. On the other hand, because of the idealistic and normative characteristics of the sustainability objectives (see above:

full-cost accounting example), they might not be fully in line with the moral compass of the company. In case of BPS, which is already active in various fields of sustainability, it proved to be essential to explicitly clarify the normative and idealistic character of underlying sustainability objectives when presenting the assessment results.

CONCLUSION

Despite of its comprehensive concept, the SMART Company Tool has proven to be an efficient approach for analyzing the sustainability performance of BPS and its supply chain – in all sustainability dimensions. Based on the SMART assessment, BPS has obtained an encompassing status quo analysis of its sustainability performance across all sustainability dimensions and along its entire supply chain. Both sustainability hot spots as well as the potential for optimizing the sustainability performance along the value chain could be identified. BPS may use the SMART report for internal (risk management) and external purposes (communication). Due to its normative and standardized approach, SMART prevents companies from green-washing but also is limited when it comes to individual ways of communication.

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Experiences from performing MCFA in the Mediterranean Countries

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INTRODUCTION

The paper draws on experiences in about 100 case studies recently performed within the UNIDO Medtest II project, which assists SMEs in performing Cleaner Production Projects based on a mass balance assessment, implementing as well an environmental management system to ensure continual implementation and improvement.

ABSTRACT

Experience drawn from several EMA (Environmental Management Accounting) and MFCA (Material Flow Cost Accounting) case studies shows, that establishing an Input/Output balance in values and volumes on a regular basis is still a challenge, as common accounting information systems simply don't offer the opportunities needed to easily integrate the data requirements of ISO 14051 into financial and cost accounting, stock management and production planning. The paper goes on to argue, that first the Input/ Output balance should be regularly implemented on the system boundary of the company within the financial accounting and stock management system, before more detailed systems on the level of processes should be attempted, as the later needs much more complex adoptions to cost accounting and production planning information systems. It also summarizes the challenges of working in countries in transition and recommendations from the on site assessments.

METHODOLOGY

Environmental Management Systems (EMS), Environmental Management Accounting (EMA) and Material Flow Cost Accounting (MFCA) have received increasing awareness and implementation in the last 20 years [1] - [4]. However, experience from several EMA and MFCA case studies shows, that most production companies have still not implemented information systems, that allow them to establish an Input/Output balance as a fundamental part of MFCA on a regular basis and thus continually monitor the consumption of materials and energy in physical terms [5]. So often, the Input/Output balance and tools based on it as Cleaner Production, EMA and MFCA, or Product Life Cycle Assessments [6], remain on a project based approach and are not integrated into conventional information and management systems.

The core part of EMA and MFCA is the establishment of an Input/Output balance [7] - [8]. It can be done for different system boundaries. While MFCA is often implemented on a case study level for specific production

processes [9] - [10] in a bottom up approach, the UNIDO SwitchMed Test approach argues, that there is good reason for starting with existing information systems like financial accounting and stock management and at the system boundary of the company (top down), as much information is available only for this system boundary (if available at all). The UNIDO MEDTEST approach therefor aims at integrating the regular monitoring of material flows into current information systems as the underlying information for cleaner production projects and combined with an environmental management system.

THE MEDTEST II PROJECT

The SwitchMed MEDTEST II Programme is implemented by UNIDO and UNEP (www.switchmed.eu). The Input/Output balance is an essential part of UNIDO's toolbox for environmental management and supports the implementation of environmental management systems and cleaner technologies [6]. UNIDO has developed the transfer of environmentally sound technology (TEST) methodology [11]. The experience of previous projects had revealed, that the individual use of tools for Cleaner Production, although effective for the identification of particular improvements, can easily lead to sub-optimization of solutions and as a result the company may have serious difficulties in initiating and maintaining the desired complex changes in the organization [12].

Therefor the MEDTEST approach links Cleaner Production Approaches with the implementation of an environmental management system according to ISO 14001 [13]. In addition, the Input/Output balance on the one hand provides the data for regular monitoring of material, energy and water inputs and resulting products, waste and emissions and on the other hand provides the arguments to top management on where production efficiency can be improved and savings realized. The Input/Output balance is set up on the system boundary of the company and later for selected processes with high NPO costs and high environmental impact. It is calculated in physical units (kilograms) and related costs. The total Non Product O costs are taken as a benchmark for the theoretical Zero Emission Perspective [14].

The main focus is on the Input/Output balance and related NPO costs. The costs related to environmental protection and management, due to little environmental pressure and legislation in many countries where the UNIDO case studies have been performed, are often so irrelevant, that the NPO costs (the financial value of all losses from the Input/Output balance) constitute the only relevant cost category.

MEDTEST II is currently implemented in the food sector Israel, Jordan, Lebanon, Egypt, Tunisia and Morocco, followed by Palestine and Algeria. In each country, about 10 companies participate in the data assessment. The assessment has 4 parts:

1. Assessment of inputs and product, as well as non-product (waste and emissions) outputs for the previous business year and the system boundary of the organization in monetary terms and volumes (to the degree possible). This is done based on the profit and loss accounts in the trial balance. Most companies were able to provide this data, however often not in a very well structure and consistently. Often, all raw materials are collected on one account only. Also, some companies didn't have stock management installed, and thus only know the amounts received, not the amounts consumed. On average, two thirds of all expenditure in the profit & loss accounts relates to the consumption of materials, water and energy. Any improvements in resource efficiency will thus also mean cost reductions. Only very few companies were able to provide data in kg on raw and packaging materials used and resulting products and waste. Even if stock management is installed, the data is often recorded in units, not kg, so aggregation is not possible.
2. Assessment of total annual NPO costs, which contain the costs of all inputs, which have not left the company as a product output, End-of-Pipe costs and Environmental Management costs. The loss percentages for raw and packaging materials as well as final product and the total costs for operating materials, water and energy are used to calculate the baseline for improvements. In addition, if existing, costs for waste disposal and wastewater treatment are added. These costs for NPO will not be zero in the near future, but in an ideal production, all inputs should be used as efficiently as possible and mainly be converted into products. In average, MFCA costs are 5-10 % of total expenses in the profit & loss accounts.
3. Distribution of the total annual costs and main material and energy flows to the main process steps in order to identify focus areas for further cleaner production investigations. Only very few companies were large enough and had enough data in order to be able to distribute the losses to main processes. But, some companies were able to provide good estimates which were later partly refined during the engineering focus of the projects.

CONCLUSION

This general approach for Input/Output balances in SMEs in transitional countries was successfully implemented by the author in case studies between 2001 and 2013 in Latin America (Argentina, Costa Rica [15], Honduras [16] and Mexico), Asia (Vietnam [17] and Cambodia) as well as the southern Mediterranean countries (Egypt, Morocco

and Tunisia [6] and the current SwitchMed project. However, companies are hardly willing to publish the deficiencies of their accounting systems. Therefore the results of the projects are only available on a general level and not published on a company level.

It was often impossible to establish a full Input/Output balance in volumes in a one to two days workshop, but it was however very interesting for management to see the total amount of money lost as Non Product Output, as this figure can be calculated based on the list of accounts and some data from stock management within the given time frame. This new perspective changed their awareness on material and energy efficiency and for the first time had put a precise price on their losses. It thus motivated them to dig deeper into cleaner production options and at the same time improve their information systems.

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Klöpffer, Walter

From LCA to Life Cycle Sustainability Assessment (LCSA)

LCA Consult & Review
Frankfurt/Main

Structure:

- What means „Sustainability“ in the context of Life Cycle Assessment?
- The „Three Pillar Concept“
- How to connect environmental, economic and social aspects of a product system?
- Possible ways toward the standardization of Life Cycle Sustainability Assessment.
- Most urgent first steps toward standardization

Part 1 The meaning of Sustainability in the context of Life Cycle (LC) methods

The term “Sustainability” has to be defined in order to be useful for LC. Presently it is used for many, often contradicting purposes.

Our understanding of Sustainability is based on the following documents:

1. The Brundtland Report on sustainable development
2. The UNEP guiding principle (Rio 1992, Johannesburg 2002) for environmental policy, connection to LCA and UNEP/SETAC Life Cycle Initiative
3. Origine in of the term in forestry (Carlowitz 1712): “nachhaltig” becomes “sustainable” via “soutenu” (Ulrich Gruber)

Part 2 The Three Pillar Concept

Pioneering publication by Ökoinstitut Freiburg:

1. “Produktlinienanalyse” (1987) including three impact assessments, environmental, economic and social.1111
2. First papers of my group in the early years of the new century, coining of the name “Life Cycle Sustainability Assessment” by Isa Renner and Matthias Finkbeiner (2008). Acceptance of the term by UNEP/SETAC
3. SETAC Environmental LCC Code of practice Swarr et al. (2011)
4. There are widely used popular names for the three pillar concept, e.g. “Triple Bottom Line” and “PPP” (Planet, People, Profit).

Part 3 How to connect environmental, economic and social aspects?

There seems to be much concern about this question, especially among scientists. I think that a formal connection between the three pillars has no priority. The system boundaries of the three LC components have to be **compatible**, however, ideally **identical**. This is also the prerequisite for the definition of a common functional unit – the central and most useful concept of LCA.

The final step would be a verbal interpretation, as for LCA according to ISO 14044.

Life Cycle Sustainability Assessment (LCSA)*

$$\text{LCSA} = \text{LCA} + \text{LCC} + \text{SLCA}$$

LCA:
(Environmental) Life Cycle Assessment

LCC:
(Environmental) Life Cycle Costing

SLCA:
Social Life Cycle Assessment

*Important note: “The “+” signs are symbolic (no aggregation of impact scores)

Prerequisites for using the formula:

Compatible, ideally identical system boundaries of the three subsystems. One functional unit. Using the physical, not the marketing life cycle (but check whether or not the research phase can be neglected for LCC).

Status of model development:

- **(Environmental) LCA: International standards ISO 14040:2006 and ISO 14044: 2006**
- **(Environmental) LCC: “Code of Practice” SETAC Press 2011**
- **Social LCA (SLCA): UNEP/SETAC guideline 2008**
- **Life Cycle Sustainability Assessment (LCSA): UNEP/SETAC framework 2011**

The (**environmental**) LCA has the highest status and is documented by the international (and many national) standards, many publications in journals and a few text books, edited books, a journal devoted to LC) and the book series “LCA compendium”

Life Cycle Costing is an established technique and older than LCA. The specific requirements for **environmental LCC** are documented in a book and in a SETAC “Code of Practice”. There is an LCC section in Int J Life Cycle Assess. (edited by E. Günther).

The **social LCA (SLCA)** is documented in a UNEP/SETAC guideline, available via internet. It is generally believed that this guideline has to be improved or (better) transformed into an ISO standard. The Int. J. Life Cycle Assess has a section on SLCA (edited by M. Traverso). The number of submitted manuscripts increases strongly, a special issue on this topic will appear soon.

The combination of the three LC methods into one, called **Life Cycle Sustainability Assessment (LCSA)** is presented in a UNEP/SETAC guideline without detailed instructions how to do it. The Int J. Life Cycle Assess has a section on LCSA, edited by A. Zamagni.

An international standard would be welcome. There are several possibilities to combine the three LC components, however.

Part 4 Four possible strategies toward the standardization of Life Cycle Sustainability Assessment (LCSA)

There are at least 4 different ways to combine the three components into one standard. Which one should be realized?

LCSA Option 1

This is the “Three pillar” version already shown above.

- **Option 1** contains three life cycle assessments for environment (LCA), economy (LCC) and social aspects (SLCA)
- **Weighting** should be discouraged, as in ISO LCA
- Comparative assertions to be published should be treated as in ISO 14040+44 (2006): critical review by expert panel. The misuse potential of LCSA is certainly not smaller than in the case of a stand-alone LCA!

Although this is my preferred option, there are others which have to be considered.

LCSA Option 2

LCSA =

“LCA new”

This option would extend the present standards ISO 14040+44 considerably

This possibility is purely theoretical, since ISO 14040 is already the “mother-standard” of several other important standards. It is added here for the sake of completeness.

LCSA Option 3

LCSA = Eco-efficiency + SLCA

This option is **real**, since Eco-efficiency is standardized:

ISO 140145: 2012

This standard is based on ISO 14040+44, but takes into account - in addition to the environment – an element called “**value**”. This term is not defined in the standard, but can optionally be a price or – better – by the LCC, as in the BASF eco-efficiency method. This method can be extended by a kind of SLCA into a full sustainability assessment. Since hardly any external critical reviews exist, this method should not be used for comparative assertions,

For many products, the price is a reasonable approximation for the **cradle-to-point of sale** life cycle. The “value” requested by the ISO 14045 may be much higher (think about masterpieces of art), but in general for industry products it could be used.

Option 3 is partly preferred by industry, where

Eco-efficiency = LCA + LC”Value”

LCSA Option 4

LCSA = LCA + Socio-economic Analysis

This second “dualistic” solution has been proposed by IFEU (Heidelberg) in this citation and in an unofficial text by the Austrian ministry of the environment. In a very recent publication, this method was called “Data envelopment analysis” (DEA) and contains many elements known from SLCA and economic (e.g. labour cost) LCA.

Option 4 should be feasible, if the economic “pillar” is preserved. However, due to the fusion of the economic and the social component is not stated explicitly (what seems to be purpose of this exercise).

Part 5 What says ISO 14040 about LCSA?

It was known from the beginning of the standardization of LCA in the 1990s that the economic and social aspects belong to a full LC analysis, as shown in this citations:

*“LCA addresses the **environmental aspects and potential impacts...**” throughout a products life cycle from raw material acquisition through production, use, end-of-life treatment, recycling and final disposal (i.e. cradle-to-grave)”.*

*“LCA typically does **not** address the economic or social aspects of a product, but the life cycle approach and methodologies described in this international Standard **may be applied to these other aspects.**”*

Krannich, Teresa and Guenther, Edeltraud

Environmental value chain management and financial performance

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Extended abstract:

Protecting the environment became a priority topic for companies. Environmental aspects occur in the whole value chain and therefore it is essential to consider environmental aspects of the value chain in management decisions. A comprehensive literature review shows that considering environmental aspects in the entire value chain and thus implementing environmental value chain management (EVCN) can enhance competitive advantage and long term success in companies. The central goal of this paper is to identify the influence of EVCN on corporate financial performance (CFP) empirically with a regression analysis.

INTRODUCTION

Protecting the environment, as a part of sustainable development, is a priority topic throughout all societal areas. In global, as well as in regional politics the environment plays an important role within the work of institutional organizations like the United Nations and the European Commission.⁹ In companies, the social and ecological aspects in addition to the financial or economic ones also gain in importance. In recent years, in many companies sustainability departments have evolved and the protection of the environment is part of their corporate guidelines and codes of conduct. More and more, companies tend to environmentally control their entire value chain and try to think beyond the legal entity [1]-[3]. This paper analyses whether this pays for companies.

VALUE CHAIN MANAGEMENT

In 1985, Michael Porter developed the concept of value chain in his work on competitive advantage. He claims that competitive advantage can only be achieved by including all value-added activities such as designing, producing, marketing, delivering, and supporting the products and services [4]. According to Porter, five primary activities and four support activities which add value to the company can be identified. The primary ones are inbound logistics, operations, outbound logistics, marketing and sales as well as service. The support activities are firm infrastructure, human resources management, technology development and procurement. Accordingly, we define environmental value chain management (EVCN) as the management of the entire VC concerning environmental aspects.

RELATIONSHIPS OF ENVIRONMENTAL VALUE CHAIN MANAGEMENT AND FINANCIAL PERFORMANCE

Researchers and the economy have been analyzing and discussing the relationship between environmental performance and financial performance intensively [5]-[7]. However, only few studies focus on the relationship between EVCN and CFP, even though it is obvious that in the context of globalization the necessity of environmentally controlling the value chain and its complexity rise [1]. Goger analyses environmental upgrading with regard to the global value chain in factories in Sri Lanka and detects negative financial impacts. She points out that environmental upgrading is risky for suppliers, because it is not assured that the invested money will be recuperated and the question of who is going to pay for environmental upgrading remains. This depends on the business case of CSR and whether the supplier can translate it into a competitive advantage [8]. Bhaskaran, et al. analyse the environmentally sustainable food production and marketing industry in Australia [9]. They discover a global lack of holistic environmentally sustainable food production and marketing programs, nevertheless, they conclude that there is no reason for companies to produce and handle business activities under environmentally sustainable standards, because there are no special benefits for customers - who control the demand - and it is simply too expensive for companies [9]. While Goger and Bhaskaran et al. emphasize the negative impact of EVCN on CFP, there are also some articles that explore positive impacts. EVCN can enhance the competitive advantage [10]-[13]. Hartman and Stafford already stated that active natural resource management is important for the long-term success and ensures corporate sustainability in generating competitive advantage [10]. Madu argues with the increasing interest of consumers in the protection of the environment. They are aware of the environmental impact of a product throughout the entire value chain. "Being environmentally correct is not only a social responsibility for companies but also a business strategy that stands to yield huge profits for companies" [13]. Porter and Kramer developed the concept of shared value. When creating shared value through EVCN, companies focus on profits that create societal benefits. Not only customers, but also employees and citizens demand that companies find a way to protect the environment. Companies can create a competitive advantage while simultaneously contributing to social welfare [12]. De Marchi et al. analyse the global value chain framework and find a positive relationship between green strategies in the value chain and financial performance. More precisely, this includes reducing production costs,

⁹ For more information see: <http://www.unep.org> and http://ec.europa.eu/dgs/environment/index_en.htm (access on 12th December 2015).

improving the competitive position and entering new markets [1]. This shows that implementing EVCM is inevitable for companies. These studies, however, do not empirically analyse the correlation between EVCM and CFP with regression analysis.

DATA AND METHOD

In order to measure EVCM as independent variable, a content analysis is conducted regarding the whole value chain of a company. The coding scheme is displayed in Table 1.

TABLE 1: CODING SCHEME

1a	Are environmental requirements made of suppliers?
1b	Are environmental requirements set for services purchased from suppliers?
2	Is there active involvement in the topic of building management?
3	Are environmental aspects of usage considered?
4	Is the value added stage of supply and disposal (energy, (waste) water, waste) managed environmentally?
5	Are logistics processes (transport) handled in an environmentally oriented way?
6	Are the employees included in improving environmental performance?
7	Is R&D in the company organized along environmental?
8	Does the company have environmentally oriented products/components/services?
9	Are there any environmentally oriented institutional (organizational) innovations?
10	Are environmental investments reported?

As a framework, the value chain model of Porter is used (Figure 1) [8].

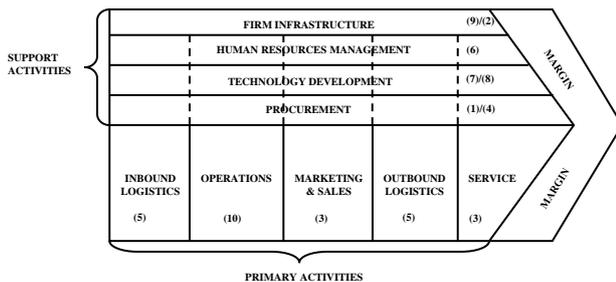


FIGURE 8: VALUE CHAIN ACCORDING TO PORTER WITH ALLOCATED CODING SCHEME

The 70 biggest companies of Europe which took part in the Good Company Ranking [14] were analysed. Environmental and sustainability reports of the year 2012

are considered in this content analysis and are coded with a scheme which includes all the steps of the value chain regarding Porter's value chain model (see Figure 1 and Table 1). Financial performance, as dependent variable is measured with profitability indicators such as return on assets (ROA) and return on sales (ROS). The collected data is analysed with a multiple regression analysis.

CONCLUSION

Based on the sample of 70 companies we expect significant positive relationships between EVCM and CFP. Many research papers do not amply consider the environmental aspects throughout the value chain and therefore an essential aspect of the impacts of the business is missing.

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Recent History of Japanese Corporate Sustainability Management

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Extended abstract: This study clarifies the recent history of sustainability management focusing on management, accounting and reporting in Japanese companies with GDP, resource productivity, net resource input, final disposal and CO₂ emission as a background of corporate environment analysing by official statistical information and SNA (Systems of National Accounts) data.

INTRODUCTION

Introducing of Environmental management began in Japanese large corporations in 1990s. ISO 14001 certification began in 1997 in Japan and lasted long in largest certified organization numbers in the world. In the early 2000's, global corporate scandals and Japanese corporate scandals both happened. CSR word was used often in Japanese newspapers in 2003 and CSR activity started in a corporation. Large corporations became the top runner and has led in environmental management until 2008-2009.

This study clarify the recent history of sustainability management focusing on management, accounting and reporting in Japanese companies with GDP, resource productivity, resource input, final disposal and CO₂ as a background of corporate environment using official statistical information and SNA(Systems of National Accounts) data.

TREND OF JAPANESE CORPORATE SUSTAINABILITY MANAGEMENT

By the collapse of the bubble economy in 1991 in Japan, many companies faced on the organization improvement. The impact of Earth Summit in Brazil, Rio de Janeiro in 1992 was strong influence for companies about environmental issues. Large corporation changed into Multi-national companies from market globalization and exchange fluctuations.

NEC set environmental charter in 1991, Panasonic set Matsushita charter (environmental declaration) in 1991. FUJITSU set environmental charter in 1992, and Fuji Xerox set environmental vision in 1993 [1].

Analysis of government statistical data, "Corporate research of environment-friendly activity" by Ministry of Environment from 1996 to 2014 shows trend of Japanese corporate sustainability management [2]. Figure 1 shows ISO 14001 certification rate, 60% of the listed companies in 2001, and reached to 80% in 2004. Unlisted companies, it is about lower than a 20% of listed company. Figure 2 also shows Corporate environmental accounting. Implementation of environmental accounting reached to 40% in 2006, 505 companies in 2103. Unlisted companies almost gave up to using it. Figure 3 shows publishing rate and number of Corporate environmental report. It reached to around 40% and 1200 companies in

2008. Year 2006 to 2008 was mature point of Japanese environmental and CSR management as a triple corporate sustainability aspect, management-accounting-reporting. In 2006 new government law, mandatory reporting of emission of GHGs for large companies was issued. 2008 was starting year of Kyoto protocol until 2012. Many large companies prepared for those issues. On September 2008, Global recession was happened and Japanese companies have to change their financial and organizational activates.

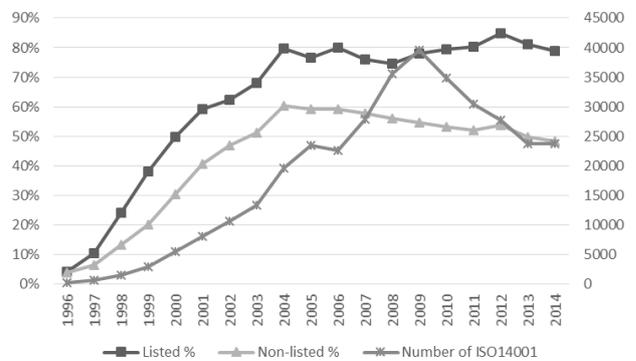


FIGURE 1: ISO 14001 CERTIFICATION RATE AND TOTAL NUMBER.

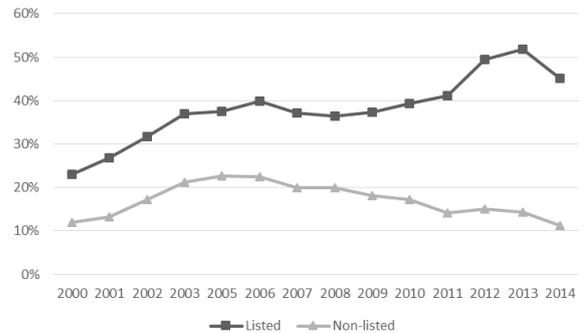


FIGURE 2: EXECUTING RATE OF ENVIRONMENTAL ACCOUNTING.

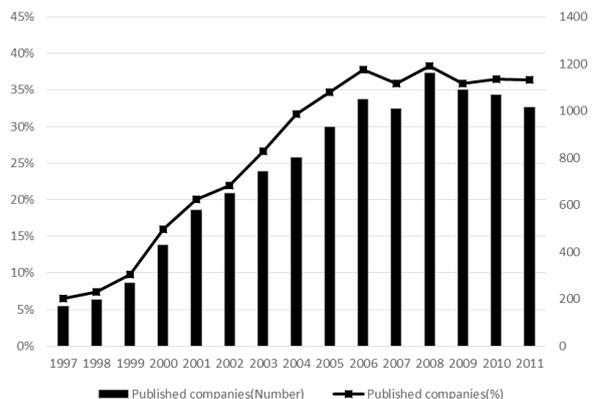


FIGURE 3: PUBLISHING OF ENVIRONMENTAL REPORT.

FINANCIAL AND ENVIRONMENTAL INFORMATION ABOUT JAPAN

To clarify Japanese sustainability management, it is important to research long term trend of corporate environment background like GDP, resource productivity, resource input, final disposal and CO₂ emission.

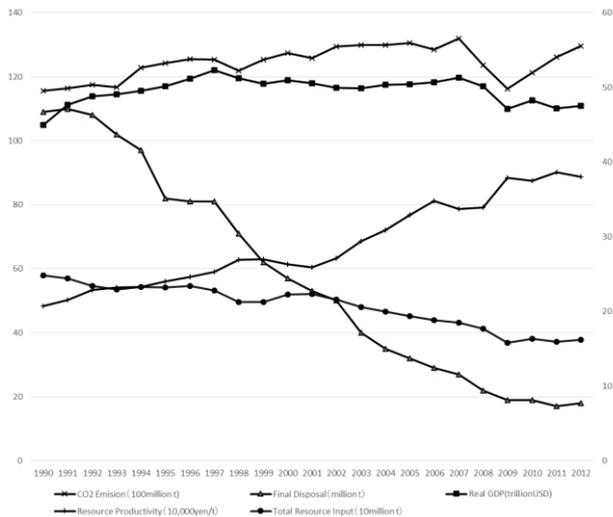


FIGURE 4: GDP, RESOURCE PRODUCTIVITY, RESOURCE INPUT, FINAL DISPOSAL AND CO₂ EMISSION.

Figure 4 shows each trend of GDP, resource productivity, resource input, final disposal and CO₂ emission [3]-[5]. The statistical analysis was made by multiple regression analysis. The variables set as follows, independent variable: CO₂ emission, dependent variable: real GDP, resource productivity, net resource input and final disposal. The statistical analysis identified that there is statistical significance between CO₂ emission and GDP**, resource productivity*, net resource input** and final disposal** during 1990-2012 period for 23 years. (**:p<.05 *<.1). This result means macro Japanese industrial and social system still do not decoupling between using a fossil resource and production even resource productivity was going up. But reducing final disposal is contributing for reducing CO₂ emission.

DISCUSSION AND CONCLUSION

This study clarifies the recent history of sustainability management focusing on management, accounting and reporting in Japanese companies and relation between CO₂ emission and GDP, resource productivity, resource input, final disposal. Most of Japanese large companies already do EMS but environmental accounting and reporting is not active and especially many non-listed companies quit environmental accounting.

How to clear these problems? There are two evidence: 1st, listed company will be more active about sustainability management. 2nd, Kunori et al (2016) mentioned the results of statistical analysis that global companies are enhancing environmental activity because of reacting of corporate environment [6]. There are two major change of corporate environment. One is global recession in 2008. It changed Japanese companies a lot; loss of world market, lack of cash flow, high exchange rate, decrease of wage, investment, R&D and cost cutting. They stop aggressive strategy and shift to conservative strategy. This situation is not good for enhancing sustainability management. But global pressure for corporate sustainability management already comes up; ISO26000(2010), ISO14051(2011), GRI-G4(2013), ISO14001:2015(2015), UNFCCC-Paris Agreement (2015), Engagement in the UN Global Compact. Japanese large companies especially global companies will shift to sustainability management following global environment, regulations and guide line. But rest of that seems to be low sustainability activity because of a lack of tangible and intangible asset.

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Is Integrated Reporting the right stick to illuminate sustainable value? Perspectives from South African stakeholders

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Extended abstract: The purpose of the study was to explore whether the institutional mechanism of Integrated Reporting <IR> is fit for purpose in illuminating value and facilitating more holistic business strategy in corporate South Africa. A series of conversations were held with a range of relevant professionals to understand and reveal the multiple perspectives in the regard.

BACKGROUND

Integrated Reporting <IR> is a mechanism developed by the International Integrated Reporting Council (IIRC) to hold companies accountable for their value creation (or destruction) across the 6 capitals; to communicate their approach and strategy for long-term value creation to investors; and to surface potential areas of risk or opportunity that were not evident in a short-term silo-based reporting methodology [1], [4]. Whilst some progress has been made, even in a country like South Africa where <IR> is built into statutory requirements, the evidence of impact and change are not sufficiently significant [6].

THEORETICAL PERSPECTIVE

Corporate reporting is designed as an account of business performance, as delivered by those tasked to manage it, for the information purposes of those own or are invested in it [3]. In recognition of the multiple priorities and contextual complexities in which businesses currently exist, the process of integrated thinking is highlighted as a means of sense-making in this regard [1].

The Integrated Reporting framework asserts that integrated thinking is necessary for the delivery of truly integrated reporting and that integrated thinking will enable businesses to better understand the relationships that exist among the capitals it makes use of and in doing so, develop a greater and more sustainable understanding of value creation. [6]

SAICA proposes that integrated thinking is the 'engine that drives value creation' [9]. It is however argued that whilst integrated thinking does drive the consideration of capitals and elements of potential value creation, it is an understanding of the transformative approach of integrative thinking that will actually drive value creation [1], [10]. Understanding the value chain and role of capitals within this value chain is therefore a crucial element of integrative thinking and fundamental to long-term value creation and sustainability [2].

Furthermore, inappropriate KPIs and remuneration, an ongoing focus on financial indicators of performance and a lack of adequate non-financial data are believed to

hinder the prevalence of integrated thinking. The current priorities of the investor community are also highlighted as a hindrance to integrated strategy formulation and the focus on a broader base of value [8], [9].

The objectives of <IR> are therefore to enhance the quality, transparency and meaningfulness of information disclosed to stakeholders and providers of financial capital in a concise and 'cohesive' manner; to help companies better understand risk and materiality and in doing so, to allocate capital more appropriately; to highlight a broader value base and improve a culture of stewardship and accountability of the 6 capitals; to support integrated thinking; and to emphasize short, medium and long-term value creation [9].

THE RESEARCH STUDY

The research design comprised a multi-methods case study approach and employed a series of conversations in the form of 13 semi-structured in-depth interviews with a cross section of high level SA professionals; captured in narrative form to convey the richness and scope of the interactions [5].

The objective was to explore the mechanism of integrated reporting and the perceptions and views of the professionals using it, as to whether it is fit for purpose in pursuit of growing value creation.

RESULTS AND FINDINGS

The journey started with a sustainability consultant who highlighted that reporting requirements are complex, not well integrated and shift focus away from actual performance and that regulation is about disclosure, not performance which is not adequate to shift the agenda. There is also little focus on who reports are being written for and what they are targeted to achieve. This together with the largely short-term priorities of investors focused primarily on financial performance has caused <IR> to become a tick-box exercise and consultants are complicit in this malaise as they help present a prettier picture than that which actually exists, resulting in good disclosure and reporting ratings but no improvement in non-financial performance.

The ESG analyst for a large firm quite vocal on the subject of responsible investment suggested that the transparency provided by <IR> is important in being able to make a bet on management, but for <IR> to enable actual transformation it needs to be embedded into the DNA of companies and at this point it is largely

perceived as a time consuming, resource intensive and overly complicated tick-box exercise.

Another sustainability consultant suggested that the integrated report is badly delivered because an understanding of materiality is lacking, as is the link between risk, materiality, reporting and decision-making. He declared that companies use <IR> to build their public face but few communicate real purpose and that the pursuit of regulatory compliance; the pervasive silo mentality within companies; and their poor stakeholder engagement processes make <IR> a big challenge and limit the opportunities that integrated thinking could present.

The Risk Advisory partner at a prominent professional services firm purported that <IR> should not force companies to reconsider strategic integration of sustainability considerations nor to institute a different ethical or sustainability agenda; but rather that it should be an honest reflection of a company's performance and intentions regardless of what they are. She highlighted that the pressure to find something to put into each capitals section in the <IR> makes the situation worse and that <IR> is simply about transparency, not a lever for strategic change.

The Director of CSI at a South African giant renowned for innovation advised that in her organisation <IR> is simply an onerous regulatory requirement requiring time and effort, and is by no means a driver of internal thinking or processes that shift the strategic agenda. She proposed that <IR> should inform business on how to do better and to develop appropriate KPIs but that largely development and transformation are left in the 'nooks and crannies' brought out for the purposes of corporate reporting.

The <IR> partner of another large professional services firm proposed that <IR> should be used to articulate a value proposition with a strategy to achieve it and in doing so to attract capital but that there is the mismatch between quarterly and annual performance and long-term value propositions. <IR> should be the story of the right strategy in the real context, with the evidence of execution but the current framework is limited by both its language and by its inadequate illustration of capital usage.

The CEO of another highly innovative and rapidly growing firm in the IT consulting space advised that the regulatory and labour environment in SA creates challenges for the private sector that are not conducive to an enabling business environment and that <IR> is one such regulatory requirement that is simply administrative. He confessed to not ever reading his integrated report and not caring about its contents, which he deemed not useful to anyone.

Another professional services partner credits <IR> as a significant game-changer in shifting the way CEOs think and approach their organisational strategies; changing businesses attitudes and shifting the board composition and mechanisms of accounting.

The strategy director of one of SA's oldest financial institutions concurred that it is important for business to recognize its broader role in society but that integrating this across an organisation remains a challenge and that the <IR> in their organisation is three steps behind their strategy and not actually an adequate reflection of their current position.

A high profile ESG Advisor who has recently retired himself from one of SA's newer and more innovative financial services firms suggested that generally investors do not understand what it means to use ESG data, that the system is so complex and misaligned; and that the agenda of change has also been corrupted by the consultants who have viewed and pursued the likes of <IR> and sustainability as a new and large reporting revenue stream resulting in production of inauthentic <IR> that simply creates the façade of compliance.

The ex-Chairman of another professional services firm shared that a lack of comparative measures and penalties prevent <IR> from reaching its potential and that currently it is practiced as a tick-box exercise with little emphasis placed on its analysis. He offered further that the professional services industry loves <IR> because they make a lot of money from it; but whilst <IR> does provide extensive information, this is often quite technical and largely unused by anyone.

The strategic services director of a significant national food producer shared a positive and high regard for <IR> but she admitted that it is a challenging process that requires a lot of thinking and a significant shift in the approach to corporate reporting. She confirmed that <IR> has provided the opportunity to produce a comprehensive story of quality company information and is a useful tool for multiple purposes.

Finally the foreign national Group Executive for Strategy and Corporate Affairs of a well-loved SA food retailer felt that stakeholder engagement was vastly missing from the SA landscape and that <IR> is simply a regulatory check box exercise in statutory compliance where the process of integration becomes the skills of producing and integrated report not the skill of integrated thinking around business performance.

The world views of these participants have been characterized by the following themes which represent the multiple perspectives of the concern about <IR>'s fit for purpose in illuminating value.

(+) is a positive indication about the value of <IR>. (+-) is cautiously optimistic. (-) reflects a pessimistic view and (--) indicates no belief in its value at all.

- The somewhat sceptical sustainability consultant (-)
- The optimistic ESG analyst (+-)
- The very sceptical sustainability consultant (-)
- The business of business proponent (--)
- The morally obliged corporate (+-)
- The value-based accountant (+-)
- The anomalous CEO (--)

- The game changer (+)
- The strategist for dinosaurs (-)
- The evolved ex banker (-)
- The frank ex-professional services chair (-)
- The committed to the challenge executive (+)
- The perplexed foreign national (-)

CONCLUSION

In contrast to the tone of the literature, through a deep exploration into the way professionals in South Africa have experienced <IR> and the vastly sceptical views that have emerged, it would seem that the trustworthiness of <IR> to deliver on its intended purpose is indeed questionable and warrants further investigation.

<IR> is a new framework and there is some confusion and conflict in relation to what it is designed to achieve and how it sets about doing so. Further, given that SA is at the forefront of <IR>, the diversity of perspectives incorporated in the study could provide significant value to other domains where the <IR> framework is just taking root. The spectrum of stakeholders interviewed represents a comprehensive synopsis of a range of professional world views on the subject of <IR>, the understanding of which could also facilitate more insightful planning and execution of the framework into new markets.

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Stakeholders vs investors accountability in integrated reporting: Case insights from an early adopter

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This research explores view(s) of corporate accountability that are implicit in integrated reporting (IR). The empirical setting features a global insurance company that pioneered IR in its 2012 annual financial report. Several in-depth interviews with the IR “preparers” from this firm depict how its IR has been built, as well as the contextual conditions underlying the decision to shift from financial reporting to IR. The results also reveal the predominance of investors’ (vs. stakeholders’) accountability, particularly in reference to addressees of corporate accountability in the IR. This paper offers new insights for literature dealing with corporate reporting and accountability in a novel, integrated reporting setting.

AIM AND THEORETICAL FRAME

This paper seeks to respond to calls for case research on integrated reporting practices [1]-[2], [3] by empirically exploring the implementation of integrated reporting (IR)¹⁰ by an Italian listed insurance company operating worldwide. The company, Assicurazioni Generali S.p.A. (hereafter, *Generali* or *the Company*), is a pioneer of IR, in accordance with the project established by the International Integrated Reporting Council (IIRC) in 2011. It joined the IIRC pilot programme in 2012, actively participates to two IIRC business networks (i.e. insurance network and national network of Italian IR adopters), and has already published three annual IRs (2013, 2014, and 2015) that adopt the international Integrated Reporting Framework (IIRF) principles issued by the IIRC [4].

A number of studies offer in-depth assessments of IR practices (e.g. articles published in 2014 in the *Accounting, Auditing and Accountability Journal* special issue on integrated reporting), but to the best of our knowledge, no previous research has empirically investigated the view(s) of accountability that are embedded in the process of IR preparation. We therefore aim to analyse the discourses of IR preparers (i.e. persons responsible for and/or daily involved in the preparation of the IR) on the IR implementation.

According to the IIRC, IR should enhance accountability and stewardship for a broad base of capital [4]. With its focus on multiple “capitals” (e.g. human, natural, social) and other non-financial subjects, IR may offer accountability to a wide plethora of stakeholders. However, critics question the possibility that IR can cover stakeholder accountability [5]-[6], [7]. The primary focus of IR on capital providers’ information needs could mean

that it does not necessarily address the decision-making and accountability needs of stakeholding publics [5]. Compared with the Global Reporting Initiative, the IIRC’s proposals are “remarkably regressive,” with a strong investor bias and possibilities only for “investor accountability,” and no attempt to discuss issues around corporate sustainability [8, p. 25]. In other words, if IR is intended to discharge the duties of accountability for the responsibilities most closely connected to the investors, its potential to help stakeholders understand nonfinancial impacts and hold managers accountable for them may be constrained [1]. We empirically address this issue and explore how IR preparers come to select corporate accountability content, by reasoning about the subjects disclosed in the IR (i.e. what), the language used (i.e. how), and the IR addressees (i.e. to whom).

In turn, we describe how the “production” process for the IR text (here, the process of determining what is said and not said and who will be addressed by the report) depends on the organizational context and, more broadly, the reporting context in which the text gets produced, acknowledging the “inseparable relationship between the text and context” of organizational reporting and communication [9, p. 226]. The socio-linguistic approach depicted by the linguist Teun A. van Dijk led us to avoid interpreting the context as an “objective” social variable and instead suggested the consideration of subjective mental constructs that define and give relevance to such context [10]-[11], [12]. We take inspiration from this approach and focus our empirical analysis on understanding how the view(s) of accountability that are implicit in IR preparers’ discourses are influenced by their interpretations of the contexts in which the preparation of the IR text takes place.

METHODOLOGY

For the discourse analysis underlying this research [13]-[14], [12], we rely on in-depth interviews with managers and employees of the Company. The interviews were developed to discern not only the motivations for the decision to adopt IR but also how IR preparers ponder “what is said and what is not said” and “how it is said” [9, p. 226]. The IR itself is a report that is largely informed by a principle-based framework and thus is flexible in terms of its specific content [4].

The interviews took place in dedicated meetings with the authors or following IR presentations offered to various panels (e.g. public presentations, insurance group meetings, university presentations to students, televised debates). The interviewees received extensive information about the research purpose, and their privacy

¹⁰ We use the acronym “IR” to refer both to integrated reporting, or the process of preparing an integrated report, and to the integrated report, which represents the “outcome” of this process. The context determines whether the acronym refers to integrated reporting or reports in each instance.

and anonymity was carefully respected, especially when citing the content of their speech to other interviewees and Company members. The authors obtained permission to record the interviews digitally and use these responses for research purposes. If interviewees requested that we delete selected portions of their delivered answers, we did so. The interviews also were manually transcribed in the language in which they took place (English or Italian).

Recognizing concerns about the methodological rigour and subjectivity of discourse analyses [15]-[16], [17], we took several steps to ensure subsequent traceability of the research method. The transcriptions of the interviews were coded according to a general coding framework underlying the research. The coding criteria captured three main accountability contents to be investigated [18],[19]: the subjects inserted and explained in the IR (what), the language of the IR (how), and the intended addressees of (the messages contained in) the IR (to whom). We collected all sentences that referred to each of these three issues, independent of the interviewees, then relied on further distinctions that we developed to classify them into more specific, homogeneous topics. Some of the issues evident in the interviews appeared to be linked in intertwined messages, such that discourses about two or more issues were present together. We tried to disentangle the intertwined discourses related to multiple issues, to better detail each of the main issues associated with the accountability content.

Finally, we coded all the sentences referring to two themes (“text” and “context”) to clarify the preparers’ cognitive processes for constructing the text while also considering the social context in which it was produced [12]. In this phase, we investigated three types of additional sources: (a) the “text” in the form of IRs produced by the Company for the 2012 to 2015 financial years; (b) secondary sources pertaining to the “context” (information about the organizational structure and governance system of the Company, the insurance sector, and the IIRC); and (c) previous research on corporate reporting and accountability issues. This step improves comprehension of the views shared within the Company by the IR preparers.

PRELIMINARY FINDINGS AND INTENDED CONTRIBUTIONS

The analysis shows that the view of accountability embedded in the preparation of the IR is investors’. Specifically, the choice of subjects in the IR focuses primarily on financial and strategic issues rather than nonfinancial or sustainability questions. In addition, the discourses of IR preparers stress that the IR (i.e. text) reflects several contextual factors: complaints from investors and capital providers about the complexity of traditional annual reports; a lack of interest among shareholders in “soft” (narrative or nonmonetary) sustainability information; and the separation of financial and sustainability units within *Generali*. In this respect, the empirical analysis reveals the preparers’ reasoning regarding accountability content and how this process depends on their interpretation of the context(s) in which the IR is “produced”. Finally, empirical evidence sheds

light on the dominance of investors’ accountability, as the primary addressees of accountability in the IR.

With this empirical stance, this article responds to calls for more case research on IR implementation by highlighting the role of practitioners in informing the text. Previous research mostly describes the role of organizational and institutional factors in the IR adoption process (e.g. [20]-[21]-[22]-[23], [24]). The present study elucidates the need to pinpoint the mediating role of preparers in terms of how the report is prepared—particularly with reference to how these actors consider the organizational and reporting contexts while writing the text.

This paper also can contribute to the debate about the relationships between IR and accountability. Previous research has investigated how IR may allow companies to provide accountability for subjects that have not traditionally been addressed by financial reporting (e.g. value creation process, sustainability, capitals) and what classes of stakeholders may benefit from IR (e.g. investors, other stakeholders) [25]-[6], [8]. These prior studies have been more conceptual in nature, addressing relationships in terms of how the IIRF might inform the content of accountability provided by companies; the present study instead offers a field-based investigation.

Finally, this article contributes to the more general debate about the future of corporate reporting. Regulators, practitioners, and academics increasingly are involved in discussions of how to improve corporate reporting (e.g. [26]-[27]-[28], [29]). The “meanings” and “means” of “better” reporting also continue to come under scrutiny [30], [9]. This contribution to the debate testifies to how practitioners, and preparers in particular, are working to improve corporate reporting and why they consider IR “better” than more traditional forms of external reporting (e.g. financial reports). In this respect, this study intercepts the academic discussion about the “narrative turn” in accounting practice and research [31]. More broadly, it addresses the call for more (interpretative) research on corporate reporting practices and practitioners [32]-[33], [34].

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Investigating the Determinants of Travel Mode Choice: Measurement Matters

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Summary: Unsustainable mobility is a relevant concern for developed countries as well as for emerging economies. Private mobility has the biggest share in polluting the atmosphere, so that active steps to switch to alternative paradigms are needed: indeed, a successful shift to sustainable travel modes requires changes both in regulations and in individual behaviours. The authors conducted a meta-analysis to systematically analyse the findings of 58 sample studies, examining the predictive capability of psychological, habitual, and environmental correlates of sustainable vs. unsustainable travel modes. As expected, the results revealed significant relationships between determinants and behavior. However, findings show how the studies reach inconsistent results, with such heterogeneity undermining the usefulness of emerging evidence.

Moderator analysis is performed in order to analyse possible explanations of such heterogeneity. An interesting outcome with relevant implications for policy is represented by the fact that the specific operationalization of behaviors in primary studies significantly moderates the relationship between all determinants except habits and actual behavior. Contrary to this, the measurement of travel intention does not explain relationship between any correlate except environmental concern and behavioural intention. Further research is hence needed to better understand the most appropriate way to deal with such variables in empirical studies.

INTRODUCTION

The shift towards sustainable mobility is a crucial issue, with policy makers planning different strategies and policies to reduce the ecological footprint of travel patterns. Such strategies, which can be categorized into push and pull measures [1], cannot be successful without an active involvement of citizens, who represent the key actor: indeed, psychological factors are more effective than infrastructural changes in leading to a behavioural change [2]. It is hence crucial to understand the relevance of different socio-cognitive factors as drivers of travel mode choice.

We conducted a meta-analysis on a database of 58 empirical studies. The results show a high degree of heterogeneity, indicating the presence of concealed factors causing such fragmentation. Stemming from such basis, the present study identifies and statistically examines factors moderating the significant relationships emerging from the meta-analysis.

Coherently with the Theory of Planned Behavior [3], the findings suggest that intention to use different travel modes is the main antecedent of actual behaviors. Other constructs of the theory like attitudes, subjective norms, and perceived behavioral control are close predictors of intentions and (to a lesser extent) behaviors. Norm Activation Model [4] and Value-Belief-Norm theory

[5,6], as well as habit-based [cf. 7,8] extensions of TPB are also examined. On the one hand, both habits and past use emerge as strong correlates of travel mode choice. Environmental variables, on the other hand, seem to play a marginal role in predicting actual mobility-related behaviors; yet, they are strong predictors of intentions to choose an eco-friendly travel mode. Behaviors and intentions are hence affected by different sets of predictors, consistently with the so-called intention-behavior gap [9].

METHODS

The present study stems from the results of the meta-analysis, synthesizing existing literature and statistically analyzing drivers of sustainable travel behavior. 58 primary studies from 1992 to 2016 are included in the dataset based on inclusion criteria, and a random effect model is selected to analyze the combined effect size, r' . A high degree of heterogeneity emerges from the results, as suggested by I-square > 0.75 and significant Q-statistics. Heterogeneity refers to the variation in primary study outcomes caused by between-study error and not by within-study error. Based on the synthesis of existing literature, similar meta-analyses [cf.10,11] and experts' opinion, five moderators have been selected: sample type, study period, geographical location, commuting purpose and measurement-operationalization of behavior (intention). Trip purpose can be categorized in general, shopping, work and errand trips. As regards travel behavior (intention) measurement, existing literature adopts a partition into *actual* and *typical* [10]. Typical behavior represents use of a transport mode without any specification of time period while actual behavior observes behaviors over a certain time period. Typical behaviors and intentions are further grouped into two mutually exclusive categories: *more than one week* and *one week or less*. The moderators are hence referred to as measurement (MST), trip purpose (TRIP), geographical location (LOC), publication year (YEAR) and sample type (SAMPLE), while the dependent variable is the effect size obtained from the meta-analysis.

ANALYSIS

To analyze the causes of heterogeneity across primary studies, we run meta-regression using Comprehensive Meta-Analysis 3.3; the results are shown in Table 1¹¹. MST appears to be the prominent factor in affecting the heterogeneity of results: the way in which behaviors and intentions are operationalized and framed in a survey does affect heavily the correlation with their predictors.

¹¹ Only effect sizes with significant moderating effect of at least one moderator are reported

Indeed, measurement moderates the relationship between most determinants and behavior. On the other hand, though, the measurement of intention (typical vs actual) does not explain the heterogeneity of results in the majority of cases: indeed, only in case of descriptive norms (DES-INT) the intention measurement is significant ($R^2 = 0.62$). Also TRIP has a relevant moderating role: specifically, it significantly explains the descriptive norm-behavior (DES-BEH), environmental concern-behavior (ENV-BEH) and intention-behavior (INT-BEH) relationships. In the case of correlates of behavioural intention, TRIP only predicts the descriptive norm-intention (DES-INT) relationship; however, it does not explain the proportion of total between-study variance ($R^2 = 0$).

SAMPLE (general, employees, students, and others) significantly explains attitude-behavior (ATT-BEH), attitude-intention (ATT-INT), past use-intention (PAST-INT), and intention-behavior (INT-BEH) relationships. LOC (Europe, North America, and Far East) does not contribute in explaining heterogeneity in effect sizes, consistently with literature suggesting that psychological determinants of TPB are generally homogeneous across different regions [12]. Finally, YEAR has little relevance as it explains intention behavior (INT-BEH) and environmental concern-intention (ENV-INT) relationships, only. As policy makers' strategies were planned and implemented primarily over the last decade, we expect that public awareness increased over time, translating individuals' environmental concerns into intentions and overt behavior.

TABLE 1: Meta-regression Results (Dependent variables are effect sizes between predictors and behavior/ intention)¹²

Dependent Variable	k	MST		TRIP		LOC		YEAR		SAMPLE	
		Q-stats (df)	R ²	Q-stats (df)	R ²	Q-stats (df)	R ²	Q-stats (df)	R ²	Q (df)	R ²
ATT-BEH	37	9.98 (2) ***	0.23	n.s.		n.s.		4.39 (1) **	0.01	22.0(2) ***	0.27
ATT-INT	38	n.s.		n.s.		n.s.		n.s.		7.87(3) **	0.27
INJ-BEH	28	13.2(2) ***	0.18	n.s.		n.s.		n.s.		n.s.	
INJ-INT	29	n.s.		n.s.		n.s.		n.s.		7.96 (3) **	0
DES-BEH	10	16.2(2) ***	0.50	13.2(1) ***	0.54	n.s.		n.s.		n.s.	
DES-INT	13	33.0 (2) ***	0.62	4.43(1) **	0.14	n.s.		n.s.		n.s.	
PBC-BEH	26	7.67 (2) **	0.20	n.s.		n.s.		n.s.		n.s.	
PBC-INT	32	6.75(2) **	0	n.s.		n.s.		n.s.		n.s.	
ENV-BEH	10	7.48 (2) ***	0.40	12.6(1) ***	0.63	n.s.		n.s.		N/A	
ENV-INT	16	n.s.		n.s.		n.s.		5.62(1) **	0.15	n.s.	
PROB-BEH	14	n.s.		n.s.		n.s.		n.s.		n.s.	
HAB-BEH	19	n.s.		n.s.		N/A		n.s.		n.s.	
HAB-INT	14	n.s.		n.s.		n.s.		n.s.		n.s.	
PAST-INT	10	10.2(2) **	0.12	n.s.		N/A		n.s.		25.0(3) ***	0.55
INT-BEH	22	30.3(2) ***	0.63	9.85(2) ***	0.14	n.s.		15.0(1) ***	0.34	11.2(2) ***	0.25

** p<0.01, * p<0.05, . n.s. non-significant, N/A=not applicable

k= number of studies included in meta-analysis

MST= measurement of dependent variable; TRIP= trip purpose; SAMPLE = type of sample in primary studies; YEAR= publication year as proxy of study period; LOC=geographical location; ATT= attitudes; INJ= injunctive norms; DES= descriptive norms; PBC= perceived

¹² Only effect sizes with $k > 10$

behavioral control; PROB= problem awareness; ENV:= environmental concern; HAB= habit; PAST= past use; INT= intention; BEH= behavior

CONCLUSION & IMPLICATIONS

Increased car dependency is a crucial issue of our times [13], as private mobility results in economic, environmental and societal repercussions [14]; as a consequence, various policies and strategies have been planned and implemented to address the problem. Strategies aiming to lower ecological footprint of travel patterns and to change mobility-related behaviors are referred to as Travel Demand Management (TDM) measures [cf. 15]. Acceptability of transport policy measures and change in travel behavior also require understandings of socio-cognitive factors [15,16,17]: indeed, commuters represent the key actor, as they determine by their every-day decisions the success or failure of any commercial initiative or public policy measure. Acknowledging the importance of individual behavior, the present study focused on behavioural dimensions of private car vs. alternative transport modes.

A meta-analysis was performed to synthesize the vast literature on travel mode choice, often reaching inconsistent results. Moreover, we provide an added value to the debate by analysing the moderating effect of given variables, capable of explaining the high heterogeneity emerging from the meta-analysis. The results suggest that behavioural measurement methods are highly relevant and significant in explaining fragmentation and heterogeneity of outcomes. The implications for policy makers are evident. Since commuters' decision-making processes are bound to represent a crucial informational background for TDM and/ or soft policy measures, it is necessary to gain deep understandings of the relationship between operationalization and framing of constructs on the one hand, and outcome of empirical investigations on the other hand. This will prevent policy makers from planning and implementing their strategies based on an over-simplified interpretation of the information at hand.

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Measurement and reporting of sustainability effect of urban mobility

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Summary: the sustainability of transport and urban mobility in particular, has become over time a major concern for policy makers and a conceptual challenge for scholars of different disciplines. In spite of significant technological improvements being introduced over the last twenty years, according to EPA transport is still responsible for 14% of global GHG emissions, more than half of NO_x emissions and about 15% or more of other harmful pollutants. Unlike other sectors, it is estimated that transport will increase its emissions in the future. Within urban context the environmental impacts of transport are even more relevant, and flanked by further social and economic impacts given the involvement of the large majority of world's population. According to UNFPA, 54% of the world's population currently lives within urban areas and 80% of global GDP is produced in towns. In Europe, urban dwellers represent 73% of total population and such figure is on the increase. Cities are also crucial hubs for the transport of goods and people at medium and long-range, thus the quality of urban mobility infrastructures influences the quality of the entire transport system.

Such framework placed urban mobility as a priority in the policy checklist as well as in sustainability research. In this chapter we try to highlight the evolution of sustainability assessment methods and tools referring to transport and urban mobility, through the review of key contributions in the field.

Keywords: Sustainable mobility, urban sustainable mobility, sustainability assessment, sustainable transport.

INTRODUCTION

In parallel with growing concerns about the environmental and socioeconomic problems related to the urbanization processes, the assessment of the impact of Urban Mobility Systems (UMS) on sustainability has become a crucial topic. The proceedings of the conference organized in 1996 by OECD entitled "Towards Sustainable Transportation" represent not only a review of crucial issues but also a fair portrait of the debate, at that time, on the principles for sustainable mobility (OECD 1997). In transport, the debate on sustainable development and related principles had burst few years earlier (Banister & Button 1993; Whitelegg 1993), and the OECD proceedings fairly summarize both the consolidated knowledge and the (sometime even severe) debate on mobility of the time. For this reason, in the spirit of a twenty-year review, we adopt the OECD proceedings (OECD 1997) as a watershed, useful to highlight two decades of evolution on the thoughts on sustainable transport. For the aim of this chapter we will refer to the ante-1996 positions and literature as "initial" or "original", as opposed to the current ones, although there is not such a evident borderline, since debate on

sustainable transport started long before 1996. Given this necessary simplification, to our opinion a few traits had a significant impact on the assessment of the sustainability of transports, and of urban mobility in particular.

1) *A shift in the focus from "transport" towards "mobility"*. Mobility is a broader concept than transport, since mobility "refers not only to actual movement, but also to a potential to move and thus to the spatial, economic, and social context of movement" (Gudmundsson 2003). As a consequence, contemporary analysis is much more interdisciplinary than that of twenty years ago, when technological development and public policies were basically the only levers of intervention. The emphasis on individual mobility and on the implementation of land-using infrastructures is replaced by a focus on providing sustainable accessibility through the integrated planning of land use and mobility (Bertolini et al. 2005; Curtis 2007; Geurs & van Wee 2004). The integration of mobility and land use planning, albeit a long tradition, only recently reconsidered the role of transport demand forecasts in orienting the infrastructural development.

2) *From eco-centrism and techno-centrism to socio-centrism*. The last decades witnessed an increased relevance of the impacts of transport as a consequence of the political prominence given to sustainability in general and to the specific issues caused by transport in particular (Button & Nijkamp 1997; Gudmundsson 2004). The initial emphasis on the environmental impact, mostly summarized in terms of pollution and land consumption, has been integrated (not substituted) over time by an increasing attention on social and equity aspects (Banister 2002), in the attempt to heal the evident discrepancy between a techno-centric approach to transport planning and its effects in terms of socio-economic impact on the urban environment (Hoogma et al., 2002). Moreover, the increasing relevance of the urban dimension has highlighted a variety of issues requiring a system-based policy orientation (Goldman & Ghoram 2006) and enhanced the contribution of approaches other than economics and engineering (i.e. geography, urban planning, behavioral sciences, management).

3) *The emerging inherent value of travel*. The view of travel as a derived demand (i.e. merely providing utility through reaching the destination) rather than an inherently valued activity, has been questioned and gradually abandoned, replaced by an emerging concept of mobility opportunity as a key contributor of economic and social benefit (Banister 2008). Such a shift in perspective has an impact on assessment insofar it induces different framing of variables that are traditionally assumed as priority goals of transport

planning and proxies of travel quality as well (e.g. speed and time minimization). Nowadays the concept of sustainable commuting considers the overall door-to-door journey from a multi-modal perspective, thus including a combination of means of transportation (walking and biking included) as a way to maximize efficiency and effectiveness of commuting (Kumar et al., 2013).

4) *The relevance of the local context.* The last two decades boosted the peculiarities of specific areas of transports and the dichotomy between issues related to transport in general vs urban and local environment; indeed, the implementation of local sustainability principles may be in conflict with the principles of sustainability applied to macro-regional level. The impact on sustainability assessment mainly derives from the increasing relevance of urban dimension, embedding both constraints and opportunities for the development of sustainable mobility (Banister 2008).

5) *A broader and more complex articulation of economic and financial issues related to mobility.* Originally, the economic sustainability of transports and UMSs was somehow given for granted, problematized in strictly economic terms of public costs vs public benefits (Lakshmanan et al. 2001) and in market vs public control. Little attention has been paid both to the external costs of transport and to the financial sustainability of UMSs (Buehler & Pucher 2011). Today great emphasis is given to the trade-off between socio-environmental improvements and the economic sustainability of transport. Two aspects to be investigated clearly emerge. First, an attempt to define a method to assess the external costs of transport (Bickel & Friedrich 2013; Essen et al. 2011) in order to set an efficient pricing for transport infrastructures (Maybach et al. 2007). Second, the assessment of UMSs' economic benefits envisaging the creation of efficient business models for transport services, in order to trigger dynamics of business model innovation capable of supporting the sustainability transformation of markets (Schaltegger et al. 2016). There is widespread consensus on the relevance of the issue among experts, companies (testified, for instance, by the WBCSD program Sustainable Mobility 2.0) and, of course, policy makers. Nevertheless, the possible development of business models to support sustainable urban mobility is still receiving little attention from academic literature and with a focus angled towards specific solutions rather than to the overall mobility system (e.g.: Cohen & Kietzmann 2014; Christensen et al. 2012).

SCHOOL OF THOUGHT & KEY RESEARCH FINDINGS

Given the multidisciplinary nature of mobility issues, several strands could be identified with respect to the various branches of knowledge involved. Furthermore, the contributions on the topic are numerous so that the selection presented in this chapter is necessarily affected by subjectivity.

In our view it is more a matter of perspective than of school of thoughts. Gudmundsson (2004) identifies three approaches to the assessment of sustainable transport. The first approach stems from the implementation of a

policy agenda and includes sustainability into transport planning through the consideration of specific indicators. The second approach stems from the replication and adaptation of the sustainability concept in the field of transports to determine its implications (Gudmundsson 2004, 37), while the third approach is actually the synthesis of the previous two.

Treasuring from this contribution, we believe that the actual differences in predominant perspectives reflect the different goals of those (experts and scholars) who tried to give conceptual soundness to the inherent contradictions in the concept of sustainable mobility.

In our view, two perspectives emerge as a result of two types of conceptual efforts.

The first perspective, *principles-oriented*, tries to adapt and operationalize the general principles of sustainable development into the mobility field, thus identifying sustainable paths for mobility systems development and related priorities. At the basis of this approach we envisage the quest for the guiding principles for the development of mobility systems, which can be summarized by the question: "Which mobility?" (Black et al. 2002; Gudmundsson & Höjer 1996; Holden 2012, pp. 10 ss).

The second perspective, *planning-oriented*, aims at managing the trade-offs emerging when conflicts among priorities (i.e. the contradictions between desirable and undesirable effects of mobility systems) become evident. This approach focuses on planning, on how mobility systems should be set up and what they should do, given the priorities and the consequences (both desirable and not) of the evolution of mobility demand (Banister 2008; Kennedy et al. 2006; Litman and Burwell 2006). The main goal of this second approach can be summarized by the question "Which issues?"

In both cases there is an evident cross-fertilization between the theory-based and the policy-based contributions, which in literature merge with each other with very blurred boundaries. Also, in both cases there is a need for measures synthesizing theoretical robustness and practical feasibility. Great efforts have been devoted in reconciling these two aspects, in order to find "the right balance between a measure that is theoretically and empirically sound and one that is sufficiently plain to be usefully employed in interactive, creative plan-making processes where participants typically have different degrees and types of expertises" (Bertolini et al. 2005, 218).

This evolution generated contributions both from practitioners and from scholars of several disciplines trying to include in practical methods and tools the complexity of sustainability principles applied to mobility.

Contributions deriving from on-ground experiences are extremely numerous. A recent report from EU Com. DG Move (2013) probably represents the best example of how to apply the set of analytical tools available today for measuring the impact of UMSs, according to the pragmatic perspective of urban planners and policy makers (EU Commission – DG Move 2013).

As regards the academic perspective, two main types of

contributions emerge. The first deals with methods' frameworks and indicators in an integrated way. Table 1 lists contributions providing reviews of frameworks, methods and indicators (both for sustainability assessment in general and for mobility in particular).

TABLE 1: CONTRIBUTIONS ON THE TOPIC OF SUSTAINABLE MOBILITY OVERALL FRAMEWORK, METHODS AND INDICATORS FOR ASSESSMENT

Frameworks, methods and reviews of indicators and evaluation systems for sustainability in general	Böhringer & Jochem 2007; Hiremath et al. 2013; Ness et al. 2007; Singh et al. 2009.
Frameworks, methods and evaluation systems in the field of mobility	Gudmundsson 2004; Huang et al. 1998; Nicolas et al. 2003; Olofsson et al. 2015; Richardson 2005; Santos et al. 2010.
Reviews of indicators in the field of mobility	Black et al. 2002 Gudmundsson 2003; Hüging et al. 2010; Jourard & Nicolas 2010.

The second type of contributions focuses on the assessment of specific areas presenting peculiar methodological and practical challenges.

Table 2 presents a list of references dealing with frequently mentioned areas of assessment. Each area presents different levels of generality and, consequently, overlaps between areas occur (e.g. quality of life includes accessibility, health, safety perception, etc.).

TABLE 2: AREAS OF ASSESSMENT OF SUSTAINABLE MOBILITY AND RELATED CONTRIBUTIONS

Accessibility	Gudmundsson 2003; Bertolini et al. 2005; Geurs & van Wee 2004.
Eco-efficiency	Doi & Kii 2012; Usón et al 2011.
External Costs	Bickel & Friedrich 2013; Essen et al 2011; Maybach et al. 2007; EU Com. DG Move 2013.
Footprint	Amekudzi et al. 2009.
Land Use	Bertolini et al. 2005.
Multimodality performance	Kumar et al 2013; Mishra et al. 2012; Welch & Mishra 2013.
Participation, involvement	Loukopoulos & Scholz 2004.
Quality of life	Steg & Gifford 2005.
Societal impact	Dempsey et al. 2011.

METHODS AND TOOLS

Both the methods and the set of indicators proposed for measuring the sustainability of mobility systems can be

very different according to the above-mentioned perspectives (principles vs planning oriented) and to the area.

The technological, environmental and economic dimensions of mobility can rely on a vast set of tools to measure direct impacts of transport. For variables such as emissions, energy consumption, investments, direct costs, etc. there are shared assessment methods and consensus over the direction of improvement (e.g. zero emissions). The complexity increases as a) more comprehensive measures of the impact are explored; b) the sustainability impact includes social aspects. In these cases data interpretation can easily get controversial. For instance, a lower number of travels means less impact on the environment but not necessarily a better quality of life, probably a lower social involvement, etc. Furthermore, the social environment is at the same time the object and the yardstick of the sustainability impact, since the societal perception of sustainability issues changes over time and across space. For instance, the acceptance of a given level of pollution or of a congestion charge will change together with technological development, and might differ significantly across countries, according to their level of economic development.

Not surprisingly, recent debate focused more on the social than on the economic or environmental side. This represents the most intriguing and promising field of research, for at least two reasons. First, efficiency and effectiveness of mobility systems have a direct impact on a large number of the key variables of social sustainability. Second, measures of social sustainability cannot be directly deduced by environmental and economic indicators but should be assessed on multiple scales (Dempsey et al, 2011).

To sum up, while in the past greater emphasis was given to specific indicators, in the last two decades the measurement of mobility impacts on sustainability is focusing on multi-faceted concepts encompassing aspects that summarize socio-economic and environmental factors. Three closely interrelated concepts, in particular, play an important role in linking the various aspects of sustainability, while being indicators for both goal planning and performance evaluation: land use, accessibility and multimodality (or interconnectivity).

Land Use is used to express both a measure of the impact of mobility infrastructures and as an accessibility enabler (Bertolini et al., 2005; Geurs & van Wee, 2004). When used as expressive of the impact "land use serves as an indicator of land-linked environmental problems, such as reduction of biological diversity, closing down of valuable food production areas and cultural landscapes, and conflicts between users vying to use the same areas." (Holden 2012, 211).

Accessibility represents the most commonly used proxy for assessing the social impact of mobility. It has been defined in several ways (Gudmundsson, H and Höjer 1996, 275; Black et al. 2002, 186; Bertolini et al. 2005, 209; EU Com.. 2013, 32), but all definitions refer to the range of activities (work, leisure, services) that can be accessed in an efficient way. A comprehensive definition which considers both land use (e.g.: urban sprawl, urban

design) and the mobility system is the following: “The extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s).” (Geurs & van Wee, 2004, 128).”

Multimodality (or interconnectivity) refers to “public, ordinary networks in urban areas, particularly in metropolis where the citizens may utilize the combinations of several modes of transportation” (Kumar et al. 2013, 796). It is often associated with accessibility, although the two concepts are distinct insofar the latter normally refers to areas and services, while the former refers to the mobility systems. Interconnectivity is measured through “frequency, speed, distance, capacity, required transfers, and activity density of the underlying land use served by a transit node, for all modes” (Welch & Mishra 2013, 31).

The growing attention that these composite indicators receive in literature leads to the assumption that they will receive greater attention both from practitioners and from scholars.

RELEVANCE TO PRACTICE

Twenty years of increase in the knowledge about the impacts of mobility led to greater awareness of overall improvements related to proper mobility management and reporting. We envisage at least three major implications for corporate practice.

The quest for efficiency will benefit from considering mobility management (concerning fleets, logistics, commuting) as a long-term oriented investment coordinated with local and regional mobility policies.

At the same time the constant advancement in UMSs will reshape business models around new concepts of “freedom of movement” separate from that of “private mobility”. This will push carmakers, which are already shaping their strategy on different business models, to enhance this evolution (Stocchetti 2013, 53). On the other hand we could expect several changes in the business models of products and services related to urban mobility, and we believe that there are many unexplored opportunities.

CONCLUSIONS AND OUTLOOK

The assessment of mobility impacts on sustainability made significant progress in the last twenty years, becoming a priority for policy makers: indeed, today companies have to consider mobility (which includes yet it is not limited to transport) from the perspective of the sustainability impacts and consequently from the standpoint of long-term competitiveness. As the social awareness of mobility-related issues increases, citizens represent a key-target of reporting concerning such area. Yet, besides reporting the impacts of mobility the future challenge will be to take into account the costs of mobility non-development. Poor mobility is associated with under-development, health issues, lower quality of life, lower business and employment opportunities, hence lower competitiveness: namely what is often (and somehow reductively) called external costs. Sustainability and management scholars must find viable

solutions to report such external costs beyond the monetary value provided by an economic approach, thus contributing to the full control and awareness of corporate’s impacts.

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Sustainability Accounting Practices in Supply Chain Management During the Previous Two Decades

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Summary: Sustainability accounting practices in the management of supply chains during the last two decades have demonstrated the following characteristics. First, the trend to adopt sustainability accounting practices in supply chain management is recent. Second, sustainability management accounting, rather than sustainability financial accounting, is dominant in supply chain management; physical sustainability management accounting practices which do not reflect monetary value are also common in managing supply chains. Third, it is noted that there is a limited and narrow focus of sustainability management accounting practice applications in supply chain management. Fourth, there is a lack of knowledge in this field and little to no collaboration in collecting, measuring, and reporting sustainability performance data. Fifth, there is a dearth in common standards and sustainability accounting tools available for the management of supply chains; that is, there are few common metrics or measurement tools for sustainability performance in supply chain management. Finally, there is a scarcity in studies which have focused on supply networks. That is, the existing, narrowly defined scope and boundaries of studies of supply chains will provide only short-term, efficiency-based solutions. Rather than focusing on the supply chain, the entire scope of the supply network should be researched in order to provide analysis of sustainability accounting tools. Such deep analysis will result in informed, relevant, useful decision making.

Keywords: Sustainability accounting practices, sustainability management accounting, sustainability financial accounting, sustainability, supply chain management

INTRODUCTION

Globalisation brings both opportunities for businesses and threats in considering the scopes and boundaries of their operations. When organisations expand their business scope to include global operations, supply network management becomes an increasingly critical function in achieving corporate sustainability [9]. The internationalization of the supply network brings into play a more complex system, one which is necessary in order to control the managerial challenges created. It also brings to companies the greater risk of being associated with poor sustainability related management practices. Accounting practices should address the complexities of a supply chain involving the focal firm, as well as upstream and downstream business partners. As Burritt and Schaltegger (2014) point out, if their relevance is to be retained, accounting practices need to change in order to reach beyond the corporate scope in the supply chain.

This paper investigates how sustainability accounting practices in the supply chain management research discipline have developed. This literature review takes a systematic approach to identify the focus, orientation and salience of sustainability accounting practices in supply chain management research over the period 1996 – 2015

(20 years). The three questions are addressed relevant to this period: (1) What has been the focus of research in sustainability accounting practices in supply chain management and how has this changed over time? (2) What is the orientation in sustainability accounting practices in supply chain management and how has this changed over time? (3) What is the significance of sustainability accounting practices in supply chain management and how has this changed over time?

The scope of the literature review on sustainability accounting practices in supply chain management encompasses both financial and management accounting approaches which are explicitly used in sustainability accounting literature (e.g. sustainability reporting, sustainability disclosure, environmental management accounting, balanced scorecard, etc.). Considering these studies, a broad range of sustainability accounting tools and methods are listed in Table 1. Initially 14 keywords of management accounting are adopted from Schaltegger et al.'s (2013) environmental management accounting literature review, and we end with 8 keywords in financial accounting and 32 in management accounting, a total of 40 keywords in sustainability accounting.

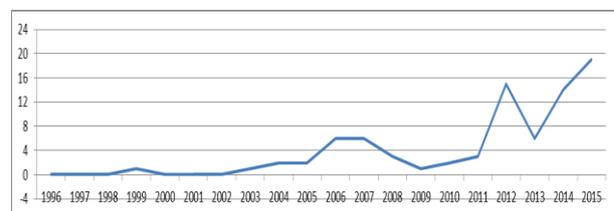


FIGURE 1: HISTORICAL DEVELOPMENT OF SUSTAINABILITY ACCOUNTING IN THE SUPPLY CHAIN MANAGEMENT FIELD

Overall, the trend indicates that sustainability accounting mentioned in supply chain management journals has increased only during the last three years, from 2012 to 2015 (see Figure 1). In the ten years between 1996 and 2005, only 12 articles regarding sustainability in supply chain management research can be found, whereas in the next five years, between 2006 and 2010, the number increases to 18 articles with an average of 3.6 publications per year. In this timeframe, we notice an increase of publications, in particular in 2006 and 2007, with 12 articles. The last five years between 2011 and 2015 showed a significant increase with up to 19 articles in 2015, averaging more than eleven articles per year. As shown in Figure 1, the recent trend is to see an increasing emphasis on sustainability accounting in mainstream supply chain management journals.

TABLE 1: KEYWORDS USED FOR SUSTAINABILITY ACCOUNTING PUBLICATIONS

Sustainability Accounting Keywords	
Financial Accounting (8)	Management Accounting (32)
Carbon disclosure	Activity-based accounting
Carbon reporting	Activity-based budgeting
Environmental disclosure	Activity-based costing
Environmental reporting	Balanced scorecard
Sustainability disclosure	Carbon accounting
Sustainability information disclosure	Climate change accounting
Sustainability reporting	Eco-control
Triple bottom line reporting	Environmental cost accounting
	Environmental cost accounting
	Environmental management accounting
	Environmental measurement
	Environmental performance measurement
	Full cost of environmental reduction
	Full cost accounting
	Green accounting
	Life cycle costing/life cycle analysis
	Material and energy flow accounting
	Material flow accounting/analysis
	Material flow cost accounting
	Sustainability balanced scorecard
	Sustainability management accounting
	Sustainability measurement
	Sustainability performance measurement
	Sustainability performance measurement
	Total cost assessment
	Triple bottom line accounting
	Waste accounting
	Water accounting
	Sustainability accounting
	Ecological accounting
	Environmental accounting

SCHOOL OF THOUGHT & KEY RESEARCH FINDINGS

Over the three decades, sustainability accounting has evolved to encompass an understanding of how accounting tools and systems can contribute to supporting corporate sustainability management. The term sustainability accounting has gained considerable attention from academia and practitioners, and has become a generic expression to cover sustainability financial accounting and sustainability management accounting. Traditionally, financial accounting provides a foundation for external financial reporting disclosure,

while management accounting provides data for decisions made by managers for internal planning and controlling purpose. With a critique on financial accounting, Elkington (1998) proposed a triple bottom line to expand the dimensions and indicators of corporate sustainability performance (environmental, social and economic) through sustainability accounting and reporting. From a management accounting perspective, Burritt et al. (2002) provides the framework for environmental management accounting which differentiates between measurement tools and decision situations.

Two schools of thoughts are recognized in sustainability accounting research. One is the ‘critical perspective school’ which argues the limits of usefulness of conventional and sustainability accounting for the purpose of recording and disclosing information about environmental and social sustainability performance at a firm level. The critical perspective views that sustainability accounting plays a very limited role in supporting corporate sustainability and will disappear in the future [7]. The other school is the ‘pragmatic perspective school’ which focuses on how possible solutions could be developed and implemented in corporate practice. It adopts a pragmatic approach to link sustainability accounting and corporate management practice [2]. The pragmatic perspective views sustainability accounting as a set of tools to help corporate managers to make decisions about corporate sustainability issues in planning decisions, capital allocation, and performance evaluation [1]. Both schools of thought have demonstrated that measuring sustainability is a critical, challenging task because of the uncertainty of the results and outcomes, contrasting goals of economic, environmental and social performance, and the influence of external and organisational factors [3].

Despite the popularity of sustainability accounting in research and practice, sustainability accounting practices have not yet been accepted in supply chain management. In their special issue of the British Accounting Review - Accounting towards sustainability in production and supply chains, Burritt and Schaltegger (2014) note that sustainability accounting is a relatively new practice in the supply chain management field, and several key functions of sustainability accounting should be developed further to measure relevant sustainability performance in supply chains. They raised three key questions about accounting for sustainability in production and supply chains: (i) the implications of adopting the supply chain as being the entity of focus, (ii) how do sustainability metrics differ from conventional metrics, and (iii) where does responsibility lie for such accounting? Defining the supply chain as an entity is one of the most challenging issues due to the complexity of legal forms and boundaries of liability [5]. The use of sustainability metrics in measuring sustainability performance in supply chains has rapidly increased, and the application tools and methods vary depending on the context and purpose of the study [3]. Due to the broadened entity scopes, the complexities of the increased performance measurement and responsibilities has varied. Using a pragmatic perspective, Burritt and Schaltegger (2014) proposed a ‘twin-track approach’ to

sustainability accounting, taking an inside-out approach and a complementary outside-in approach. From an inside-out approach, a key task is to identify key performance indicators (KPIs) in corporate and business strategies and to build a management support system; from an outside-in approach, a core challenge is to identify threats and opportunities and to establish sustainability policies, sustainability accounting practices and reporting and assurance from outsiders' perspectives. A combined approach - 'a twin-track approach' - is proposed as a pragmatic approach for sustainability accounting in supply chain management.

Supply networks are inherently complex because of the nature of the globalized business network, multi-tier processes and service flows, as well as the increasing uncertainty created by the supply networks' vulnerability [8], [10]. Since corporate sustainability is a multi-faceted concept which includes the environmental, social and economic aspects of a company, corporate managers face complex challenges in attempting to implement corporate sustainability. Although a single disciplinary or functional specialization has produced a better understanding of partial aspects of sustainability, disciplinary or functional specialization fails to create a sufficient understanding of the interlinkages between multi sustainability dimensions. As Schaltegger et al. (2013) map out, interdisciplinary and/or transdisciplinary research can provide a better understanding of corporate sustainability research. In order to understand the actual sustainability problems and challenges inherent in supply chains, it is necessary to obtain specific, accurate, reliable and timely information for each supplier in the supply chain as well for the business partners in inter-supply chain networks.

METHODS AND TOOLS

Using a systematic literature review, we find important aspects of sustainability accounting applications in the supply chain management field.

First, we cannot find any studies of financial accounting tools and methods of sustainability accounting in the supply chain management field. In contrast, research into managements' accounting practices in sustainability accounting (or environmental and sustainability management accounting) in supply chain management journals appears popular. The range of tools and methods available for sustainability management accounting practices in supply chains has increased. This is consistent with a field that exhibits a considerable degree of heterogeneity in terms of research tools and methods focus.

Second, we find studies into a range of supply chain activities including production and manufacture, supplier performance, logistics and transportation, buyer and supplier relationship, product development, and others. Second, we find research into multi-sustainability accounting tools and methods relating to the management of supply chains. Life cycle costing/life cycle analysis is the most popular tool, and triple bottom line accounting is the second most popular tool in supply chain

management research. Figure 2 presents the research focus and the number of papers relating to supply chain activities. Not surprisingly, we found that 38 per cent of the total numbers of articles (31 of 81) are focusing on the issue of product manufacturing within the supply chain. This is followed a specific focus on the supplier relationship at 20 per cent (16 of 81 articles). Eleven per cent of the articles (9 of 81) focus on logistics. Moreover, seven per cent of the articles (6 of 81) deal with the supplier-customer relationship and two per cent (2 of 81) focus on specific products. Other supply chain activities consist of multiple activities in the supply chain.

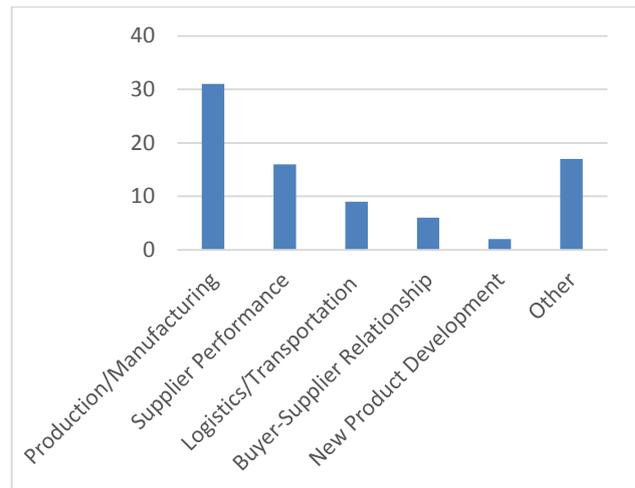


FIGURE 2: SUPPLY CHAIN ACTIVITIES FOCUS

Third, we also analysed the papers according to sustainability accounting tools and focus on methods in supply chain management (see Figure 3). Interestingly, 36 per cent of articles (29 of 81) do not specify any tools/methods used in sustainability accounting practices. However, the remaining 64 per cent (53 of 81) studies provide sustainability accounting tools or methods. The most mentioned tool is LCA/LCC (31), followed by the triple-bottom-line (11). The remainder includes material flow accounting/analysis (MFA), sustainability balanced scorecard (SBS), and key performance indicators (KPI).

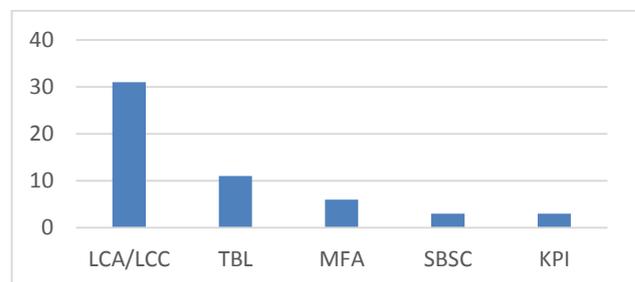


FIGURE 3: SUSTAINABILITY ACCOUNTING FOCUS

To understand the trend of these tools, we categorised them into 5 year sections (see Table 2). We find that between 1996 and 2010, LCA is the dominant tool in the supply chain management field. More recently, between 2011 and 2015, the range of multi-tools and methods has varied. Although LCA is still the dominant tool, emerging tools and methods such as triple-bottom-line accounting (TBL) or material flow accounting/analysis (MFA) have now appeared in the field of supply chain

management. Notably, physical sustainability accounting tools and methods are increasingly used in supply chain management. In particular, sustainability management accounting tools and methods are found in measuring sustainability performance in supply chain management.

TABLE 2: SUSTAINABILITY ACCOUNTING TOOLS AND METHODS IN SUPPLY CHAIN MANAGEMENT (1996–2015)

Tools/Methods	1996-2000	2001-2005	2006-2010	2011-2015
LCA/LCC	1	1	4	25
TBL	0	0	1	10
MFA	0	0	0	6
SBSC	0	0	0	3
KPI	0	0	0	3

RELEVANCE TO PRACTICE

In this study, no single financial sustainability accounting study was found in the context of supply chain management. Sustainability management accounting tools are relatively popular in supply chains, in particular, measuring sustainability performance in a single activity/function in supply chains is common practice.

As seen in Figure 2, limited, in-house production and the manufacturing aspect of supply chain and supplier performance as a part of the supplier selection process are popular. In a traditional corporate supply chain, the supply chain is defined as a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a supplier to a customer [11:4]. Supply chain management focuses mainly on the upstream and downstream relationships with suppliers and customers, delivering superior customer value at least cost. In a globalized marketplace, corporations work closely with multiple suppliers and multiple customers in a broad system – what we call the ‘supply network’. In a corporate supply network, connected and interdependent business organizations work collaboratively to manage the flow of goods, services and information from suppliers to end users, collaborating with and monitoring sustainability management.

Physical sustainability management accounting tools such as LCA, TBL, MFA are popular in supply chain management analyses without monetary value and information. That is, monetary value or information is not addressed in studies of sustainability management accounting practices in the context of supply chain management. Since most studies identified that an environmental management department or a production department collects physical sustainability information, there is lack of knowledge about monetary sustainability management accounting tools and methods. That is, there are important collaboration opportunities between accounting and finance departments and production and operation departments and/or environmental management departments. By working collaboratively with multi-teams/departments, the accuracy and relevance of

accounting tools for sustainability in the management of supply chains will be enhanced.

Measuring sustainability performance of internal production in the management of supply chains is popular.

From an internal perspective, predominantly studies focus on in-house production and manufacturing related performance measurement, and monitoring supplier performance in supply chains, while focus on issues from upstream and downstream is relatively minor. Taking an inside-out approach, under corporate and business strategies, sustainability management accounting tools and methods can offer (i) identification of KPIs about sustainability performance in supply chains, and (ii) building management support systems to operate corporate sustainability strategies. In addition, an outside-in approach can complement an inside-out view by identifying external environmental opportunities and threats, establishing sustainability policies and communication reporting practices.

CONCLUSIONS AND OUTLOOK

This study finds that the current practices in sustainability accounting in supply chain management have the following characteristics. First, recently the trend has been to adopt sustainability accounting practices in supply chain management. Second, sustainability management accounting rather than sustainability financial accounting is dominant in supply chain management; physical sustainability management accounting which does not reflect monetary value is also common practice in supply chain management. Third, it is noted that there is a limited and narrow focus of sustainability management accounting applications in the management of supply chains. Fourth, there is a lack of knowledge and collaboration in collecting, measuring, and reporting sustainability performance data in the area of supply chain management. Fifth, the management of supply chains generally lacks common standards and sustainability accounting tools. That is, there are few common metrics or measurement tools for measuring sustainability performance in supply chain management. Finally, there has been, to date, insufficient focus and collaboration on supply networks. That is, the current, narrowly defined scope and boundary of research into supply chains will give short-term, efficiency-based solutions. The supply network, rather than a single supply chain, should be addressed in order to use sustainability accounting practices to make informed, relevant, and useful decisions.

In the future, the following areas are suggested as directions for both academics and practitioners.

First, the scopes and boundaries of sustainability in supply chain management should be enhanced. Due to the complexities of supply chains locally and internationally, the entities of supply chains become key challenges in addressing the strategic roles of sustainability accounting. Accounting for a single firm (or a focal firm) is different from accounting for a supply chain. This challenge leads to the issues of how to define the scopes and boundaries of sustainability dimensions in the management of supply chains. Once these scopes and boundaries are defined,

then measuring and reporting of sustainability accounting practices should be tested for application.

Second, from an inside-out perspective, more management accounting focused sustainability accounting practices are needed. A combined or twin-track approach, with both an inside-out and an outside-in perspective on corporate sustainability issues in supply chain management, should be tested and examined for relevance and usefulness. This approach will provide the opportunity for discussion of the benefits and the trade-off between environmental, social and financial performance with the identified, measured outcomes of sustainability in the management of supply chains.

Third, more business cases for and of sustainability in supply chain management should be sought. Since there is a lack of knowledge about, and collaboration in, the application of sustainability accounting tools in supply chains, research is needed to address ways in which a focal company and multi-tier suppliers/business partners are able to improve knowledge and understanding about sustainability in supply chains in a collaborative relationship. Such research will assist in identifying a focus on sustainability, and will enable the collection and application of relevant sustainability accounting tools and methods to provide appropriate physical and monetary information for corporate and related suppliers/business partners.

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Corporate carbon and financial performance: A meta-analysis

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This article employs meta-analytical techniques to investigate the relationship between corporate environmental performance (CEP) and corporate financial performance (CFP). Whereas existing meta-studies in this research field synthesize a variety of measurements for CEP, the present study focuses on only one particular operational performance dimension: corporate carbon performance (CP) as expressed by a firm's level of carbon dioxide (CO₂) emission equivalents. The sample comprises of 67 estimations from 33 empirical studies, covering a total of 89,157 observations. Particular attention is paid to the question how CP and CFP are measured. On the one hand, it is analyzed whether the choice of measurements for CFP predetermines the outcomes of empirical research. On the other hand, it is examined how differences in the operationalization of carbon emission data influence the effect on CFP. The results indicate that while CP is generally positively related to CFP, the effect is stronger for market-based CFP measures compared to accounting-based CFP measures. Furthermore, it is found that the effect is stronger for mandatory reported emission data compared to voluntary reported emission data, stronger for emission intensities compared to absolute emissions, stronger for current CP compared to actual emission reductions, and stronger for direct emissions compared to direct and indirect emissions. The results may guide future research on the linkage between CP and CFP and highlight arguments for practitioners to implement carbon emission abatement measures.

INTRODUCTION

The relationship between corporate environmental performance (CEP) and corporate financial performance (CFP) has received substantial attention in research on business and the natural environment and is closely associated with the question 'does it pay to be green?' [1], [2]. A large body of empirical work suggests that CEP is aligned with improved CFP, e.g. [2], [3], whereas several other studies provide contradictory results supporting a neutral or even negative relationship, e.g. [4], [5]. The existence of conflicting findings generally support earlier work by *King and Lenox* who argue that it is more important to ask 'when does it pay to be green?' than 'does it pay to be green?' [6]. Indeed, several studies adopt meta-analytical techniques to synthesize empirical findings across individual examinations in order to address the question 'when does it pay to be green?', e.g. [7]-[9]. Their results suggest that CEP has the strongest influence on market-based CFP measures [8], that the relationship is stronger when the strategic approach underlying CEP is proactive rather than reactive [9], and that regional differences affect the results [7], among other things.

Notwithstanding the valuable insights that previous meta-studies provide, one fundamental shortcoming characteristic of meta-analytical research is that existing studies synthesize empirical evidence from primary studies across a broad scope of different CEP outcomes such as toxic chemicals releases, water pollution,

environmental expenditures, and legal actions (see [10] for an overview of CEP indicators used in empirical analysis). This approach has two main limitations. First, it neglects differences between ecological issues and their individual impact on the business environment: each environmental performance outcome is subject to very divergent mitigation costs and stakeholder perceptions. As *Fujii et. al.* emphasize, "[...] cost and economic benefit from pollution abatement are different for different types of pollution because the abatement technology and required equipment differ" [11]. Second, a synthesis of results across different CEP outcomes hinders a more detailed "assessment of the influence of the measurement approach on results" [10]. Different CEP measurement approaches prevail but have not yet been a central issue in meta-analytical research. However, the standardization of CEP data may be an important mediating factor influencing the relationship between CEP and CFP.

This study responds to the above described limitations and readdresses the research question 'when does it pay to be green?' In contrast to previous studies, the present study does not synthesize empirical outcomes across different CEP outcomes. Rather, it focuses on one specific CEP outcome: corporate carbon performance (CP) as expressed by a firm's level of carbon dioxide (CO₂) emission equivalents. Thereby, it contributes both to the ongoing debate on the relationship between CEP and CFP as well as to the financial implications of carbon emission abatement.

METHODOLOGY

A systematic literature review in three complementary steps was conducted to identify relevant empirical studies that analyse the relationship between CP and CFP. In the first step ProQuest's search engine ABI INFORM Complete and Elsevier's Science Direct database were employed to search the titles and abstracts of articles in peer-reviewed journals as well as in unpublished working papers. To be included in the sample, a study was required to provide an empirical estimate (i.e., correlation or regression coefficient) of the link from CP to a single or a set of multiple CFP indicators. It was searched specifically for combinations of the terms 'carbon performance' (or 'carbon emissions' or 'CO₂ emissions' or 'greenhouse gas emissions' or 'climate change') and 'financial performance' (or 'corporate performance' or 'firm performance' or 'firm value'). In the second step the reference lists of the retrieved studies were manually screened in order to extend the sample to include studies that were not identified through the applied search strings. In the third step studies were excluded from the initial sample that rely on aggregated carbon emissions in the form of bivariate dummy variables or rating-scales.

Working papers containing work that was recently published by the same authors in a peer-reviewed journal article were also excluded. The final sample consists of 33 relevant studies, comprising of 27 journal articles and 6 working papers, which were published between 2010 and 2016.

Random effects models were used to calculate mean correlations and test for the presence of heterogeneity [12]. Confidence intervals were calculated at the 95% level. Following statistical convention in meta-analytic research, it was assumed that relatively large samples produce more accurate estimates than small samples. Accordingly, inverse variance weights were used to give more weight to those studies with comparatively large samples. *Q*-statistics were used to test for heterogeneity of effect sizes. Statistically significant values for heterogeneity indicate that results of primary studies are heterogeneously distributed around the calculated summary effect. This indicates the presence of moderating effects (i.e., study characteristics) that influence the results of the studies. Sub-group analysis was used to investigate the reasons behind the presence of heterogeneity. All mean correlations were calculated with Stata® command *metaan*.

RESULTS

Table 1 summarizes the results of the meta-analysis. A statistically significant negative mean correlation was obtained for the total set of effect sizes ($r = -.053$, $p = .000$). The result indicates an overall negative relationship between carbon emissions and CFP or, in other words, an overall positive relationship between CP and CFP. The *Q*-test for heterogeneity is highly significant ($Q = 1,008$; $p_Q = .000$). This indicates that there are substantial differences in the estimated effect sizes across the studies included in the sample.

With regard to CFP measurement characteristics, the results show a significant negative relationship between CP and market-based CFP measures ($r = -.078$, $p = .000$). Whereas the estimate for the overall link between CP and accounting-based CFP measures is not significant.

With regards to CP measurement characteristics, the results indicate that the effect is stronger for mandatory reported emission data ($r = -.084$, $p = .001$) compared to voluntary reported emission data, stronger for emission intensities ($r = -.049$, $p = .000$) compared to absolute emissions, stronger for current carbon performance ($r = -.057$, $p = .000$) as compared to actual emission reductions, and stronger for direct emissions ($r = -.074$, $p = .000$) compared to direct *and* indirect emissions.

TABLE 1: RESULTS

	k	N	r	% CI	95	Q	Q _B
<i>Overall</i>	67	89,157	-.053	-.024	-.024	1,008	
Global	18	54,942	.004	.041	-.024	278	
Europe	8	4,815	-.075	.016	-.024	63	
US	11	8,014	<i>-.185</i>	-.040	-.024	347	

	k	N	r	% CI	95	Q	Q _B
Japan	16	14,236	<i>-.060</i>	-.004	-.024	150	
Australia	6	3,351	<i>-.056</i>	-.002	-.024	12	
Others	2	3,799	-.053	.038	-.024	9	
Sub-group analysis							
<i>CFP category</i>							
Accounting	34	23,418	-.027	-.061	.008	195	
Market	31	65,739	-.078	-.121	-.035	781	
							31
<i>CP reporting scheme</i>							
Mandatory	27	17,930	-.084	-.132	-.037	235	
Voluntary	38	71,227	-.033	-.070	.004	760	
							12
<i>CP indicator</i>							
Absolute	13	9,235	-.078	-.207	.053	376	
Intensity	52	79,922	-.049	-.075	-.075	567	
							64
<i>CP perspective</i>							
Current	60	88,059	-.057	-.087	-.027	995	
Reduction	5	1,098	-.004	-.102	.094	10	
							2
<i>CP scope</i>							
Direct	23	49,127	-.074	-.114		330	
+ Indirect	25	24,709	-.038	-.108		611	
							66

Note: k = number of effect sizes; N = sample size; r = summary effect; CI = confidence interval; Q = Q statistic for heterogeneity; Q_B = Q statistic between groups; CFP = corporate financial performance; CP = carbon performance; figures in **bold** and *italic* indicate significance at the .01-level and .05-level, respectively.

CONCLUSION

The results of the meta-analysis contribute to the existing literature in several ways. First, they provide empirical support based on 89,157 observations that companies are able to simultaneously reduce ecological impacts and improve CFP, as postulated by the eco-efficiency literature. This has an important practical implication: there is a clear incentive for companies to engage in carbon emission abatement. Second, the results demonstrate that investors recognize CP as an 'off-balance sheet liability' [13]. More specifically, with the emergence of climate change as a material issue for business performance, the results suggest that investors incorporate information about a firm's CP in their investments decisions. Third, the findings indicate that the results obtained in empirical research on the relationship between CP and CFP appear to depend heavily on the type of variable specification for carbon emission data, specifically the type of reporting scheme, the employed CP indicator, the perspective, and the emission scope.

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Reviewing discourse in SEA research in AAAJ: critique, contributions and possibilities for the discipline

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I

INTRODUCTION

It has been 14 years since Rob Gray's salient article in Accounting, Auditing and Accountability Journal (AAAJ) calling SEA researchers to arms in creating 'new imaginings' for the discipline. Since then, a number of apposite reviews of SEA literature have concluded that many inroads have been made into scoping the nature, purpose and extent of SEA [1], [5], [3], [7], [2], [6], [8]. Reviews have highlighted the tendency to concentrate empirical research into understanding the role of regulation, national differences and external disclosure studies [7]. Nonetheless, much remains to be done, particularly in evaluating the disjuncture between the practice of SEA and the practice of accountability. And further, how researchers have generally failed to critique, erode and re-construct the tenets of SEA to bridge this disjuncture. The purpose of the present study is to evaluate the research journey of the discipline since the calls for greater theoretical introspection, critical perspectives and empirical, practice-driven research into SEA. All SEA papers in AAAJ are categorised and reviewed since the journal's inception.

RESEARCH APPROACH

Leximancer text analysis software is used to understand relationships between high level concepts within each paper. The interrelationships between concepts are then tracked across time, specifically investigating the trends in the development of specific ideas, concepts and assumptions of SEA. Subsequently, the influence of salient work and authors within SEA will be discussed in relation to the promulgation of these trends through an analysis of the interconnections of citations between papers in our sample. Gray and Laughlin's (2012) model then frames an evaluation of the contribution of papers in AAAJ to the development of SEA, and how future studies can build on existing contributions and move into new territories with expanded possibilities for SEA research.

INITIAL FINDINGS

Our findings will be organized around the key authors in the field, the theoretical underpinnings of their study and the associated methods used. The region to which the authors belong to will be assessed in order to establish the extent to which an Australian based journal has attracted an international audience.

TENTATIVE CONCLUSIONS

Tentatively, our conclusion is that discourse in SEA is concentrated on a key range of authors and ideas which have catalysed, but also simultaneously limited, the diversity of new imaginings in SEA.

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Keeping you awake at night: Sustainability Accounting and Reporting at an Australian University

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INTRODUCTION

Sustainability accounting and reporting education has been regarded as an elephant in the classroom in a recent article [1]. A need to maintain the rage, “to keep students awake at night” through our accounting curriculum, has been recommended as a vital step in the transition to a more sustainable planet. Motivated by these perceptions, this study discusses a third year core (compulsory) course in the accounting program of an Australian University. We highlight the uniqueness of this course, its importance in the accounting program, the assessment and teaching approach which uses an active learning and flipped learning mode instead of a traditional lecture and tutorial format, and its key learning outcomes which contribute to “stopping students sleeping peacefully” at night [1].

SUSTAINABILITY ACCOUNTING AND REPORTING: THE COURSE

Sustainability accounting and reporting (SA&R) is a third year accounting course which was first offered as an elective in 2010 in an Australian University (referred to as UniGood here). Since its inception, the course does not have a textbook. Instead, students are required to read between 2-3 journal articles each week. From 2014, the final exam in this course was replaced by a major research project. The course became a core requirement in the accounting program from 2015, from when it was taught in an active learning and flipped learning mode. As such, every accounting graduate from UniGood would have to undertake this course as part of their accounting program. To our understanding, this is the only Australian university where a student has to successfully complete a sustainability accounting course as part of the requirements of an accounting program.

SO WHAT?

SA&R is regarded as an advanced level course under the Australian Qualifications Framework (AQF) and meets a number of learning outcomes required under this framework. Foremost is the knowledge learning outcome requirement. At this point in students’ program, it is feasible, indeed desirable, to reinforce and enhance the coverage of technical accounting knowledge in the course with theoretical perspectives. In SA&R, students are introduced to and utilise the various theoretical paradigms and associated theories for sustainability accounting and reporting in an integrated fashion with the technical knowledge that they develop in the course. By this point in their program critically reflect on sustainability of study, students should have successfully completed a significant amount of subjects which develop their

knowledge of technical accounting skills, the standards and applying the standards. Having acquired this technical knowledge and skills, students are well placed to ‘look back’ on their studies, and accounting’s place in the discipline and in accounting practice and organizations’ reporting practices. This facilitates the design of “rich assessment” and a learning approach which engages students, reinforces and extends their learning and assists in developing strong interest in sustainability accounting among students – the next generation of leaders of the profession and business!

THE ASSESSMENT AND TEACHING APPROACH

SA&R has this portfolio of inter-related inter-connected assessments; a research paper which refers to a relevant published journal article, continuous assessment which requires a one page synthesis of the 2-3 journal article readings for the week, a major research project (undertaken in teams) comprising a written report and an oral presentation, and a reflective learning diary. These assessments meet three critical requirements of the AQF learning outcomes; Knowledge, Communication and teamwork, and Self-Management. Students develop important Research and Inquiry, Communication (oral and written), Teamwork, and Reflective learning skills.

SA&R is taught in an active learning and flipped learning mode where the traditional lecture and tutorial format is replaced by an approach which requires students to engage in pre-class, class and post-class activities. Students need to watch preparatory videos, read and summarise journal articles, and access resources before attending an interactive workshop (the class) where they submit their summaries (the continuous assessment), engage with a number of discussion questions, and seek guidance on the course assessment, including the research paper and team-based research project. Post-class activities require a learning diary to be kept each week to document and reflect on student learning.

CONCLUSION

Just as we started, we conclude; sustainability accounting education should encourage students to challenge current practices and pose questions about our future on this planet. We discussed a course that has been introduced to do just that. SA&R replaces mainstream approaches to teaching and assessment with an innovative approach, designed to encourage creativity and critical thinking. Students are encouraged to read sustainability accounting research and undertake projects on sustainability accounting. They develop communicative and reflective skills, and learn to work as part of a team, skills which are highly

regarded and sought by employers of graduates [2]. Graduates from the accounting program in this university will be armed with a wealth of knowledge and skills on sustainability, with the potential to become business leaders cognisant of not just economic issues but also social and environmental issues.

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Lueg, R.; Radlach, R.

How Do Organizations Manage and Control Sustainable Development? A literature review from 1988 to 2013

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PURPOSE OF THE LITERATURE REVIEW

The purpose of this systematic literature review is to synthesize evidence of management control systems (MCS) that are employed by organizations to enforce sustainable development (SD). We aim at suggesting a roadmap for coherent research.

METHODOLOGY

The literature review is based on an initial sample of 12,139 sources between 1988 and 2013. We then discuss 83 empirical studies in natural and social sciences. The MCS framework of Malmi and Brown (2008) ensures a comprehensive understanding of SD enforcement in practice.

FINDINGS

We identify diverse types of controls that organizations use to enforce SD. Our findings problematize examples where the MCS is unable to appropriately address all relevant aspects of SD. We find that organizations prefer to manage and control smaller aspects of SD, such as environmental responsibility. Social responsibility is addressed less frequently, and only few organizations implement a sustainable MCS (SMCS) that addresses all aspects of SD. Classic ‘cybernetic’ controls are the preferred choice in MCS, but organizations have advanced beyond them during the past decade.

CONTRIBUTIONS

Our main contribution is a structured map of contemporary research that points to areas where our understanding of SMCSs is still scarce, such as their interplay with contextual factors and the resulting, long-term performance effects.

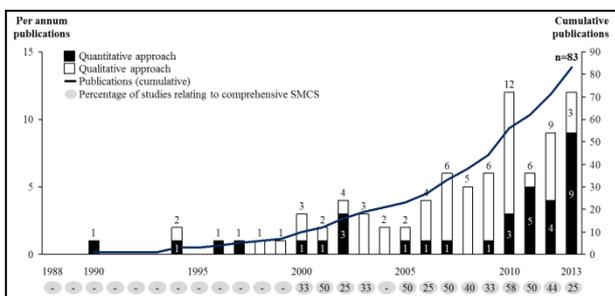


Figure 1: Frequency and methodology of empirical studies 1988-2013 (n=83). Absolute and in per cent.

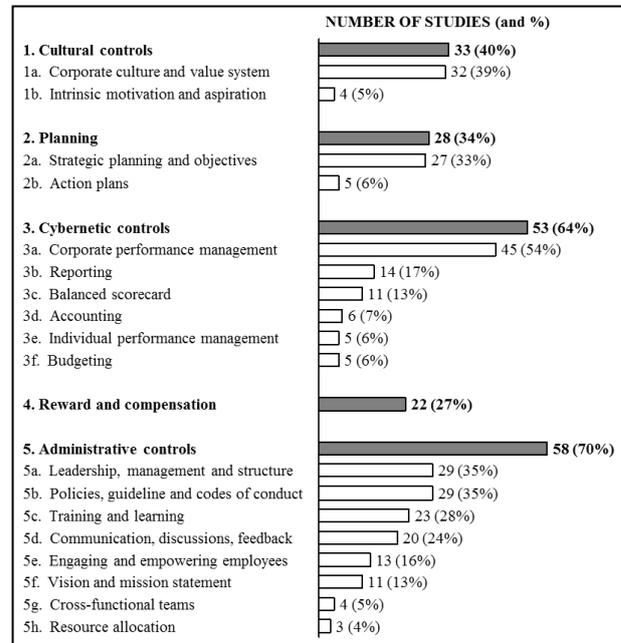


Figure 2: Frequency of control applications (n=83). Counts are not mutually exclusive and can refer to more than one control type.

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Investment Appraisals based on Material Flow Analyses

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Abstract: This paper proposes a model-based approach, which allows the application of material flow analysis (MFA) and the resulting material flow models not only to assess the ecological and economic efficiency of products, service and underlying production systems (life cycle assessment (LCA) and cost accounting). The objective is to use MFA and the resulting models as an integrated computer-based information resource for investment appraisals. Therefore, the modelling procedure is divided into two steps: a period-oriented analysis of material and energy flows and stocks (MFA) and efficiency analyses (both LCA and cost accounting) as evaluation steps of the models. A remarkable feature of the period-oriented models is that they make it possible to represent the investment life cycle in different phases (setup, use phase, and phase-out), to deal with investments as capital stocks and to assess period-related cash inflows and outflows. From there, it is easy to compile investment appraisals, including indicators like payback periods, return on investment (RoI) and net present value (NPV). The resulting concept integrates different research fields: accounting, chemical engineering (process flowsheeting) and computer science (graphs and nets).

INTRODUCTION

Material flow analysis (MFA) and in particular life cycle assessment (LCA) represent a view on the role of methods, instruments and related communities in the environmental management accounting framework and accordant information systems. Main focus is on the efficiency of production systems and supply chains [1]; the basic principles and algorithms are very similar to cost accounting approaches. Instead of calculating the costs of products and services, life cycle assessment aims at assessing all direct and indirect environmental impacts – in two phases: life cycle inventory calculation and life cycle impact assessment [2]. Of course, cost accounting and life cycle assessments are based on different system boundaries.

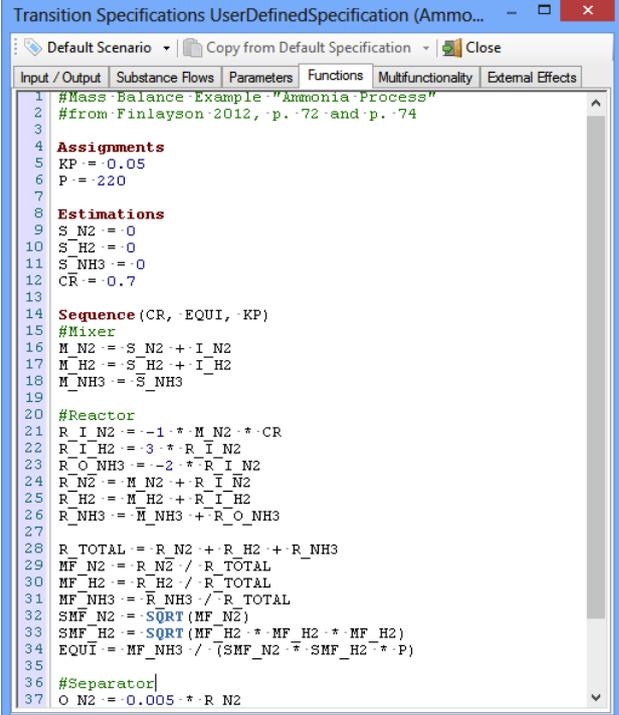
Both instruments, cost accounting and life cycle assessment, start with positive outcomes: functions, products and services. The aim of the methods is to assess the negative consequences. Therefore, the methods model and analyse means-end relationships. In case of physical productions systems, life cycle assessment and cost accounting approaches utilize models on the level of material and energy flows and transformations, for instance chemical reactions or physical transport of substances. As a consequence, the methods rely on different interpretations of the principle of cause and effect: the causal principle and the final interpretation [3, 4]. A prominent problem of such a combination is the allocation problem, the problem to deal with joint processes [5].

Different design strategies are available to implement calculation engines for efficiency analyses. These strategies include a two-step approach that splits the

inventory analysis into two parts [6]. In a first period-oriented modelling step all material and energy flows and stock are calculated; they are not related to specific products or services. The first step follows the causal principle.

This step can be called material flow analysis, where the term material is used in a broader sense: substances, energy, intermediate goods, licences etc. Suitable modelling and calculation procedures require the integration of insights, findings and approaches from different research fields and scientific disciplines: computer science (Petri nets [7]), chemical engineering (process flowsheeting [8, 9, 10]) and accounting. The different approaches for their part rely on mathematical methods.

Figure 2, 3 and 4 apply the Petri net approach to represent the structure of material flow systems. Petri net are specific graphs, which allow the representation of processes (the rectangles in the diagrams, so-called transitions), of stocks (the circles in the diagrams, so-called places) and the flows between them. The circles or stocks are important to represent the investments / assets.



```
1 #Mass Balance Example "Ammonia Process"
2 #from Finlayson 2012, p. 72 and p. 74
3
4 Assignments
5 KP = 0.05
6 P = 220
7
8 Estimations
9 S_N2 = 0
10 S_H2 = 0
11 S_NH3 = 0
12 CR = 0.7
13
14 Sequence (CR, EQUI, KP)
15 #Mixer
16 M_N2 = S_N2 + I_N2
17 M_H2 = S_H2 + I_H2
18 M_NH3 = S_NH3
19
20 #Reactor
21 R_I_N2 = -1 * M_N2 * CR
22 R_I_H2 = 3 * R_I_N2
23 R_O_NH3 = -2 * R_I_N2
24 R_N2 = M_N2 + R_I_N2
25 R_H2 = M_H2 + R_I_H2
26 R_NH3 = M_NH3 + R_O_NH3
27
28 R_TOTAL = R_N2 + R_H2 + R_NH3
29 MF_N2 = R_N2 / R_TOTAL
30 MF_H2 = R_H2 / R_TOTAL
31 MF_NH3 = R_NH3 / R_TOTAL
32 SMF_N2 = SQRT(MF_N2)
33 SMF_H2 = SQRT(MF_H2 * MF_H2 * MF_H2)
34 EQUI = MF_NH3 / (SMF_N2 * SMF_H2 * P)
35
36 #Separator
37 O_N2 = 0.005 * R_N2
```

FIGURE 1: SPECIFICATION OF AN AMMONIA PROCESS [9].

The calculation procedures apply methods for solving systems of non-linear algebraic equations. These methods combine block decomposition (to identify a sequence of non-reducible sets of equations [11, 12, 13]) and root finding [10, 14, 15] (to solve these non-reducible sets). In some cases, it is possible to optimize the strategy that the

solver can apply. The integration of the algorithms allows the calculation of flow rates, flow properties (e.g. temperature and pressure) and components (e.g. substances).

Figure 1 shows the specification of a single process in a supply chain (ammonia synthesis, adopted from [9]). Some of the variables represent input and output flows of the process, for instance L_N2 and L_H2, others stand for process parameters, helper variables and the equilibrium constant. A procedure, similar to the goal-seeking feature in spreadsheet tools like Excel[®], is applied to determine the conversion rate CR that fulfils the chemical reaction equilibrium equation (the variable EQUI should be equal to KP).

The results of the first step are used as a data source of the second calculation step. The second step analyses the means-end relationships within the given period-oriented material flow model. Depending on the evaluation boundaries it is possible to calculate costs (typical boundaries are *company*, *production process* and *supply chain*) and life cycle inventories. Here, inventory calculation methods (matrix methods) come into play [16, 17].

Dividing the formal method into two steps is a precondition to apply material flow analyses as a data source for investment appraisals.

INVESTMENT APPRAISALS

Of course, efficiency analyses are important instruments in value-creating processes: they help to discover and to assess improvement potentials. But to improve production systems and supply chains, additional activities are required, in particular investments: new buildings, machinery, trainings etc. And an additional information instrument is necessary that supports the analysis of investment life cycles [18], including indicators like payback periods, return on investment (RoI), net present value (NPV), accounting rate of return or profitability index.

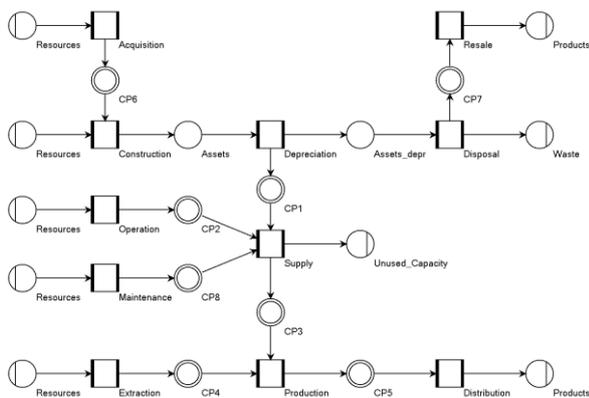


FIGURE 2: MATERIAL FLOW MODEL (SIMPLIFIED).

The advantage of the two-step approach is that different evaluation steps are possible. Period-oriented material flow models serve as a possible data source of this kind of analysis if they are able to deal with stocks and sequences of periods so that cash inflows and

outflows can be derived from the models. In fact, material flow networks provide means to represent material and energy flows as well as stocks [6]. Even if the resulting models are called material flow models, they provide information about stocks changes and absolute stocks. Moreover, the stocks make it possible to divide investment life cycle into several periods and to represent different phases of investment life cycles: setup phase (cash flows resulting from acquisition of machinery, buildings etc.), use phase with periodic returns and depreciation of the assets and finally phase-out and disposal including resale.

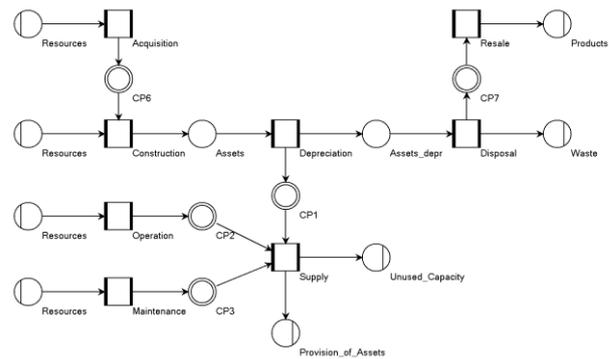


FIGURE 3: MATERIAL FLOW MODEL OF THE INVESTMENT LIFE CYCLE.

Figure 2 shows a simplified reference model. In the first period the assets are constructed and/or acquired. So, there occur inflows to node (place) *assets*. These flows represent an important outcome of the decision: the required assets. In the next periods (use phase) the assets are utilized. The assets lose their value due to their utilization or time-dependent depreciation. In the last period the asset enters the disposal process.

In other words, stocks are used to represent the investments and the assets. They link together the different phases in the investment life cycle. The use phase connects the investment life cycles (figure 3) as a sub-model to the production processes, which require the assets (figure 4). This link is commonly called demand, usage or supply. Even if the link consists of virtual flows or the combination of virtual flows and virtual processes, it is important because the link represents the means-end relationship between the investments and the associated production processes, similar to links in strategy maps [19]. In figure 3 the virtual process *supply* allocates maintenance, operation of the assets and depreciation to the production process. This is necessary in the cost accountings and life cycle assessments.

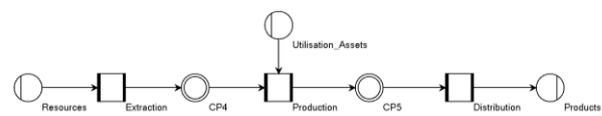


FIGURE 4: MATERIAL FLOW MODEL OF THE PRODUCTION SYSTEM.

Virtual processes as sub-models can be specified in a similar way as chemical reactors, transport processes or assembly lines: with aid of equations and algorithms. But

they occur in the models due to different reasons, for instance to apply depreciation methods.

An advantage of such a modelling approach is that the models represent not only the investment life cycles of capital assets but also in detail the utilization of capital assets in production processes and supply chains. The cash inflows and outflows of the use phase can be assessed in detail: revenues, purchasing of raw materials, labour cost etc., grouped by time periods (e.g. years).

INTEGRATED EFFICIENCY ANALYSIS

The discussed approach to MFA-based investment appraisals makes sense in particular when it is integrated into a modelling framework that provides information about the resulting efficiency based on the same assumption and models. Data source is a material flow model that includes all material and energy flows for all periods. By adjusting all costs in a way that they virtually occur in the same time period as the costs objects they are allocated to, as in static investment appraisals for a average period, it is possible to calculate the total efficiency of all products and services. The cost assessments include not only the costs of the production processes but also the costs of required assets including depreciation, operations, maintenance etc. The instrument implements the first iteration in the recursive scheme of utilizing infrastructures [20].

ENVIRONMENTAL CONSIDERATIONS

Investment appraisals are in instrument that helps to assess the economic outcome of decisions. Nothing is said about environmental considerations and measures like ecological payback periods (EPP) and ecological advantage ratios (EAR) [18]. Of course, it is not possible to offset revenues and environmental impacts like carbon footprints in the same way. But the approach can be used in a similar way.

The implementation of improvement potentials normally result in environmental impacts of required buildings, machinery etc. But these assets allow the reduction of environmental impacts in the future. And in fact, measures like EPP and EAR rely on differences: the annual reduction of environmental impact added (EIA) through the investment or the EIA reduced over the total investment life cycle [18].

INFORMATION INSTRUMENTS

Indicators like EPP and EAR illustrate that the advantages of production systems and associated assets normally are not assessed from the scratch. In most cases, production systems already exist and the question is how to improve them. Starting point of the development of appropriate information instruments is that a decision-oriented information system has to provide information about reductions (in general differences) that result from an implementation of a decision. The question is how to calculate differences.

Material flow cost accounting (MFCA) can be interpreted as an approach to assess improvement potentials [21, 22]. Material loss is the key word for the specification of those improvement potentials: What will

happen regarding the costs if we avoid the material loss in the supply chain? Such an approach can be simply enhanced: improved processes, modified production systems etc. [23, 24]. This includes new assets so that the effects are not always positive, in particular in the setup phase.

The calculation of improvements potentials cannot longer interpreted as an allocation of costs to the virtual cost object *material loss*, it is rather a two-scenario approach: a business-as-usual scenario (default scenario) and a scenario that assumes the implementation of the improvement potentials.

Similar to investment appraisals, such an enhanced MFCA approach that assesses not only the economic outcomes but also environmental impacts can be used as a data source to determine EPPs, EARs and similar indicators.

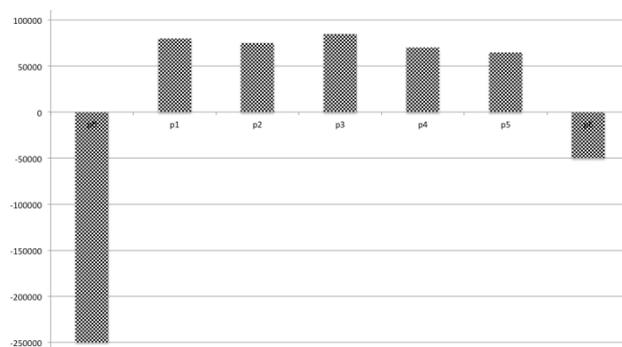


FIGURE 5: MODIFIED CASH INFLOWS AND OUTFLOWS OF A DECISION, INCLUDING REQUIRED INVESTMENTS (SIMPLIFIED).

The resulting calculation procedure for investment appraisals consists of three components: (1) the calculation engine for a sequence of period-oriented material flow models (e.g. based on a sequential modular approach [8, 10]), (2) an evaluation procedure that determines time-depended cash inflows and outflows and (3) a component that derives the relevant figures and indicators from models (see figure 5).

CONCLUSION

Life cycle assessment has become an important information instrument in the field of corporate sustainability management. In combination with integrated cost accounting approaches, it helps not only to assess the global environmental impacts of decisions in the past and in the future and resulting structures and processes; it assists the identification of improvement potentials concerning ecological and economic efficiency. However, one question that receives relatively less attention is about subsequent decisions and activities, in particular with respect to required investments. This contribution looks at the problem of providing information for these decisions: This paper discusses a concept for MFA-based investment appraisals.

So, the basic assumption of this contribution and the concept is that organizations are regularly working on their economic and ecological efficiency. But the paper does not examine or even prove this assumption. The focus is rather on possible and improved information

support for these activities. The next step in this investigation is the implementation of (computer-based) prototypes while “constantly searching what works and what does not work: building, tinkering, and experimenting” [25].

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Marco-Fondevila, M.; Moneva, J. M.; Llena, F.; Scarpellini, S. and Llera-Sastresa, E.

Carbon footprint accounting of the aggregated wine production process

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The accounting and implementation of the environmental sustainability standards to modelling the management control based on the Carbon Footprint (CF) of wine production has been the principal goal of this study. For this goal, an innovative method of analysis and measurement of the costs and CF of each product has been implemented in a Spanish winery.

As principal result of this study, the aggregated carbon footprint accounting of wine production was introduced in the management control of the firm which included the agricultural activities, land use and all parts of the value chain of the wine sector.

INTRODUCTION

The increase in production, quality and competitiveness undergone by the wine sector during the last years has been unfortunately reached at the expense of reducing the sustainability of traditional production processes.

In this scenario, in which the higher environmental impacts in the wine production process are consequence of the energy consumption from fossil fuels, carbon footprint can be pointed out as an appropriate sustainability indicator to be utilized in the winery decision-making. This paper deals with the integrated accounting of CF focusing on the wine sector, within the extensive literature regarding environmental accounting.

In the proposed CF integrated method, all activities have been considered in a simplified and internally applied procedure, including all the components of wine packaging (bottle, stopper, capsule, label, boxes, pallets, etc.) because it is considered to be of high importance for this analysis. Furthermore, agricultural practices for vineyards have been included as well as the landscape conservation related issues.

With these premises, the main objective of the study case presented in this paper is to model the Carbon Footprint (CF) of a winery for different type of wine products to be integrated into the management control.

BACKGROUND

The quantification of greenhouse gas emissions often underpins the life-cycle of wine can be considered an adequate methodology for the accounting itself [1]. Nevertheless, wineries can find LCA methods rather expensive and unprofitable due to the medium term approach.

In summary, the ‘greening of accountancy’ involves principally reappraisal of how to identify and measure the relevant costs of processes and products (such as ‘Total Cost Assessment’) and it includes life-cycle management [2], environmental cost accounting [3], life cycle assessment (LCA) and life cycle costing [4], [5], [6], or material costs flow accounting [7].

In this field, the extensive literature review offered by Christ and Burritt [8] reveals that practices within wine firms are still largely unexplored and often inadequate. In general terms, a lack of quantitative environmental data about operational processes and products is an important barrier to improve environmental performance of this sector.

For these reasons, in this study case, a principal research question such as “can CF been applied in an integrated way to the accounting in the wine sector?” has been tackled.

METHOD AND CASE STUDY

To achieve the principal aim of this study, an applied innovation project was performed in a Spanish winery company in the Region of Aragon “from the vine to the table: carbon footprint labelling of the aggregated wine production process”, as a study case that is described in this paper.

A method of analysis and measurement of the cost differences for each product typology has been implemented in a case study and tested to be a control interface between the management control of the firm and the specific platform designed to provide detailed information for management purposes, in particular, considering all the stages of wine production.

It has to be taken into account that no matter the environmental approach, the most problematic time-related issues are: the definition of the time horizon within which the climate impacts are taken into consideration, and the identification of the timing of the emissions and their related impacts. In our analysis the time-related horizon was approached in a short term basis, considering the yearly scenario, which coincides with the agricultural cycle, as the more adequate to frame the costs accounting system. This is possible due to the application of CF calculation instead of a complete LCA analysis.

The study was conducted by the authors in the framework of a public grant of the Spanish Ministry¹³, jointly with a team of specialists of the firm. The main goals of the project were to assess the carbon emissions linked to every bottle of wine produced by the company considering the whole cycle from the ‘cradle’ to the moment when the bottle is ready to be traded, and to develop a carbon accounting system which would permit the company to track and monitor at any

¹³ Spanish Ministry for Economy and Competitiveness under the program INNPACTO, with the project name of “ETIVICO2”. The public data of the project are available in the company’s Website, as well as the environmental commitment adopted and the goals assumed for the following years. For more information, please see <http://www.sanvalero.com/> (acceded on February 2016).

given moment, the carbon emissions accumulated in the process, by unit of production.

The selected method to calculate and account the carbon emissions was the Greenhouse Gas Emissions Protocol (GHG Protocol), which is an initiative jointly, developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), with the support of private companies, public institutions and environmental organizations. It is an international renowned tool to companies and organizations willing to perform and communicate their carbon emissions inventory.

The case study winery reached a carbon footprint up to 12.734 tons of CO₂ equivalent in 2013, and of 10.224 in 2014. In a preliminary approach, a unitary volume of carbon emissions can be assigned to every unit of wine produced (litre), showing an average of 0,828 kgCO₂eq/l in 2013 and of 0,795 kgCO₂eq/l in 2014..

As a result, every type of bottle of wine container traded by the company would be labeled with its specific volume of carbon emissions.

From a short term perspective, the economic savings are possibly the most relevant result as of now. The energy audit conducted in the first part of the research revealed relevant inefficiencies in part of the production equipment, as well as some inefficient processes which could be significantly optimized. The measures taken subsequently rendered notable savings almost immediately. Together with this decrease in energy consumption and carbon emissions, the company has benefited from a completely new style of relationship with the employees and farmers. The latter, who now feel as part of the company, are currently involved in other improvement initiatives besides the carbon emissions accounting. Studying the possibility of using different types of fertilizers, less aggressive, or managing the water resources jointly, under optimized scheduled schemes, are new initiatives which are now managed together by farmers and the company.

In the long run, the company expects to gain international reconnaissance and a competitive advantage in the most environmentally exigent markets. The possibility to keep track of the carbon emissions per product during the production process, brings in a whole range of opportunities to decrease the carbon footprint, compensate the carbon emissions, develop a near-to-zero emissions line of products, etc. The winery is now able to set of carbon footprint per product, together with the project results and expectations for the future.

CONCLUSION

Overall, the study case relied on the triple bottom line rationale, since it had environmental goals linked to reducing the carbon emissions, social implications associated to the inclusion and empowerment of farmers in the process, and economic objectives, aligned to the reduction of energy costs, the access to new markets and the improvement of the company public image. The innovative axis of these three visions was the accounting perspective, embedded in the idea of Material Flow Accounting, which contributes to both the managerial decision making process and the

accountability initiatives which the company may adopt.

In this case study, the developed IT application has been integrated into the company management system, allowing the emissions accounting and its automatic association to systems such as the financial accounting, the product and supplier record, etc. This way, the company can have a constantly updated record of the approximate volume of CO₂ emissions related to purchases or production units as well as timely information on the environmental performance of its suppliers/producers in terms of carbon emissions and energy efficiency.

On the other hand, benefits directly associated to the implementation of initiatives for the measurement, accounting and labelling of emissions throughout the entire value chain of the wine sector, are elevated and distributed throughout the entire chain. Knowing the levels of emissions generated in the primary activity in the fields, from the different agricultural processes involved, allows bringing in new measures for improvement that mean lower costs in energy consumption with consequent savings and increase in industrial competitiveness.

In general terms, international standards and guidelines should be capable of taking into account CF in all the value chain in such a way that its measurement and internalization directly relies in the firm through its management control and accounting system.

As regards to methodological issues, the simplification of CF internal measurement through the energy audits chosen for the analyses, was found to be especially efficient. It has not to be ignored that processes would need to be studied in more depth to model the sector CF and to define general guidelines.

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Moritz, Stefan

“Exhibition organisation” and “booth building” under aspects of sustainability of the supply chain.

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I. INTRODUCTION - HISTORY

MIV began in 1988 with sales activities of different products and services for the hotel industry by products of Economic Laboratories (EL), Caddie, Rubbermaid (RCP) and Henkel Hygiene.

In 2008 we were asked by an Australian company to assist the planning process of the company's appearance at the European congress of Nuclear Medicine in Munich. On the spot we recognized the massive volume of waste while setting up the booth and dismantling the entire stands, as well as the volume of one-way catering materials. By the experience with former contractors, especially EL, we realized the chance to set up a new business with a strong sustainable approach.

We enlarged our business to a full service provider as a one-stop-shopping agency for exhibition organization. We developed consequently environmental savings and sustainable systems to serve companies for their exhibition activities. Thereby we strengthened our eco way of producing and servicing our clients in environmental friendly manners.

II. RESEARCH

- a) First, we analyzed the existing booth building systems in the market with regards to the use of materials, durability and handling.
- b) Reduction of overhead costs and the use of materials were investigated by common placement of several companies on a joint stand, to implement permanently our sustainable principle.
- c) At our booths energy consumption was measured. We developed solutions to increase sustainability.
- d) Physical stress of employees during an exhibition was examined on possible improvements. The process of organization at the stand and especially the physical effects of different floor systems were considered.
- e) A customer survey helped to find out whether a stand design may be used for a longer period of three to four exhibitions with equal but individual custom styles, to be more sustainable and environmental saving.

- f) Site inspections, hotel reservations and event organizations before and during a trade show were studied on sustainable solutions and resource potentials.
- g) We examined the possibilities of optimizing the catering at the stand in terms of material flow (cups, mugs, food...), production processes and –locations and delivery logistics, as well as the transport logistics for promotional materials from customer office to exhibition.

III. METHODS

In general it was difficult and nearly impossible to find an existing matrix for this special business to figure out the CO₂ emissions for the single positions described. Therefore we used the internet and information's of suppliers of basic materials like aluminium. CO₂-consumption for flights, overnights in hotels, transportation could be found in known internet portals. In addition our experience from the comparison with previous events and our present system are incorporated.

- a) Egger from Austria yielded ratios on the CO₂ emissions in the production of wood-based materials. Internet search by manufacturer of stand construction systems. [8]
- b) Customer survey to figure out customers competitive situation, stand size and stand equipment, regarding of their needs.
- c) Energy monitoring of all electrical loads based on an exemplary booth.
- d) Customer survey, obtaining medical orthopaedic specialist opinions.
- e) Individual customer interviews.
- f) Customer survey, internet search on CO₂ pollution of flights, accommodation, cost structures, individual spent time for research. [11]
- g) Internet search, trade research, product tasting, calculation of transport logistics.

IV. RESULTS

a) *Case systems*

– low budget optics, low stability, low flexibility.

Individual plywood construction

– high material consumption of wood, paint, bonding material and high transport weights.

Open profile or node systems

– usually aluminium rails with inside fibreboard or synthetic planking – rail systems and planking with a relatively short life because of possible damage, high individuality.

“Sträter Design GmbH” from Munich became our partner; they developed their own, flexible, long lasting system. They haven’t realised and commercialized the environmental savings and sustainability of their system.

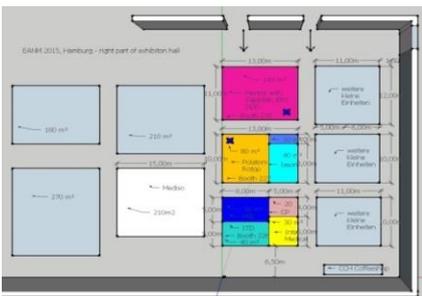
– Sträter is using concealed aluminium frames, which can be even used when dented. External planking in standard formats with high quality coating and a long life of 8 or more years. High individualization throughout large selection of RAL colours or film plots. Low use of manpower during setup and dismantling. Light transport weight. Planking of the frame on 2 sides possible. As well as almost no waste during setup and dismantling. [1]

Certified and extremely sustainable planking production manufacturer: *Egger* from Austria [8]



[1] During setup – 4 companies, total area 140m²

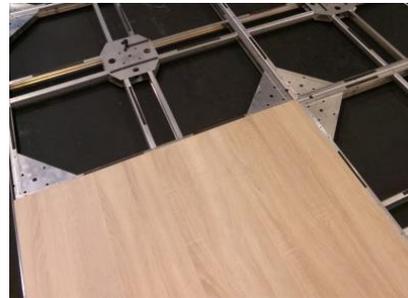
- b) Booking of larger stand areas after consultation with different companies. Frame structure planked on both sides saves exhibition space, construction material and costs for all companies involved. Faster construction with less manpower. [4]



[4] Principle of customer concentration,

you see 1/3 of the exhibition hall.
Coloured blocks are our clients.

- c) Use of multi-level electrical distribution. Shutdown of all unneeded power equipment overnight. Development of own LED lighting systems and a brand new ceiling suspension system with less weight and size.
- d) Use of swinging floor panels instead of one-way carpet or plywood with laminate. Sustainable material flow through long life cycle of frame- and planking systems. Proposal has no waste. Gentle on the musculoskeletal system. Short walking distances at the booth by individual (customer) designed product-related furniture with storage space. [3] [10]



[3] Swinging floor system



[10] New ceiling suspension, individual furniture with storage capacity, swinging floor, design of Dresden and solid wooden furniture in use now since 6 exhibitions.

- e) Contractual agreement of min. four exhibitions with the same design. Used material is stored properly for multiple missions. High quality fabric banner reduces transportation weight and provide a high level of individualization and design. [2]



[2] *Yellow*: fabric banner fits at different booth sizes
Red: here a smaller booth with additional planking in the corner, which is left, if the booth is smaller.

- f) In consultation with all participants at the same event, site inspections are carried out only by one MIV staff. CO₂ reduction in flights, accommodation and time for research at the location. Booking of accommodation for all participants due MIV under sustainable aspects.

Procurement and delivery of tickets for public traffic mostly included and delivered to customer before departure. Booking of busses for bigger groups in advance to transport from airport to accommodation.

- g) Use of high quality polycarbonate mugs and cups – produced in Germany under GMP conditions. Long life cycle, machine washable, no danger of fracture/injury, high hygiene factor, visually appealing. Central purchasing of F&B in light, reusable packaging, healthy food items from sustainable, ecological sources – coming from the region. Delivery of foldable, stable transport boxes in 1/8 pallet size to all participants. Thus, no packaging waste at the booth. Better screenability of packaging is given at the site of the company. Low storage requirements of empty boxes during the exhibition and safe transport without packaging materials back from the exhibition. All items in the storage area like cleaning products, towels will be collected after the show and professionally refurbished, recycled or cleaned in our warehouse and prepared for the next use. [5] [6] [7]



[5] *Right side*: a lot of waste vs. foldable boxes in the upper shelf.



[6] Sustainability information at the coffee desk.



[7] Long life Cups and mugs from Germany.

V. CONCLUSION

We couldn't find any competitor with the same range of services and eco mind-settings, who is assisting corporations from the first idea of a booth with to all details needed. Most of our target group are medium sized enterprises, often without a dedicated marketing department. Mostly, the exhibition duty is done by a personal assistant on top of the usual work load. Therefore, nobody has time or passion to take environmental issues of savings and controlling into their business account.

We demonstrate with our project **“European congress of nuclear medicine 2015”** (EANM) at the CCH in Hamburg (Oct. 2015) our green acting by organizing an industrial exhibition, which is customer friendly but also as much sustainable as possible: An area of 3.200 m² with 179 exhibitors during four days – 5900 visitors from all over Europe. MIV served 13 companies at 11 booth's – at 600 m² and booked more than 630 overnights.

These factors led to the following savings: [9]

- 13.505 kg CO₂
- 54.547 kWh energy
- 5000 kg not (only one time) used chipboard
- 250 kg less waste for catering
- 262 kg water based colour
- 850 kg less transport weight and space

In 2016 MIV applied for the “Green supplier award” during the IMEX, Frankfurt. This is an annual exhibition for worldwide event agencies and DMC. This award is sponsored by Green Meeting Industry Council (GMIC) [12]

To understand, how the savings shown before are incurred, you have to look at the “Green supplier award saving list” at our website. Unfortunately there is not enough space in this abstract.

In general MIV is keen to find students, who are interested to deepen this exiting business as a part of their master degree.

REFERENCES: *

- Our website: Messeorganisation.com/english
 [8] [Egger Environment-Sustainability](#) - PDF
 [9] [Green Supplier Award Saving list](#) - PDF

Proceedings of the 20th Conference of the Environmental and Sustainability Management
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[11] www.atomosfair.de

[12] gmicglobal.org/page/IMEX11AwardCaseStudy

[MIV 2015 annual green report - PDF](#)

* If you only have a paper version, you find all references
at our website!

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Environmental Accounting in Climate Change Mitigation and Adaptation Strategies of Nigeria's Quoted Companies

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INTRODUCTION

The challenge posed by Climate change can no longer be ignored as the impacts have been pervasive and tremendous in various spheres of human existence. The initial efforts at tackling the challenge through international treaties have focused on what national governments can do to minimize their Green House Gas (GHG) emission. Good as these efforts were, they were deficient in scope as the principal contributors to GHG emission were yet to come on board. Business has begun to take the challenge seriously desirous to determine the extent of risk and opportunities involved in climate change. It is becoming increasingly notable that if meaningful results will be achieved companies as key stakeholders must be involved in the efforts at adapting to, and mitigating the effects of climate change.

Companies are concerned about their financials and so demand to know what the nature of climate change impact mitigation and adaptation is. Often, it is viewed as a cost and needs to be accounted for, thus the accountancy profession has to define its role in determination of the financial implications of climate change impacts and the benefits of mitigations in the midst of inter-disciplinarian complex. As observed by Riva (2015), the role of accountancy has gone beyond traditional arenas to the realms of calling attention of clients' attention to cost-cutting measures in energy usage. The reformation of corporate goals from mere profitability to sustainability implies a shift in corporate strategies to make sustainability its fundamental option. The mission of companies is to deliver long term value and manage risks in the interests of stakeholders. The adoption of green production portrays the organisation as responsible, responsive and forward looking.

Environmental Accounting (EA) is a vital tool for the accomplishment of sustainability in corporate world. Hass (2008) described environmental accounting as a product of environmental and economic statistics. The transformation of these statistics to accounts involves three activities: one, distinguishing between physical and monetary flows; two, generating economic accounts; and three, producing assets accounts (both physical and monetary). To achieve this, EA reuses existing data, reorganizes them to match economic data, establishes matched data sets that can be confidently used for analysis and identifies areas not covered by current statistics so that these gaps can be filled. CIMA (2010) was more decisive, identifying nine areas of managerial accountants' roles in corporate response to climate change. These nine areas are cardinal to adaptations strategies of corporate bodies to climate change from the standpoint of

quantifying the impacts and monetizing them for external and internal reporting. This is meant to provide a guide to mitigation strategies which at the moment has yet to be the focus of practice.

ABSTRACT

Climate change is the result of increased concentration of greenhouse gases in the atmosphere which affects food security, outbreak and prevalence of certain diseases, productive capacities, weather conditions and so on. Environmental accounting provides a framework for capturing the multidisciplinary assessment of emissions to enable companies to evolve suitable strategies for mitigation of, and/or adaptation to climate change. The main objective of this paper is to investigate Environmental Accounting (EA) roles in climate change mitigation and adaptation decisions. Specific objectives are to assess the extent of EA adoption in estimating the costs of climate change mitigation and adaptation; analyze the key factors relevant to climate change accounting; evaluate the roles of EA in climate change decisions in firms. Questionnaire was used to collect data for this study. Chi Square and ANOVA methods were employed for inferences from survey.

There's a convergence of opinion as to the adoption of EA in climate change decisions. Principal factors influencing climate change and the degree of use of EA in plotting the direction of policies and decisions related to climate change mitigation and adaptation were determined. It was concluded that EA had significant roles to play in climate change mitigation and adaptation decisions. It was recommended that disclosure of environmental compliance should be a requirement of regulatory authorities in Nigeria. It was further recommended that corporate organisations should integrate climate change mitigation into their activities and projects. Every new project should undergo Environmental Impact Assessment (EIA).

Key Words: Environmental Accounting, Climate Change, Environmental Accounting Compliance Disclosure and Climate Change Adaptation and Mitigation Decisions.

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In search of Integrated Reporting quality - An empirical analysis

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SHORT ABSTRACT

Despite the proposed benefits to stakeholders, as well as the number of contributors aiming at identify and propose best practices on the IR adoption, such as the initiatives sponsored by the IIRC, it seems that IR is still scarcely diffused among companies. This could be the consequence of some critical issues in its adoption. Especially difficulties in the complete application of the IR framework and the quality of the integrated reports have been pointed out as main relevant issues.

Starting from these premises, this paper aims to identify the variables that may have an impact on a better quality of IR.

To pursue such an objective an empirical research has been carried out on a sample of 128 integrated reports published in years 2013 and 2014. We have developed a framework for quality assessment of integrated reports based on 23 variables that as a whole identify an Integrated Reporting Scoreboard.

Multivariate statistical analyses, such as factor analysis and cluster analysis, have been applied to identify the IR quality attributes and the determinants of different levels of IR quality.

EXTENDED ABSTRACT

The integrated reporting (IR) is generally considered a natural evolution of the corporate reporting movement, aimed at favoring the implementation of a sustainable strategy by an integrated thinking. This should enable stakeholders to evaluate more effectively an organization's ability to create present as well future value. Moreover, the integrated report should present an organization's use of and dependence on different types of resources/capitals, in order to allow users of performance information to assess firm long-term viability and more effectively allocate scarce resources [8].

Despite the proposed benefits to stakeholders, as well as the number of contributors aiming at identify and propose best practices on the IR adoption, such as the initiatives sponsored by the IIRC, it seems that IR is still scarcely diffused among companies.

This could be the consequence of some critical issues in its adoption. Communicating the firm strategy and the process of value creation represents one of the most relevant difficulty for enterprises [5]. Issues in the complete application of the IR framework have been pointed out by the IIRC itself, that in 2013 published a document that summarized comments of some institutional investors and companies participating at

the pilot program "Investor Network".

The following main critical issues in the adoption of the IR framework have been outlined by the literature and practice: (i) the absence of connectivity among strategy, business model, performance and future outlook, due to the limited narrative flow and use of diagrams and maps; (ii) the presence of an informative gap in areas, such as governance, stakeholder engagement and materiality process; (iii) the inadequate description of the business model; (iv) materiality and completeness of information; (v) the limited practice of a third-party verification of the integrated report, that can generate a credibility gap of IR [2], [7].

In the light of such an evidence, the interest of practitioners, managers and academics is shifting from the type and quantity of information included in the integrated reports towards the quality of IR disclosure. In 2012 Ernst & Young launched the "Excellence in Integrated Report Awards", that aimed at analyzing the state of the art of IR in South Africa and to promote a better quality of IR and best practices in its adoption. In 2014 the IIRC issued a document on "Assurance on IR: an exploration of issues", with the aim of generating interest on this aspects. Some authors have focused on IR quality and the assessment of the degree of implementation of the IR framework as well as the type of disclosed information [1], [7]. However, there is still a lack of empirical evidence on the IR quality determinants.

Starting from these premises, this paper aims to identify the variables that may have an impact on a better quality of IR. They can be found both in the external drivers coming from the firm's environment and in the internal determinants, which are linked to specific characteristics of the enterprise.

To pursue such an objective an empirical research was carried out, on a sample of Integrated Reports published in years 2013 and 2014.

First of all, a framework for quality assessment of integrated reports was developed, that was based on twenty three variables that as a whole identify an Integrated Reporting Scoreboard articulated into the following four areas (figure 1):

- Content, that assesses the consistency of the document with the elements and guiding principles of the IR framework;
- Background, that assesses whether the document presents a general section devoted to discuss relevant issues, such as: 1) the objectives pursued by the IR, 2) the motivations underlined the choice of

adopting IR, 3) the manager in charge of IR process, 4) the CEO's commitment towards sustainability and IR, 5) the beneficiaries of the document, 6) the consistency of IR with generally applied disclosure standards, 7) the title of the report;

- Form: it assesses: 1) the readability and clarity of the document (presence of an index, graphs, tables, glossary, references to various sections of the document, hyperlink to external sources, to firm website or the other documents), 2) the synthesis (number of pages of the document) and 3) the accessibility of the document (hard copy documents versus web-site accessibility);

- Quality, that assesses whether: 1) an internal audit and/or 2) a third-party verification has been carried out and 3) the company has received acknowledgements and awards for IR.

Secondly, a scoring system was defined in order to assess the quality of integrated reports according to the identified dimensions of the Integrated Reporting Scoreboard.

Our analysis focused on 128 integrated reports taken from the 'Getting Started' section of the IR examples website filtered with the years 2013 (63 reports available) and 2014 (65 reports). We have considered this section because we may suppose that integrated reports contained in it are benchmarks in terms of application of the IR framework. We have chosen the years 2013 and 2014 because our study was carried out during 2015. Moreover, in 2013, first, the "Consultation draft on the International <IR> framework" (April) and, then, the "International <IR> framework" (December) were issued. Thus, we may suppose that reports published since 2013 are more consistent with the IR framework than in the past. Table 1 presents the main features of the 128 analysed companies.

Data were collected and codified using content analysis of all the integrated reports of the 128 sample companies [9]. All documents were carefully read and classified, consistently with the proposed Integrated Reporting Scoreboard framework. Two researchers read all 128 integrated reports and autonomously classified them. They were trained on the scoring protocol to assure the reliability of the analysis [6]. Only few discrepancies emerged, that were discussed within the research group and resolved.

Once defined the dataset, it was analysed using multivariate statistical analyses, such as factor analysis and cluster analysis in order to identify the IR quality attributes and the determinants of different levels of IR quality. The statistical analysis is currently underway so the research findings will be presented and discussed in the full paper.

Our research has some limitations typical of qualitative studies, such as content analysis. Such a methodology may be characterised by an unavoidable subjectivity of the evaluation process [3],[6] as well the difficulty of generalizing the results beyond the sample studied. Even though the Integrated Reporting

Scoreboard and the scoring system have been developed referring to previous studies, their definition, first, and implementation to assess the 128 integrated reports then, may have implied some subjectivity.

Moreover, we have considered only integrated reports available on the 'Getting Started' section of the IR examples website, but other companies could have disclosed an integrated report even though this is not published in the IIRC website. Besides, we have focused the analysis on a specific period of time. Finally, we have considered only documents in pdf format, while information on IR could be disclosed also by other means, such as web sites, and other documents, such as investor relations presentations.

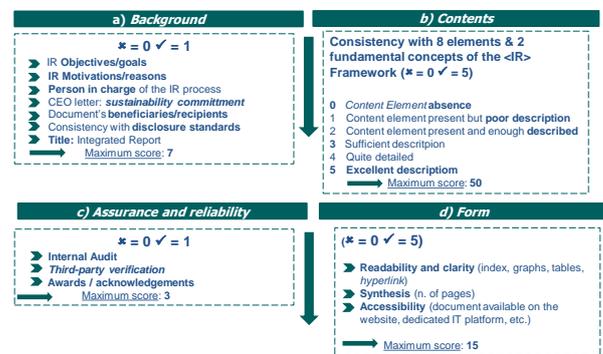


FIGURE 1: THE INTEGRATED REPORTING SCOREBOARD

TABLE 1: MAIN FEATURES OF THE RESEARCH SAMPLE'S FIRMS

	2014		2013	
	No.	%	No.	%
Organization type				
Publicly listed	55	85%	52	83%
Public industry	5	8%	7	11%
Other	5	8%	4	6%
	65	100%	63	100%
Region				
Africa	9	14%	7	11%
Asia	10	15%	14	22%
Australasia	3	5%	3	5%
Europe	36	55%	31	49%
North America	3	5%	4	6%
South America	4	6%	4	6%
	65	100%	63	100%
Industry				
Basic Materials	6	9%	6	10%
Consumer goods	7	11%	7	11%
Consumer Services	8	12%	8	13%
Financial Services	15	23%	13	21%

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Healthcare	3	5%	3	5%
Industrials	6	9%	9	14%
Oil and gas	6	9%	5	8%
Professional Services	4	6%	3	5%
Public sector	1	2%	1	2%
Real Estate	1	2%	1	2%
Technology	1	2%	0	0%
Telecommunications	2	3%	2	3%
Utilities	5	8%	5	8%
	65	100%	63	100%

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Sustainability Accounting Education: Past, Current and Future

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Summary: This chapter reviews the past development and current practices of sustainability accounting education (SAE) in the past two decades. Key issues are outlined to enlighten the necessary changes and future directions for SAE development.

Keywords: *Sustainability accounting education, research and practice, curriculum, pedagogy*

INTRODUCTION

There is no doubt that over the past two decades, sustainability concepts have been introduced into many disciplines and areas of university education. Accounting is one of these areas that have seen increasing development of sustainability topics. Accounting and business schools seem to have been convinced that their graduates need to be socially and environmentally responsible professionals.

Research on sustainability accounting education (SAE) can date back to early 1990s when Gray et al. (1994) first proposed the case for social and environmental accounting education. In response to the commitment to sustainability signed by higher education leaders in *Talloires Declaration* (ULSF 1990) and the *Agenda 21* [40: 363] which highlights the critical role of education in “promoting sustainable development and improving the capacity of the people to address environment and development issues”, Gray et al. (1994) criticizes accounting as an area resistant to sustainability initiatives for decades and contends that this resistance to change may have led to the ethical and intellectual inabilities of accounting practitioners. Accounting educators are partially to blame because they have not produced professionals with adequate knowledge to shield them against those ethical failures. The main contribution of the paper is its great foresight on SAE as a solution to this problem. The paper highlights that SAE can build ethical foundations for accounting students, mitigate the failures they face in relation to ethical and sustainability issues and help them transcend the constraints intrinsic in the technical and conventional accounting course contents.

Gray et al.’s (1994) seminal paper inspires a two-decade debate over sustainability-related (social, ethical and/or environmental) accounting education, such as Humphrey et al. (1996), Bebbington (1997), Gordon (1998) and Stevenson (2002), Thomson and Bebbington (2004), Mangion (2006), Sundin and Wainwright (2010) and Khan (2011). Gray and Collison (2002) later echo their first call for change and

further argue that a major revision of accounting degrees to establish the critical link between sustainability and accounting education is the only way in which accounting can remain a profession, serve the public interest and respond to the exigencies of sustainability. Based on decades of SAE experience, Gray (2013) recently complementing his earlier works by using a practical case of sustainability accounting course design to demonstrate how sustainability accounting can be effectively taught in a classroom.

Another interesting and inspiring paper is Mathews’ (2001) article where several insightful thoughts about pedagogical issues of SAE are discussed. In addition to the usefulness of SAE in developing students’ moral thoughts and helping them understand the role accounting has in society with regard to sustainability and stakeholders, Mathews (2001) proposed practical curricular contents and assessment methodologies, adding to the debate about the actual structure of SAE courses. He suggested a qualitative nature of such courses, including topics such as general background of social and environmental accounting, the philosophical bases of the issue, the empirical studies in the area, introducing and building on the concept of sustainability, relevant areas of management accounting, critical perspectives on social and environmental accounting and reporting, etc. Grinnel and Hunt III (2001) appraise that Mathews’ proposal develops important skills for students beside the technical knowledge, e.g. moral reasoning, critical thinking, analytical, communication and continuous life-long learning skills. The article provokes a series of commentaries and debates on SAE development, such as Booth (2001), Gordon (2001), Grinnel and Hunt III (2001) and Milne (2001).

Despite the increasing acceptance of SAE in literature and the acknowledgement of its pedagogic value in educational practice, the development of SAE in (mainstream) accounting research and degree/program is still limited. The following sessions review the past achievements, current practices and the key issues identified in SAE research and practice. This review aims to provide insights for future directions of SAE development and change.

PAST DEVELOPMENT

Early works of SAE mostly focus on establishing and justifying the area of SAE in accounting literature and education. Primarily taking from a critical perspective, the need for SAE is built upon the missing link

between accounting and its contexts such as the environment and society. As Gray and Bebbington (1993, 13) underpin, “the very practice of accounting and its current fundamental assumptions about economic profit, cost, success and failure are absolutely central to the environmental crisis”. The conventional form of accounting has contributed to unsustainability rather than sustainability, which needs to be critically addressed in accounting education if we want to develop ethical and socially responsible accounting graduates and professionals [12].

Along with the emergence and significant development of sustainability accounting in 1990s, the importance of sustainability as part of, if yet an essential part of, accounting education has been accepted by accounting educators [20] and professionals. Early pioneers such as Gray et al. (1994), Humphrey et al. (1996) and Babbiington (1997) have established a crucial link between substantiality and accounting student skills. SAE has been accepted as creating student awareness of a wider obligation of corporate behavior [32], [19] and stimulating critical thinking and reflection, which are clearly lacked in conventional accounting courses and syllabus [18].

There seems to be a sustained interest in, and debate about, the development of environmental and social responsibility agendas in accounting education throughout the 1990s. Empirical evidence in the 1990s has indicated an uptake of SAE but in a small number of universities. Humphrey et al. (1996) conducted a series of interviews with accounting departments at British universities and revealed that over 20% of universities introduced sustainability accounting topics as part (more than 10% of the content) of a mainstream accounting subject. The evidence clearly shows that sustainability accounting has been newly introduced at some institutions where they had no such history in the past.

Following up with Owen et al.'s (1994) survey results in 1993, Stevenson (2002) subsequently examined SAE development at the UK and Irish universities in 1998 to see what changes occurred since the initial uptake of SAE. The results show a small increase of sustainability accounting materials covered in part or full of accounting courses and environmental responsibility appears to be the most popular topic included in SAE. Apart from this, there has not been any substantial improvement in relation to SAE over the 1990s. The issues and barriers such as the lack of competency in teaching interdisciplinary knowledge and the lack of support from professional accounting associations have been raised and discussed repeatedly in earlier studies.

The criticism, however, did prompt some positive changes and development by professional accounting bodies later. Since the 2000s, professional bodies have started to specify the minimum number of SAE subjects and sustainability-related contents that must be

covered in undergraduate and postgraduate accounting degree courses [19], [14]. The incorporation of social and environmental responsibility in professional qualification and accreditation has provided an important opportunity to embed SAE into accounting curricula [14]. For example, Mangion (2006) and Sundin and Wainwright (2010) consistently find that the new direction set by professional bodies such as then Institute of Chartered Accountants in Australia (ICAA), now Chartered Accountants Australia and New Zealand (CAANZ) and Australian Society of Certified Practising Accountants (CPA) has significantly influenced the adoption of SAE among Australian universities. Having worked with Association of Chartered Accountants (ACCA) in the UK to promote social and environmental accounting education in British universities since 1994 (Owen et al. 1994), Owen (2013) has recently looked into new opportunities for ACCA to increase its involvement in SAE and calls for the association being open and flexible to new challenges such as integrated reporting (i.e. integration of financial, social and environmental responsibility and performance). Owen (2013) argues that to embrace integrated reporting in new accounting curriculum, it needs to have a strategic focus so that wider business performance metrics can be formulated for longer rather than short-term sustainability.

In reviewing the past achievements of SAE, the growing importance of SAE to accounting education is clearly noted. As a developing area within accounting education, SAE has evolved and changed over two decades. It is believed that the research and curriculum development of SAE will continue evolving and changing because of the dynamic nature of this area [29], [12].

CURRENT PRACTICE

SAE is no longer a new initiative in current educational practice. Most recent surveys and empirical investigations indicate a continuous development of SAE in university curricula. While SAE has been embraced by many more universities compared with two decades ago, this embracement is peripheral [18], [9]. SAE remains so far a marginal section in accounting education and more broadly in higher education for sustainability. This is despite a significant amount of sustainability accounting research taking place especially in developed countries.

Using universities that have signed the Talloires Declaration 1990 and those with prominent sustainability accounting researchers' affiliations as an example, Khan (2011) found that signatories' universities in Canada, USA, United Kingdom and Australia offer much more SAE than other countries. Yet, the coverage of SAE information at the websites of these “better performers” is less than 30% (indicating limited public data). The study also found that the focus of SAE in university curricula is mostly on post-graduate and research education rather than on undergraduate and coursework accounting education

development. Although SAE has been offered in various forms including stand-alone subjects and those embedded in other accounting and non-accounting courses, the level of stand-alone courses are generally shallow and primarily around theories such as frequently used legitimacy and stakeholder theories with little experiential learning.

Mangion (2006) and Sundin and Wainwright (2010) investigated the coverage and approaches of SAE in Australian universities and consistently found an increasing level of SAE incorporated within accounting major subjects. Mangion (2006) revealed 83% of Australian universities include some form of sustainability accounting in various accounting courses and 73% of them offer SAE within other subjects. The findings are similar to New Zealand (NZ) universities where Botes et al. (2014) revealed that all NZ universities have integrated SAE into their accounting and business degrees, but such integration is more at the postgraduate instead of the undergraduate levels. Again, limited offering of stand-alone SAE courses and a superficial level of incorporation of SEA into accounting programs are consistently found in these recent studies.

Development of separate or stand-alone sustainability accounting subjects seems to be stagnant in SAE practice for decades. Humphrey et al. (1996) earlier found only 11% of British universities offered stand-alone sustainability accounting subjects and the number of student enrolment in these subjects was very low. Sundin and Wainwright (2010) recently found of 22 Australian universities only four (18%) offered stand-alone SAE courses, compared with three (13%) found in 2004 by Mangion (2006). In addition, Khan (2011) found all stand-alone SAE courses offered by signatories of Talloires Declaration were electives. Similarly, Botes et al. (2014) found that while all NZ universities offered SAE in business degrees, only one university had a compulsory sustainability accounting as part of core courses in accounting degree programs.

KEY ISSUES

In current SAE practice, sufficient integration of sustainability accounting into already overly crowded accounting curricula has proved difficult. The continuous SAE debate in extant literature has drawn attention to the following four key issues.

1. Content focus

Whether and how SAE experience can change attitudes and behavior are largely influenced by what is taught in classroom and business experience [28]. Different SAE content focuses may result in different learning outcomes and affect students' evaluation of social and environmental responsibility even in their later business career [38].

However, despite promotion of sustainability accounting and corporate social responsibility by

professional accounting bodies, accounting major course structure and subject content are still dominated by traditional professional body requirements which are mostly technical focused [33]. This often leads to strong competition for only a few (often only one) accounting elective slots available for non-mainstream accounting topics [21]. In such a technical focused teaching environment, consideration of sustainability is at great danger of being overlooked or superficial [14].

As Gray (2013, 323) reiterated, a fundamental difficulty for accounting educators, in his view, is "how sustainability accounting educators justify what they teach is not obviously compatible with a growing body of very disturbing (un-sustainability) data". Hazelton and Haigh (2010) contended that until the professional bodies give SAE explicit support and increase its weighting over traditional technical requirements, it is unlikely that SAE in accounting faculty can embrace sufficient breadth and depth, and substantive changes will be restricted to pedagogical approach.

2. Pedagogical design

In commenting Mathews' (2001) paper, Booth (2001) points out that there is not adequate explanation about how the content of a sustainability accounting course should be delivered. In addition to the question of *what*, Thomson and Bebbington (2004) highlighted an equally important question of *how*. As sustainability is such a broad and confronting concept, in which way sustainability should be approached and represented in classroom is critically challenging [9].

Pedagogical design of SAE is of significance because it may determine how likely deep learning in classroom and life-long learning will take place. For example, Wynder et al. (2013) examined if SAE will increase a person's weighting on environmental performance in a balanced scorecard. They found that although the third year students who receive more SAE place significantly higher weight on environmental performance in overall business performance evaluation than the first year students who receive lower SAE, experienced professionals give less weight to environmental performance than the third year students. There seems to be a lack of deep change in students' critical and intellectual capabilities, which makes the effectiveness of SAE being constrained in classroom rather than being life-long. As Boyce et al. (2011) argued, deep educational change needs to encompass both the content and practice of classroom activity and changes in the self-consciousness of students and educators. Broad concepts and conflicting views and evidence around sustainability need to be addressed and discussed upfront to provoke critical thinking and exploration in a deep educational engagement [9].

Pedagogical approach has been brought into many SAE

practical case discussions. For example, Thomson and Bebbington (2004) suggest SAE should use a variety of means of student involvement in course design and encourage more interactive classes instead of lectures. Boyce et al. (2011) suggest that SAE curriculum can be designed on the basis of a broad conception of accounting and accountability as power-laden social processes. As these processes involve multidiscipline, they proposed a multidisciplinary team teaching approach which provides students with a richer base of sustainability accounting knowledge. Hazelton and Haigh (2010) indicated that SAE class delivery needs to replace slogans and monologues with dialogue, thought provoking, practical projects and new tools such as multi-media to bring more engagement and reflexivity into classrooms.

3. Stand-alone or embedded

While debates on sustainability accounting education continue to produce ideas and increasing uptake of sustainability topics within existing accounting courses and programs, previous empirics all point out that practice of sustainability accounting as a standalone or a core course in current suite of accounting programs remains strikingly thin.

Technically Sefcik et al. (1997) offered some advantages of developing stand-alone SAE related courses such as an environmental accounting course could be offered as a capstone course that involves contemporary issues and integrates many areas of accounting. But this discussion is still based upon the conventional accounting paradigm rather than questioning the underlying assumptions of conventionally financial-dominated accounting or offering any alternative ways of thinking about the potential role of accounting [23], [13]. As highlighted by Sundin and Wainwright (2010), there is a serious risk when incorporating or embedding sustainability accounting into other mainstream accounting or business degree courses because this may further trigger the presentation and reflection of sustainability (accounting) issues in a superficial and legitimacy-seeking way.

As such, Bebbington (1997) contended that if SAE is not offered as stand-alone compulsory courses, it is likely that student enrolment in those courses will be very low. This means it is almost impossible to enable our future generation of accountants to fully understand the prejudices and constraint of conventional accounting. A further implication of this shallow understanding is that when students entering the 'real world', sustainability issues would appeal less than business financial performance to them (see evidence in [38]) and they are more likely to legitimize business behavior rather than making real changes to reduce social and environmental impacts [33].

4. Institutional commitment

Research also suggests that slow progress of sustainability education is not just within the accounting discipline. It is across board in many other disciplines [34], [31]. There seems to be a lack of a holistic institutional commitment to sustainability education in the broader context, which adds a further layer of barriers to SAE development in a single discipline [22], [27].

Evidence shows that implementation of sustainability education is limited in higher education institutions globally, particularly in the areas of curriculum change and pedagogical reform. For example, Thomas and Nicita (2002) in Australia, Segreda (2002) in Costa Rica and Verbitskaya et al. (2002) in Russia all report superficial outcomes of sustainability education development in universities. Most university students in non-environmental disciplines have few opportunities to access environmental or sustainability related information in their degree programs [34], [31]. As Thomas and Nicita (2002: 477) highlighted, "The bulk of information that assists development of environmental literacy and/or education for sustainability continues to be accessible only by those most directly involved in environmentally focused education courses, such as environmental sciences...specific information regarding the movements in other course areas has not been widely evident".

Moore et al. (2005) and Qian (2013) pointed out that the most significant barrier to transforming university curricula towards sustainability is the lack of institutional commitment, a commitment that needs support from top management and a large number of lower and middle level staff whose teaching or research expertise and interests are not in sustainability. Verbitskaya et al. (2002) argued that before sustainability values and understanding can be embedded in the tertiary education sector, fundamental reform of the entire educational scheme is necessary. As Sherren (2006) reinforced, the current model for sustainable development privileges scientific perspectives in defining and tackling sustainability. She called for disciplines in the social realms (accounting is clearly one of them) to respond to, or to serve, the scientific development for sustainability.

Most current uptakes of sustainability education in universities rely on bottom-up development efforts to lead change. Development of sustainability education, including SAE, often hinges on individual academics' interests and capabilities of teaching the relevant subjects [33], [18]. This has proved hard to diffuse or to obtain support and resources from other academics and more critically university decision-makers. Many organizational change studies suggest that commitment of top management is vital to the success of organizational change and transformation (e.g. [15], [17]). Therefore, creating an institutional commitment to educational change for sustainability (involving SAE change) is needed.

CONCLUSIONS AND OUTLOOK

This short overview of 20 years' development of SAE first highlights that the establishment of the critical link between sustainability and accounting education in the 1990s and the increased adoption of SAE during the 2000s are encouraging. However, because addressing social and environmental issues and responsibilities would question the fundamental principles of accounting practice, only marginal engagement and development of SAE in accounting research and education can be found in current practice [33], [9].

In addressing the lack of substantive change/development of SAE, current debate in the area of SAE has focused on four areas of issues. These involve:

- The overly crowded technical contents in accounting programs have limited the space for SAE development;
- The equally important “how” question has not been given adequate attention in pedagogical design for SAE development;
- The little practice of sustainability accounting as a standalone or a core course in current accounting programs may increase the risk of superficial development of SAE and the ignorance of critical issues in conventional accounting;
- The lack of a holistic institutional commitment to sustainability education in the broader context of higher education presents a further barrier to SAE development in the accounting discipline.

In response to the contested issues identified in SAE development and looking out for new avenues of SAE research and practice, the following areas may need to be elaborated in the future. First, future direction of research on the theme of content and pedagogical development is likely to focus on what specific sustainability accounting topics need to be brought in, what the effective course design from a pedagogical perspective should include, and more importantly, how to implement in practice a ‘active, dialogical, critical and criticism-stimulating method’ to enable deep learning for SAE [14]. As entailed in Schaltegger’s commentary (2013), how sustainability is approached and taught to make a difference for students and make a case for sustainability accounting educators is an important question needing a thorough answer.

Second, as mainstream accounting dominates educational practice and research, academics may have to work more closely with accounting professional bodies and business practitioners to identify solutions to the critical and structural change of accounting education programs. Although compared with fast growing body of “very disturbing (un-sustainability)” accounting and finance subjects [13:323], SAE remains peripheral and is often regarded an “outsider”, new ways to approaching to mainstream “insiders” are

likely to be developed. For example, instead of using criticism as the only strategy to develop SAE, managerial approaches that provide constructive resolutions for social and environmental problems and use accounting as a tool to make incremental changes may help to break current impasses in SAE.

Also, engaging with top management for an institutional change is desirable for the long term educational change for sustainability. A commitment to sustainability from the top management is important to lead to a fundamental change in organizational culture and strategy [6]. Active leadership where priority is given to sustainability is the only ingredient for transforming the whole higher education institutions for sustainability [6]. As such, higher education leaders need to actively establish the change agenda, gain commitment to the change goals and engage stakeholders, all of which are essential steps towards a successful and sustained change for SAE in the future.

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Revival of the fittest? – Intellectual capital in Swedish Companies

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EXTENDED ABSTRACT

This study analyses the degree of intellectual capital disclosure of information in a sample of Swedish NASDAQ OMXSAX30 listed companies, primarily with respect to voluntary disclosure of non-accounting information on knowledge-based resources. In 2010, the International Integrated Reporting Committee (IIRC) was founded with the aim of creating a global framework for integrated reporting. Intellectual capital is one key capital of an integrated report. Differences in reporting practise, especially with respect to intellectual capital, however, reflect to a major degree differences in institutional settings, culture and traditions. The methodology used in the analysis is a disclosure index consisting of 78 items that has been developed by Bukh et. al [1], but being used by a number of studies [2],[3]. Disclosure index research in accounting and business reporting practices has been widely applied, because such studies represent an aspect of disclosure quality. Although a large stream of research on IC has been generated, up to now there is no study examining if there is a difference in intellectual capital disclosure between companies that apply integrated reporting and those that issue traditional annual reports. Sweden has a long tradition in intellectual capital. In the 1990s, intellectual capital reporting had much attention among Swedish companies. Skandia with its Navigator had been one of the leading companies within intellectual capital. Therefore, this study also analyses the amount of intellectual capital disclosure in the annual reports of the former frontrunner of intellectual capital reporting Skandia. The level of Skandia's intellectual capital disclosure 20 years ago is compared with the current level of reporting top 30 companies. How different is the level of intellectual capital disclosure in Swedish companies now in comparison with the leading company 20 years ago? Has integrated reporting led to a revival of intellectual capital reporting?

Consequently, the aim of this study present paper is threefold. First, to give an indication of the importance of intellectual capital information in current reporting practice. Second, to compare the findings from the recent disclosure study with information on intellectual capital in the leading company 20 years ago. Third, is there a difference in the level of reporting intellectual capital regarding the tradition of intellectual capital? The results are interpreted in the light of the increasing importance of disclosing information on intellectual capital in integrated reports to the capital market and constitute a contribution to the ongoing debate on

corporate reporting practices.

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Integrated reporting adoption and organizational change

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ABSTRACT

Although some research have analysed integrated reporting emerging practice (de Villiers et al. 2014; Stubbs and Higgins, 2014; Haller and Van Staden, 2014; Higgins et al.2014; van Bommel, 2014; Brown and Dillard, 2014) further research is still needed to understand its adoption and implementation in organizations.

Moreover, despite previous research did not find a link between accounting practices and a real sustainability change in organizational practices, the momentum (Eccles and Krzus, 2015) and the time elapsed since IIRC framework was issued (2013) justifies revisiting the question of whether and how IR practices could produce changes in organizations.

This research responds to calls for further research about whether and how integrated reporting adoption effects any change at the organizational level (Adams, 2015) and aims to explore and understand the organizational change pathways of Spanish organizations involved in Integrated Reporting. We ground our analysis in Laughling's (1991) approach of environmental disturbances and organizational transitions and transformations as well as in further contributions that either develop this theoretical framework (Gray et al. 1995; Larrinaga et al., 2001; Higgins, Stubbs and Love, 2014) or provide additional insights to the understanding of design archetypes, interpretive schemes and organizational dynamics (Ranson, Hininigs and Greenwood, 1980; Bartunek, 1984; Greenwood and Hinings, 1988,1993; Hinings and Greenwood, 1988; Broadbent and Laughlin, 2005). As underlined by Laughlin, the different models of change (inertia, rebuttal, reorientation, colonization and evolution) are only heuristic devices and skeletal models that require empirical investigation to understand better the organizational change pathways.

An exploratory multiple case study research of Spanish organizations self-declared as integrated reporting adopters has been conducted analysing corporate reports and interview data. Twenty three semi-structured interviews to twenty eight-sustainability, financial reporting, control and corporate compliance- managers in nineteen organizations have been carried out.

Our analysis reveals that most organizations follow a reorientation change pathway, introducing integrated reporting as a new design archetype that results in

subsystem change and the reinforcement of the prevailing interpretive systems without affecting the basic coherence of the organization. However, some evidence of inertia, rebuttal and colonization has also been found.

These organizations are not necessarily considering IIRC framework as a catalyst for change. Indeed, our exploration does not reveal IIRC framework as a disturbance for integrated reporting. In contrast to Stubbs and Higgins (2014), who take for granted IIRC framework as a disturbance for Integrated reporting development, our investigation unveils that the disturbance for integrated reporting is the result of a set of institutional pressures: the coercive influence of EU regulation of non-financial disclosure, corporate governance regulation, and adherence to Sustainability development goals (SDG), the normative influence from GRI, sustainability rankings and indexes and the mimetic pressures coming from benchmarking analysis among organizations.

It also provides insights into the links between sustainability and integrated reporting. In this regard, it is worth mentioning that some interviewed managers underline that integrated reporting advances sustainability reporting by offering them an opportunity to explain why they do the things -and not only the things they do.

Furthermore, materiality is portrayed as a critical (and complex) issue for organizations that privileges its internal dimension over its external dimension and where GRI emerges as a useful normative framework for the materiality determination process and as a de facto law to organizations for sustainability/integrated reporting.

Integrated thinking is a general concern of interviewed organizations but we have come to the conclusion that IIRC is rapidly losing track of IR developments and it is not considered as a jolt or as a catalyst for change by integrated reporting adopters. Quite the contrary, organizations are trying to move towards more integrated information autonomously from IIRC and, mostly, they acknowledge that real integration is still a challenge due to technological constraints or restricted commitment of certain departments.

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Energy culture: what drives energy efficiency management?

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Extended abstract: Currently, there is hardly empirical evidence for effects of cultural controls within environmental management control systems. We close this research gap by analysing case studies on energy efficiency management in the manufacturing industry. We investigate if an industrial energy culture exists and what cultural factors are conditional for positive overall management outcomes. We apply an explorative, systematic review and Qualitative Comparative Analysis to detect those set relations.

INTRODUCTION

Investments in energy efficiency are a key to climate change [1]. And they define a clear business case: the accumulated global energy savings amounts to almost USD 6 trillion since 1990 [2]-[3]. Yet, only a third of recommended energy savings are realized by companies [4]. While energy efficiency can be declared as interdisciplinary inside of companies, environmental management accounting has a high importance in this context. Until now, numerous studies investigated the so-called energy efficiency gap or energy paradox [5]-[7]. However, the cultural dimension is an important but often neglected driver for energy efficiency [8]-[9]. In this context, Faruqui states that “culture eats strategy for breakfast” [10]. Moreover, scholars demand an integration of sustainability into management control and strategy, also as a contribution to environmental management accounting [4],[11]. Several investigations of management control further see culture as a given and exclude its potential and influence [12]-[14]. Guenther et al. position cultural controls on a strategic level within an environmental management control system (EMCS) [15]. On the other hand, Stephenson et al. introduced a concept of energy culture to understand cultural aspects of energy consumption behaviour, yet initially applied on household level [16]-[17].

This article addresses, first, existing research gaps on what elements form a framework of energy culture on industry level. We also investigate and integrate EMCS to achieve a stronger influence of management disciplines to energy culture through cultural controls. Second, we assess what cultural factors within the framework are sufficient or necessary conditions to the successful implementation of energy efficiency programs from the literature. To our best knowledge, there is no prior research with such emphasis. Our methodological approach is twofold. First, we use a systematic review to build and modify a theoretical framework of industrial energy culture [16]-[17]. Second, by applying Qualitative Comparative Analysis (QCA) as a deductive methodology for configuration research [18], we test this model with a subsample of case studies on energy efficiency measures for consistency and conjunctional

causal effects. QCA detects set relations of conditions sufficient or necessary regarding an outcome as defined as a successfully implemented and performing energy efficiency program as part of an EMCS.

BACKGROUND

Worldwide energy consumption continues to increase, though it already accounts for two-thirds in global greenhouse gases, mostly carbon dioxide [2]. Energy consumption is then highly important to climate change and scarcity of fossil fuels. In the context of energy efficiency, a worldwide application of best available technologies has an estimated potential to reduce up to 25% of the current energy consumption [3]. Above all, the manufacturing industry has a high capability to decrease environmental impacts and, therefore, energy costs as well [5], [19]. We define energy efficiency as the useful output of a process over the energy input of a process [20].

There is a variety of studies investigating the phenomenon energy efficiency gap, i.e. missing investments into energy efficiency. It ecological and economic potential is well known [4], [21]. Besides investigated financial and technical barriers, corporate culture plays an important role for the integration of energy efficient technologies. For example, if energy efficiency is seen as organisational innovation, culture is an essential barrier [22]. Cooremans argues that the “cultural dimension of energy use partially explains why these investments are not perceived as strategic“ [4]. In the context of EMCS, culture “sets the action and decision premises for individuals within a given culture group” [13].

In 2010, a first holistic approach has been developed to investigate cultural aspects of households’ energy behaviour in New Zealand, the so called framework of energy culture [17]. It consists of three dimensions that are highly interactive: i) norms, ii) practices, and iii) material culture. Whereas norms strongly determine people’s choices, practices define how technologies are employed, and material, respectively technology, constitute energy users’ understandings and persuasions [17].

Some factors of the framework of energy culture, e.g. efficient procedures, relate to the resource based view of Wernerfeldt [23]. Many factors can be seen as physical, organisational and human capabilities as suggested by Barney [24]. Specifically, households’ behaviour can be transferred to companies, and a regional to the national frame as well. Individuals in a broader sense can be described as belonging to clans as groups of individuals

which follow the same values [25]. Therefore, the framework of energy culture is also scalable from a cultural perspective.

Based on the management control system package by Malmi and Brown [14], Guenther et al. developed a framework for EMCS to analyse the importance of sustainability (see Figure 1) [15]. They reallocated some original elements to set them in the context of management systems and the operational level of accounting disciplines [15]. In consequence, they reassigned cultural controls to environmental management systems and lift them in the strategic focus. However, they conclude that research of empirical evidences towards EMCS shows an underestimation of clans and symbols, while control through values might be most important in a quantitative way.

INSERT FIGURE 1 FROM APPENDICES HERE

In sum, existing research to management control systems underlines our motivation that cultural aspects could play a more important role than it has been estimated so far. We expand and scale the framework of energy cultures to an industrial approach. We focus on energy management as specific case in EMCS related to the energy efficiency gap. To the best of our knowledge, an industrial concept for overcoming cultural barriers in context of energy efficiency is yet missing, although the strategic functions of cultural aspects in EMCS are acknowledged for [14], [26]-[27].

RESEARCH AIM

Through our investigation, we want to test the scalability of the energy culture framework to industrial applications. We search for reasons that hamper energy efficiency programs. In terms of environmental management accounting, we explore if cultural controls are an existing phenomenon of the energy efficiency gap. To justify our approach, it is important to show that there is an influence of an existing energy culture to corporate energy efficiency outcomes. Our central research questions are:

- What is industrial energy culture? What cultural factors are eligible?
- Does industrial energy culture influence energy efficiency management?

Using the framework in an industrial context demands to expand it by additional factors. We advance the framework of energy culture through industry-targeted factors and investigate:

- How does industrial energy culture influence energy efficiency management outcomes?

Companies operate within different contexts. From an accounting point of view, aspects like financial performance or size can be highly relevant. In terms of energy efficiency, it is interesting to test the role and maturity level of energy management:

- Do companies with a certified energy management have a stronger energy culture?

METHODOLOGY AND DATA

We used a three-step approach: first, we identified and synthesized studies relevant to energy culture and energy efficiency applying a systematic literature review. As a preliminary result, we developed a behavioural framework for energy culture directed at industrial energy efficiency programs based on Stephenson et al. [16]-[17]. Second, we screened and analysed a subsample of case studies. The cases present ISO 50001/14001 applications within the manufacturing industry in order to test our framework. That second step allowed for modifications of the framework to account for observed data availability constraints. Third, we used QCA to detect set relations between conditions and the desired outcome. Success factors of the framework constitute the conditions, an increased energy efficiency level the outcome. The latter enabled us to explore and evaluate combinations of variables as conjunctural causal for the outcome.

We applied the systematic literature review in four stages: i) selecting bibliographic databases, search strings, and research questions, ii) practical screening, iii) methodological screening, and iv) synthesizing of results [28]-[30]. We identified 2,021 studies, 1,769 were excluded during the first, another 134 during the second screening, and 4 were not available. The case study approach was based on a similar rigor proceeding, but scrutinizes a subsample of 53 cases as compared to 61 method studies. QCA is applied to examine what success factors within the industrial energy culture framework are necessary or conjunctural causal for an increasing energy efficiency [18]. Initially applied within comparative politics, QCA has seen applications in environmental sciences [31]. QCA was chosen to examine the conjunctural causal effect of factors within the industrial framework of energy culture on energy efficiency program outcomes. QCA therefore bridges qualitative and quantitative methods.

In order to accomplish rigor of research, we applied a systematic approach to ensure objectivity. Research consistency was improved by a well-documented coding scheme, pre-defined search strategy, transparent documentation, and double coding. The research design was discussed and validated by PhD colleagues following El-Diraby and Rasic [32]. However, we suspect a number of industrial, inaccessible cases on energy efficiency related to cultural controls [33].

PRELIMINARY RESULTS

Until now, we have finished work step one. Synthesizing prior research, we present a framework of an industrial energy culture along the three dimensions; norms, practices, and material culture (see Figure 2). Each factor, interpreted as barrier or success factor, is collected and synthesized from the case studies,

eventually assorted to the three dimensions. For example, norms include factors like “Environmental concerns” or “Commitment and Team spirit”, material culture has got “Energy sources” and “Measuring infrastructure”, and practices contain “Implemented accounting”, “Implemented controlling and Monitoring” or “Reward and Compensation”. The latter practices are further classified upon existing occurrence and quality of each factor into five energy management maturity level [34]. That classification is not illustrated within Figure 2. The framework of industrial energy culture is then defined as an interaction of norms, practices, and material culture to characterize corporate energy behaviour. Scaling the framework to industrial applications demands to consider context variables and boundary conditions. Practices are influenced by the structure of “Value added”, “Energy prices” or “Sector specific energy intensities”. Norms as present within companies depend on “Stakeholder pressure” or the staffs’ “Education level”. The material culture is affected by “Regulatory” or “Technical conditions”. Currently, we are working on step two and drafting the QCA, step three, as described in Section IV.

INSERT FIGURE 2 FROM APPENDICES HERE.

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APPENDICES

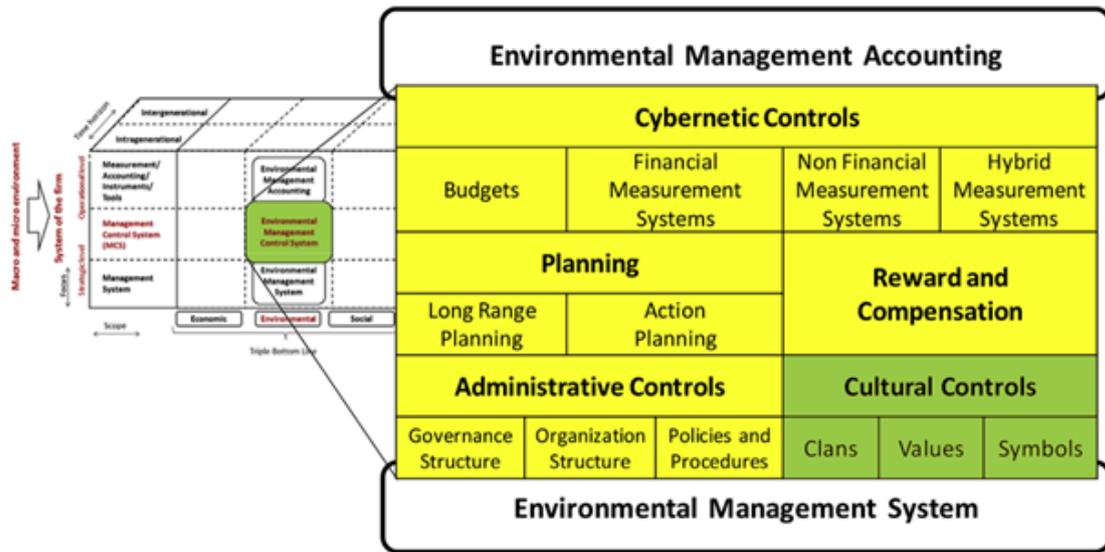


FIGURE 1: CULTURAL CONTROLS WITHIN ENVIRONMENTAL MANAGEMENT CONTROL SYSTEMS (GUENTHER ET AL. 2016).

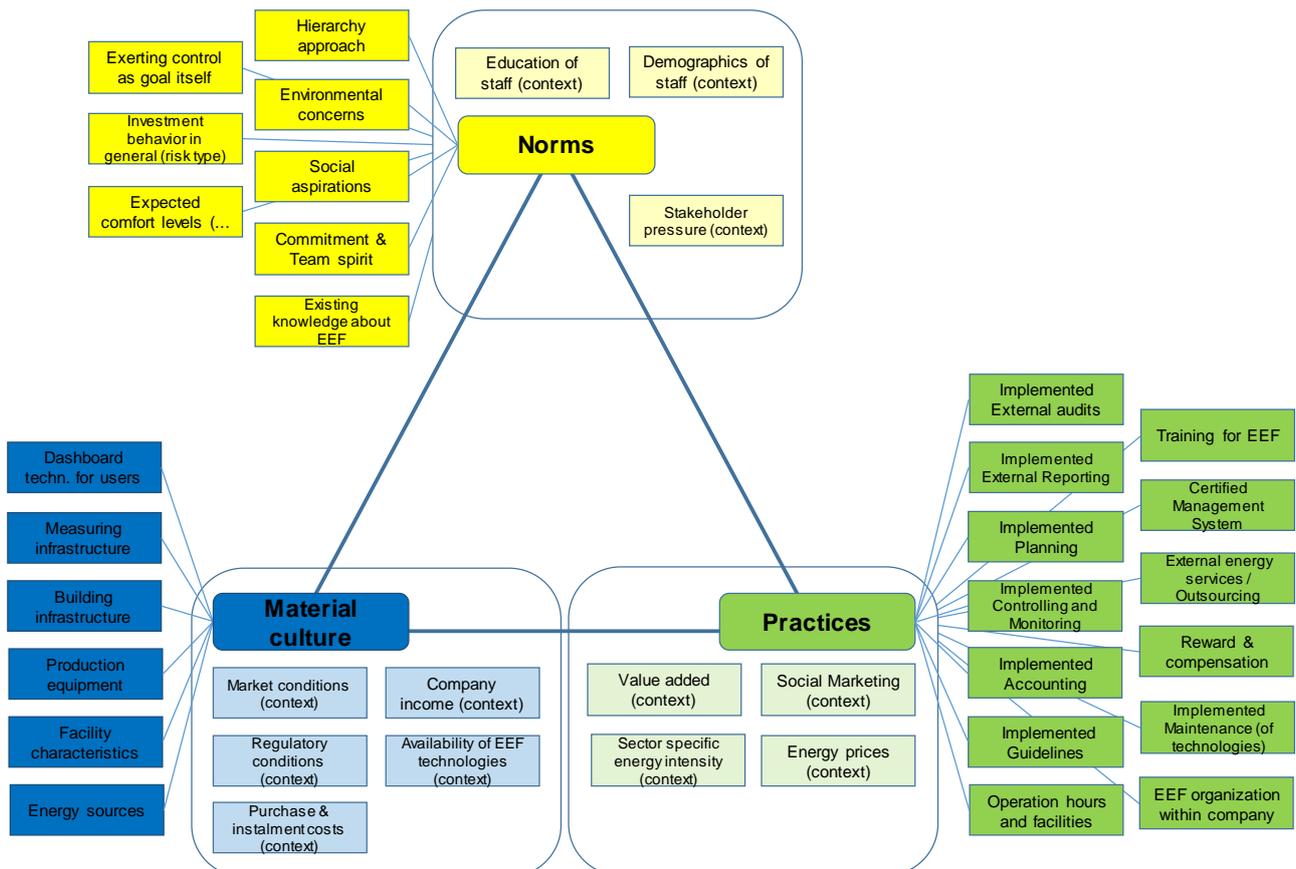


FIGURE 2: FRAMEWORK OF INDUSTRIAL ENERGY CULTURE.

Scarpellini, S.; Valero-Gil, J.; Moneva, José M.; Portillo-Tarragona, P. and Aranda-Usón, A.

The environmental concerns in the accounting processes and the main costs related to the eco-innovation investments

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Eco-innovation represents an opportunity to boost the sustainable development in Europe. For this reason, five applied cases of eco-innovation have been deeply analysed with an environmental management accounting (EMA) approach to assess eco innovations investments and to conceptualize the influence of environmental concerns in the eco-innovative firms. A specific data set has been applied to reveal the involvement of the accounting department in those principal costs management of the incremental eco-innovations.

INTRODUCTION

The intrinsic environmental component of eco-innovation [1], [2] in saving resources and reducing the environmental impact of production [3], [4] [5] without forgetting the business objectives pursued with innovation as defined by the Oslo Manual [6], allows that all, public and private parties, share a common agreement about the benefits of its implementation.

When investments are concerning about environment and innovation, it is unclear whether environmental aspects are really important when making decisions about those investments in which firms' accounting department should play an active role.

In this scenario, the main objective of this paper is to define the environmental concerns in those principal costs categories of five incremental eco-innovation investments from an EMA point of view. The involvement of the accounting department in the internal processes for those eco-innovations have been analysed as well to reveal the common green patterns of the eco-innovative organizations.

BACKGROUND

At present, the environmental accounting [7] [8] [9], [10] is of interest for both academics [11] and practitioners [12]. Accounting has been pointed out, in facts, as a tool for the corporate environmental management by [13] and it has been related to the management operational planning and decisions by [14] [15]. As well as in Europe, some barriers have been pointed out for business in other geographic areas [16].

Empirical studies have focused on the views of the role of accounting practitioners that, in general terms, are not extensively involved in the environmental accounting practices of businesses [17] [18] [19] [20]. Collins et al. [21] found that many management accountants are fulfilling their traditional role of financial specialist but not yet acting as collaborators in driving toward sustainability as a goal.

The influence of culture [22] to accommodate environmental issues into the local accounting system [23] [24] is still a subject of analysis in the literature.

The environmental costs are in facts usually hidden in manufacturing overheads [25], which makes it difficult for managers to observe the actual environmental costs related to their particular activities [26].

Some authors identified benefits related to the EMA system [27] pointing out the advantages to the company of the identification, classification and allocation of costs as they aid analysis of cost reductions and decision-making ([28], [29], [30]).

Few papers within the accounting literature, as far as we are aware, have explored the detailed mechanics of the accounting processes applied to the eco-innovation projects. Thus, EMA can be considered the set of tools useful to assess eco innovations investments.

Given these premises, this paper seeks to contribute to the knowledge regarding “which main costs are related to the environmental improvement in the eco-innovation projects”? And “which environmental conducts are adopted by business into their accounting departments for the eco-innovation investments?” Starting from a cross-case analysis the relevant conducts of firms in adopting a certain level of awareness about the environment in their accounting procedures can be dimensioned and described for eco-innovative business.

METHOD AND CASE STUDIES

Our study was conducted starting from the selection of five eco-innovation projects in the framework of an Eco-Innovation Campaign¹⁴ at the regional level [31] and through semi-structured interviews (in-depth). A qualitative analysis in deep of all factors inherent to eco-innovation projects and all those accounting processes involved was the methodological approach to understand the relation between the environmental improvements obtained through the eco-innovation projects and those main costs related to the investments.

Company	Sector	Eco-innovation project
BSH ELECTRODOMESTICOS ESPAÑA SA	Manufacturing - Appliances	Eco-design of screws for appliances manufacturing
GENERAL MOTORS ESPAÑA SLU	Manufacturing - Automotive	Efficient vehicles painting system
MAC PUAR SA	Manufacturing - Elevator machines	Eco-design of lifts
MONDO TUFTING SA	Manufacturing -	Eco-design of

¹⁴ The Campaign was financed by the Regional Government of Aragón (Spain) and the Spanish Ministry of Economy and Competitiveness. More information about the campaign at: <http://ecoinnovacion.fcirce.es/campa%20B1-para-el-fomento-de-la-eco-innovaci%C3%B3n-empresarial-en-arag%C3%B3n> (Accessed September 2015).

	Plastic	artificial turf for sports fields
SOCIEDAD ANONIMA INDUSTRIAS CELULOSA ARAGONESA	Manufacturing - Paper	Waste recovery papermaking

TABLE I. LIST OF THE ANALYSED FIRMS AND THE ECO-INNOVATION PROJECTS CARRIED OUT BY THE FIRMS

The main costs categories of the five incremental eco-innovation investments have been detailed and classified from an EMA point of view to define their relationship with the environmental improvements obtained through eco-innovation by the firms.

CONCLUSION

In general terms, we can affirm that the accounting department does not play a prominent role in developing eco-innovation projects and it is not directly involved in the environmental decisions in business.

The analysed processes related to the eco-innovation projects do not indicate that this department actively participates in the measurement of environmental risks or instruments, the definition of specific parameters or sets related to the environmental aspects of eco-innovation and no elevated levels of integration of the accounting phase into the environmental strategy have been found in the analysed cases.

A deeper integration between accounting and financial analysis and accountability would also be recommended to disseminate the intrinsic environmental improvement pursued with the eco-innovation projects.

Overall, when we classify the main costs related to the investments, we can observe different levels of environmental improvements. As a result, we could classified those investments' factors mainly focused to the cost saving and those specific factors related to the "genuinely environmental costs" of eco-innovation that represent a minority of the results obtained through such projects carried out by the firms.

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Successful implementation of a Carbon Accounting and Reporting System for small and medium-sized companies in Germany

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Summary: KlimAktiv developed a specific carbon accounting system designed for small and medium-sized companies that want to act for the climate, without being hitherto subjected to regulations. Organisations and companies starting to build their sustainability policies need a reliable, scientifically-funded as well as user-friendly tool to understand, measure, manage and reduce the greenhouse gas emissions arising from their activities - as a first step in their sustainability efforts.

INTRODUCTION

KlimAktiv gemeinnützige Gesellschaft zur Förderung des Klimaschutzes mbH (KlimAktiv), a non-profit organisation engaged since a decade in carbon footprinting and awareness raising for individuals, extended its activities towards companies. As climate change becomes a more pressing issue around the world, the interest in carbon accounting is increasing due to the pressure of society, stakeholders, investors and regulatory influences. KlimAktiv provides small and medium-sized companies (SMEs) and organisations with an easily operable software as a tool to autonomous compilation and reporting of their carbon footprint. The tool comprises an intuitive interface for non-carbon accounting experts and integrates the latest scientific and standardization developments in terms of greenhouse gas (GHG) accounting and reporting such as the Greenhouse Gas Protocol (GHG Protocol) Value Chain Standard [1] and GHG Protocol Scope 2 Guidance [2].

As their contribution to moving towards a low-carbon society, SMEs will be able to assess their impact on the climate, identify their emission hotspots, benchmark themselves, reduce their emissions and monitor the evolution of their carbon footprint over time. Often, this is the first step towards the generation of key indicators, establishment and monitoring of a climate strategy, sustainability reporting or climate neutrality.

The article focuses on the development process, the main features as well as the successful implementation of the carbon accounting and reporting system CO₂-Rechner für Unternehmen [3] (Carbon Calculator for Business) among a selected set of companies randomly chosen for their various frameworks.

DEVELOPMENT

The carbon accounting and reporting system was developed and road-tested in cooperation with a heterogeneous network of partners: energy agencies, sustainability consultants, research institutes, carbon offsetting providers, financial institutions. The aim was to establish a standardized approach to consistent

accounting and transparent reporting of carbon and other GHG emissions at corporate level. The main focus for the development network was an optimized assessment of the climate impact of SMEs. Accounting and reporting standards such as the GHG Protocol Corporate Standard [4] and the International Organization for Standardization (ISO) 14064-1 [5] are spread worldwide, nevertheless the overabundance of complex reporting systems, data sources, challenging spreadsheets and the lack of transparency in the emission factors are often seen as hurdles by practitioners in companies that are non-experts in the field of sustainability. At the end of the day, the practitioner is provided with a tool that can be used independently or with the support of an advisor or consultant.

DESIGN & MAIN FEATURES

The carbon accounting and reporting system is provided as Software as a Service (SaaS) without any requirements for installation. The online software includes relevant guidance to self-reliant compilation and reporting of the carbon footprint of a company or organisation (as user). The user-friendly interface enables the direct recording of GHG emitting activity data in sectors well-known by the practitioners: real assets, mobility, process emissions, climate friendly measures, others.

No specific knowledge in carbon footprinting is needed, nonetheless a detailed documentation on the issue of carbon footprinting, the specific features of the system as well as a user guide belong to the system package [6], [7].

Other accounting and reporting systems such as the Footprint Manager from Carbon Trust are based on a similar sectorial recording, however limited in the field of indirect (Scope 3) emissions. On the other hand, more complex tools such as Umberto NXT CO₂ from ifu hamburg or thinkstep SoFi from thinkstep integrate substantial databases that require a deeper knowledge regarding the possible climate relevance of the practitioner's activities. To find the sought information among unfamiliar data is often seen as an obstacle.

Therefore, KlimAktiv carbon accounting and reporting system concentrates on core activities common for all SMEs and skip time-consuming search through multiple datasets that are not relevant for the majority of practitioners. Yet the modular sectorial structure of the software can be upgraded anytime to meet specific needs and integrate relevant fields for the business.

Accounting

A standardized calculation methodology, TÜV NORD CERT GmbH certified algorithms as well as emission

factor sets updated on a regular basis build the core of the GHG accounting. Emission factors are based on international and national publications or regulations as well as scientific studies.

As a unique feature, SMEs are given the opportunity to record their climate friendly activities such as use of biomass, use of renewable energy, promotion of climate friendly business trips, purchase of carbon credits, climate campaigns, etc. without numerically accounting for them within the carbon footprint of the company.

Reporting

Output of the system is a detailed report conforming with the ISO 14064-1 that lays the basis to further developing of the SME's climate strategy.

The system integrates the split in direct and indirect emissions (Scopes 1, 2, 3 such as specified in the GHG Protocol Corporate Standard and categorized in the GHG Protocol Value Chain Standard). Energy indirect emissions (Scope 2) are calculated following the local-grid or the market-based approach of the GHG Protocol Scope 2 Guidance in order to allow companies to report on dedicated programs such as CDP [8]. The standards conformance provides also the basis for verification by an independent third-party.

Besides, as the system was first developed in Germany, it integrates country-specific features such as the particularities of combined heat and power (CHP) or the green electricity market.

The opportunity is given to choose the consolidation approach (equity share or control approach as defined in the GHG Protocol Corporate Standard) as well as the mapping of complex company structures (joint ventures, subsidiaries...) and complex processes.

SINGLE USER OR COMPREHENSIVE HANDLING

The carbon accounting and reporting system has been implemented successfully on the German market and is presently used by a multiplicity of organisations and SMEs in various structures, positions and frameworks:

- in various sectors: administration and service companies as well as manufacturing industries from e.g. building industry, chemical industry or metal industry;
- with various business models: from non-profit organisations to multinationals;
- in single-person companies as well as in companies with thousands of employees;
- with one or multiple business units;
- with single structures, or with numerous subsidiaries;
- with 100 kg yearly carbon-equivalents (CO₂e) or over a million metric tons CO₂e;
- with different goals: awareness raising, understanding the climate impact of the company activities, setting a quantifiable emission reduction strategy as well as looking for climate neutrality or climate labelling.

The results may subsequently be used internally or integrated in reporting programs such as CDP, Global Reporting Initiative [9] (GRI) or the Deutscher Nachhaltigkeitskodex (DNK) [10] (German Codex for Sustainability).

Below are presented selected use cases.

Single user

The user-friendly interface allows single users to record in a few clicks the activity data relevant to their greenhouse gas emissions. Once a base year has been chosen, a yearly update of activity data on the defined scheme ensures consistency in the calculation of the resulting GHG emissions. Once exported, these emissions can be integrated and benchmarked in Sustainability Reports such as by the GLS Bank [11].

Comprehensive handling

A huge hurdle in carbon accounting is the amount of data that should be recorded and the resulting manpower mobilized for a purpose outside of the core activity from the company. Registered as a consultant, infas enermetric consulting GmbH (infas) is involved in the steering and plausibility check for the Landschaftsverband Rheinland (LVR). Data of over a hundred locations, mainly schools and hospitals, are gathered individually from the members and reviewed centrally by infas [12]. Trimestrial climate round tables bring climate experts in contact and enable consistency in the gathering of activity data.

The decentralized use of the system has proven to be the most useful feature for this case.

CONCLUSION

KlimAktiv Carbon Calculator for Business is a powerful carbon accounting and reporting system with a wide range of applications, from the first step to understanding climate change issues to generating key indicators for sustainability reporting. Scientifically funded, up to date with international standards, under periodical review, it builds up for SMEs the interface between a praxis-oriented and scientifically sound tool. Feed-back enters into the on-going improvement of the system.

Designed specifically for SMEs it has proved its value among various structures, from microenterprises to multinational companies. First published in German language, its multilingualism allows today its application internationally. It is important to help SMEs facing the actual challenge of climate change and starting their path toward a low-carbon society.

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Pushing the boundaries of corporate responsibility: how to measure and manage business impacts?

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Abstract: Since the economic, financial and social crises that have emerged across the globe, both management scholars and practitioners have developed new conceptions of corporate sustainability that integrate the notion of responsibility for wider societal impacts of business. There is an emerging consensus that business may contribute to social value creation by enhancing positive impacts and reducing negative ones. However, contributions to the discourse on the implications of an impact-oriented understanding of corporate sustainability remain fragmented. Only few integrative frameworks for conceptualising corporate responsibility for impacts exist to date. This article reviews these contributions, attempts a synthesis, and sketches out its implications and challenges for corporate impact measurement and management practice.

INTRODUCTION

Businesses affect billions of people across the world through their products, operations, and value chains. Increasingly, businesses have been recognized as major driver of sustainable socio-economic development [1], [2]. However, accelerated by the global economic, financial and social crises that have emerged since 2007, trust in business' ability to self-regulate and drive positive social change is waning. In 2015, 70% of the public did not trust business leaders to be honest when faced with a difficult situation [3]. Concurrently, governments, market regulators, and stock exchanges have increasingly adopted regulations or listing requirements mandating corporate sustainability disclosures, covering both socio-economic and environmental impacts [4], [5]. This indicates an emerging consensus that business can and ought to contribute to sustainable development by enhancing positive impacts (e.g. on livelihoods, health and education) and reducing negative ones (e.g. resource consumption, pollution, human rights violations) [6]-[8], [1].

The purpose of this article is to present an integrative conceptualization of impact-oriented corporate sustainability. This conceptualization provides a starting point for identifying requirements and remaining challenges for impact-oriented management and measurement systems. As such it is intended to inform business leaders and other stakeholders wishing to consider corporate impacts in a more systematic way.

EXISTING FRAMEWORKS OF CORPORATE IMPACT MANAGEMENT & MEASUREMENT

Global business leaders and international organisations have established impact as a central theme in corporate sustainability accounting and management (cp. [9]-[11]). For instance, in its ISO 26000 standard, the International

Organization for Standardization stressed "the responsibility of an organization for the impacts of its decisions and activities [including products, services and processes] on society and the environment" ([11]: clause 2.18). Concurrently, the UN Global Compact has started encouraging its member companies to monitor and set goals in areas in which they have the most significant impacts [12]. The World Business Council for Sustainable Development recognized a need among practitioners for better guidance on considering corporate impacts and released a guide for measuring socio-economic business impacts [10]. In the same vein, the Global Reporting Initiative (GRI) released the G4 Sustainability Reporting Guidelines that highlight materiality and impacts along supply chains [9].

While business leaders are moving forward on addressing impacts, the contribution of management research has been limited. Schaltegger, Beckmann & Hansen [13] suggest that in light of the rising complexity of comprehensive consideration of corporate impacts, the answer of management research has tended to be specialization. This may explain why the academic contribution to this discourse, is still marginal. Only recently, management scholars have started to move the debate toward a more systemic view on corporate sustainability impacts (e.g. [14], [8], [15]).

Only few and incomplete frameworks for the systematic consideration of corporate responsibility for impacts exist to date. They draw on several sub-fields of management and borrow from other disciplines, such as sustainability science and ecological economics. However, they have remained limited and sometimes controversial [16]-[18], [6]. In the following, we will review key components of these frameworks and integrate their individual contribution into a fuller conceptualisation of management and measurement of corporate impacts.

A. Frameworks for corporate impact management

Porter & Kramer [8] have posited that by focussing on the generation of shared value for shareholders as well as wider societal groups, business may drive both long-term success and positive corporate sustainability impacts. The shared value approach has drawn renewed attention to a fundamental debate on the purpose of the firm, specifically on the question for whom business should create value. This discourse has been significantly shaped by Freeman's stakeholder theory [19]. Both Porter & Kramer and Freeman stress that an orientation toward stakeholder and shared value creation is to be seen as an expansion of the purpose of the firm rather than an alternative to creating shareholder value. The

responsibility of the firm in this view is thus to carefully negotiate relationships with wider stakeholder groups, including shareholders. This view is complemented by Whiteman et al.'s [20] planetary boundaries framework. Whiteman and colleagues argue that corporate sustainability need not only consider impacts on societal groups but in addition “link business processes to macro ecological processes and boundary conditions” (p.2). The authors argue that the overwhelming majority of research and practice in corporate sustainability management has focused on the firm itself or on industries. She identifies looking beyond the boundaries of the firm toward its role in the larger ecological system one of the main challenges for future management research.

This has implications for management, which we understand to include the organisational structures, processes and resource allocation decisions implemented for enhancing positive and mitigating negative impact. An expanded notion of the purpose of the firm in terms of stakeholder/shared value creation warrants the alignment of

a) **Management goals:** for businesses to address impacts and stakeholder concerns beyond the boundaries of the firm management goals will need to reflect objectives at the societal level. This includes short and long-term objectives, as well as risk management objectives to account for unintended impacts [14].

b) **Objects of management:** As impacts occur along the whole value chain, impact management cannot limit itself to managing core business operations, employees and immediate B2B or B2C relationships. Instead, it needs to take account of the whole network of value chain actors [6], [8].

c) **Steering & governance mechanisms:** While traditional command & control governance mechanisms are apt to provide effective steering in hierarchical in-firm settings, the management of impacts will require supplementing the repertoire by collaboration and network-based governance mechanisms that enable companies to effectively deal with value chain actors not under immediate control of the firm [6], [23].

d) **A changed outlook on innovation potentials:** Taking a systemic perspective and consideration for wider societal and environmental impacts may significantly enhance the potential for disruptive innovation [15].

B. Frameworks for corporate impact measurement

Impact measurement relates to the design and operation of information systems supporting impact management. In line with the expansion of notions of corporate impact management, new requirements for corporate impact measurement systems have been proposed as well.

For instance, in a recent article Maas, Schaltegger & Crutzen [16] state a need for integrating corporate sustainability assessment, management accounting, control, and reporting. They note a disconnect between measurement efforts for the purpose of creating transparency and decision-support. For both purposes, corporate measurement systems are seen to be

fragmented and only insufficiently linked to core management functions. Concurrently, Searcy [17] has developed a set of requirements for corporate impact measurement as “an integrated system of indicators and indices that provides information on progress towards defined goals to help manage the local, regional and global economic, environmental and social impacts of a focal firm and its forward and reverse supply chains over the short and long term.” (p.122). His framework explicitly stresses the systemic nature and context specificity of corporate impact measurement and concurs with Maas, Schaltegger & Crutzen [16] in demanding a closer integration of measurement and management systems.

Both frameworks place new requirements on corporate impact measurement. Building on Maas, Schaltegger & Crutzen [16] as well as Searcy [17], we posit that corporate impact measurement systems will need to

- a) take explicit account of system boundaries and an extended sphere of responsibility,
- b) develop new metrics apt to capture multidimensional and systemic effects of corporate activities on society, and
- c) deal with establishing causality along impact pathways,
- d) develop and openly discuss with stakeholders the (e)valuation factors that determine how evaluation results are translated into action.

CONCLUSIONS

Effectively measuring and managing business impacts is no easy task. Socio-ecological effects of business activities materialize along complex pathways of impact. They span global value chains, affect diverse stakeholder groups, and involve trade-offs that can be daunting to deal with.

An impact-oriented approach to corporate sustainability refers to the wider contribution of corporate contributions to sustainable development [21], [13]. This approach takes account of the complexity of system-level interactions between business, society and the biophysical environment in which they are embedded [20]. It expands the corporate sphere of responsibility toward responsibility for impacts realized within the wider economy, society and the environment beyond the boundaries of the firm (cp. [6], [22]). This includes impacts along the whole value chain and the life-cycle of products, be they direct or indirect, positive or negative, intended or unintended [23].

If we accept this comprehensive conceptualisation, corporate sustainability will have to be fundamentally rethought to account for responsibility for impacts. In line with the expression, “if you can measure it, you can manage it” – and its converse – it will not be possible to gauge sustainability results and improve on them without rethinking both management and measurement practices. In future, companies will be held responsible for impacts beyond established performance indicators related to

profits, shareholder value, or market shares. This requires a clear understanding of what responsibility for impacts entails and how it is reflected in management and measurement systems. Managers will need to develop a clear picture of the whole socio-ecological system and its interdependency with the firm. They will have to deal with ambiguities, trade-offs and systemic links. Our conceptualisation provides an integrative view on the most important elements and challenges related to managing and measuring corporate responsibility for impacts.

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Enhancing resource efficiency via environmental management control systems

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Abstract: Although there is a long tradition in analysing management control systems (MCS) in the literature, the link to environmental or sustainability-related issues still remains fragmented and there is a lack of understanding which management controls could be used for enhancing resource efficiency. In this paper, we develop a framework to conceptualize resource efficiency and its interrelation with corporate environmental performance (CEP). Furthermore, we conduct an integrative literature review of empirical studies related to environmental management control systems (EMCS) and CEP and provide a synthesized overview of tested and significant relationships illustrated as maps. Based on the framework of resource efficiency and the empirical findings for environmental management controls (EMC) and CEP, we derive hypotheses about how corporate resource efficiency can be controlled with EMCS.

INTRODUCTION AND RESEARCH GAPS

Increasing resource efficiency is a key to reducing both material costs and environmental impacts at the corporate level [1]. Companies are generally aware of the importance to improve the efficient and sustainable use of natural resources [2], [3]. Yet, there is still an implementation deficit between realizing the necessity of doing resource efficient business and actually implementing resource efficiency measures and an effectively reduced resource consumption. One reason might be the limited management (and employee's) attention [4] to meet all the corporate goals. Here environmental or sustainability management control systems (EMCS or SMCS) can provide the means to integrate resource efficiency into management systems and thereby direct the management's and employees' attention to achieve the goals set. Yet there are no empirical findings about which management controls have to be tackled in order to enhance corporate resource efficiency.

For these reasons, the target of this article is how to control resource efficiency by means of environmental management controls (EMC).

AIMS AND METHOD

The aims of the paper are therefore:

- to develop a conceptual framework of how corporate resource efficiency is related to corporate environmental performance (CEP) and
- to deduce hypotheses about how to control and enhance corporate resource efficiency by means of EMC.

There are no articles about the effects of EMC on

resource efficiency, but we can build on two current review studies for the relationship between EMC and CEP [5], [6]. We take this approach because the measurement of corporate resource efficiency represents particular environmental aspects of CEP [7] and we hope to transfer knowledge from CEP-EMCS research to corporate resource efficiency.

To this end, our contribution is to derive a framework to conceptualize resource efficiency and its interrelation with CEP from existing reviews on corporate resource efficiency [8] and CEP [7] definitions and measures. We further build on two current review papers [5], [6] to identify the relations between the applied EMC and CEP. Based on that we derive hypotheses about how corporate resource efficiency can be controlled with EMCS, which is our second contribution to existing literature.

The preliminary findings from analysing the article of Guenther, Endrikat and Guenther [5]¹⁵ are illustrated in a map depicting significant relationships between specific management controls grouped into cultural controls, planning, cybernetic controls, reward and compensation and administrative controls. Knowing about these interactions may also help to understand the effects of specific EMC on CEP or resource efficiency.

THEORETICAL BACKGROUND

Increased resource scarcity is one of the most critical environmental megatrends [9]. In order to tackle the unbroken trend of increasing material consumption [10] and decreasing stocks of natural resources, resource efficiency initiatives are key to respond to this megatrend [11]-[13]. At the micro respectively the company level, resource efficiency strategies can reduce both material costs and negative environmental impacts [1].

In this context, the term resource efficiency is subject to a broad range of definitions and measures in academic literature, depending on the interpretation of economic and environmental issues [8]. One common understanding for depicting resource efficiency is to calculate the ratio between ecological-oriented items, e.g. the use of resources in physical units, and the economic performance, e.g. economic turnover or service units (e.g. ratio of a received benefit or value to the required use of natural resources; [14]). However, there remain several pathways to define and assess corporate resource efficiency [8].

While various scholars already examined the role of

¹⁵ Until the conference, the results will be complemented by findings from Lueg and Radlach [6].

EMC to improve CEP [15]-[20], the relationship between resource efficiency and CEP still remains unclear. For instance, Porter and van der Linde [21] state that a better environmental performance can be reached by an improved resource efficiency and waste avoidance. According to this understanding, resource efficiency is a precondition of CEP. On the contrary, Lankoski [22] suggests that there might be a possible negative coherence between sustainability performance and resource efficiency, because the former ties up management capacities and requires investments that increase overhead costs which ends up in a negative impact on the productivity.

Apart from the discussion about an explicit definition for resource efficiency and its relation to CEP, the question arises how resource efficiency targets can be managed and implemented into corporate management systems. For this purpose, EMCS are promising to holistically integrate environmental issues into corporate strategies and practices, generate competitive advantages and thereby foster corporate environmental and financial performance [5]. An EMCS is particularly important, if the company shifts from merely measuring environmental or social impacts to managing and controlling environmental issues such as resource efficiency more proactively. For our analysis of the EMC, we refer to the framework of Malmi and Brown [23] who describe management control systems (MCS) as a package and provide a typology for MCS based on the distinction between decision-making and control in order to direct employee behaviour.

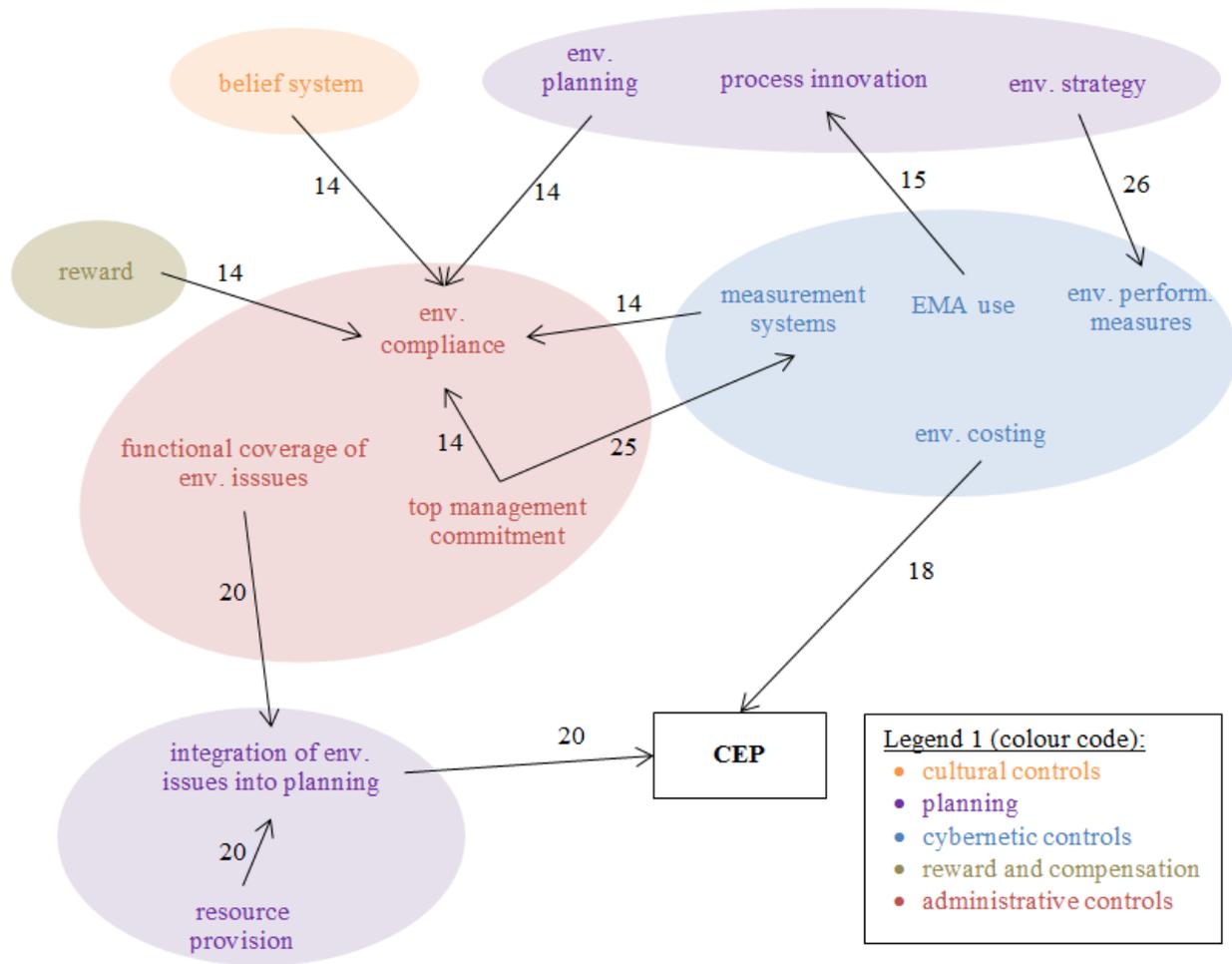
MAIN RESULTS AND DISCUSSION

As the paper is still work in progress, in the following section the intermediate results, based on the integrative literature review of papers including research on environmental management controls and CEP are presented.

Interesting insights can be found by analyzing the relationships between planning and cybernetic controls. It seems that they partly have a strong interaction, as the use of EMA tools forces process innovations [24], and vice versa the formulation of an environmental strategy as prospective planning positively influences the use of environmental performance measures [25]. A weak support was found for the relationship between measurement systems and process innovations, but none with product innovation. It could, however, be interesting to investigate if product innovation has a higher potential than process innovation to increase resource efficiency, especially bearing in mind that national-wide guidelines on resource efficiency recommend to measure the concept of resource efficiency over a life cycle perspective [14]. A further result was that firms that provide sufficient resources and successfully co-ordinate their strategy across relevant functions and departments are better able to integrate environmental issues into the strategic planning process [17] which also supports the natural resource-based perspective advanced by Hart [26]. Apart from the positive impact of a high top management commitment on environmental compliance

[27], Parisi [18] also found a positive relationship between top management commitment and the use of sustainability performance measurement systems which supports the assumption that top management commitment is a key control for various other MCS categories.

Scholars already examined largely relationships between environmental management controls and CEP. Henri and Journeault, Henri et al., Judge and Douglas, Parisi [15]-[18] and Yang and Spencer [20] confirmed a positive relationship between administrative, cybernetic and planning management controls and CEP. Figure 1 provides a compact overview of the first results of the analysed studies, which cover hypotheses and tested relationships including significant, direct and linear causal relationships between EMCS and CEP. One glance shows that CEP is already suggested in literature as a function of different EMC. There has been found proof that CEP is positively related to the integration of environmental issues into planning [17], environmental proactivity (which is itself a function of various interfused management controls like employee involvement or resource commitment and therefore not depicted in the map) [19], and tracking of environmental costs as one main cybernetic control [16].



Legend 1 (colour code):
 ● cultural controls
 ● planning
 ● cybernetic controls
 ● reward and compensation
 ● administrative controls

Legend 2 (studies including hypotheses):
 14. Epstein, M. J., & Wisner, P. S. (2005)
 15. Ferreira, A., Moulang, C., & Hendro, B. (2010)
 16. Frost, G. R., & Wilmschurst, T. D. (2000)
 18. Henri, J.-F., Boiral, O., & Roy, M.-J. (2014)
 20. Judge, W. Q., & Douglas, T. J. (1998)
 25. Parisi, C. (2013)
 26. Perego, P., & Hartmann, F. (2009)
 28. Pondeville, S., Swaen, V., & De Rongé, Y. (2013)
 33. Windolph, S. E., Schaltegger, S., & Herzig, C. (2014)
 34. Wisner, P. S., Epstein, M. J., & Bagozzi, R. P. (2010)
 35. Yang Spencer, S., Adams, C., & Yapa, P. W. (2013)

Figure 1: Direct, significant and positive relationships between EMC and CEP

CONCLUSION AND PERSPECTIVES

This theoretical paper elaborates the role of environmental management control systems (EMCS) to realize corporate resource efficiency strategies beyond mere measurement or input-output analysis. For this purpose, we present our preliminary synthesis of empirical EMCS studies included in two current review studies.¹⁶

The question arises, if these controls are indeed the key controls which should be tackled in order to increase CEP and resource efficiency in companies. In our future work we will therefore hypothesize that a robust measure for the environmental and resource efficiency performance within a company or industry should address the most relevant aspects of the overall EMCS and include operational as well as strategic or management aspects.

As in the existing EMCS studies, CEP is already

measured so differently, we suggest a measure for resource intense companies to control for the corporate environmental performance including the sub-dimension resource efficiency. On this basis, we will derive hypotheses for the relationship of EMCS and resource efficiency which we will test in future research.

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¹⁶ Until the conference, the results will be complemented by findings from Lueg and Radlach [6].

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Corporate Environmental Performance and its Communication in the Health Care Sector – A Case of Greenwashing or true Greening?

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Extended abstract:

Within the last decades, environmental issues became more and more important for organizations. Organizations' response to external and internal pressures manifests in their strategies. On the one hand, efforts have been taken to truly improve corporate environmental management and operational performance. On the other hand, strong pressures encourage corporations to search for alternative options. Some organizations mislead their stakeholders by positively influencing their corporate perception with the help of manipulative communication. This behavior, called greenwashing, poses a threat to a sustainable development of society. In this paper we present the results of a mixed method approach evaluating EMAS certified hospitals environmental statements and websites, and conducting interviews with environmental managers. We do so in order to identify drivers for greening and greenwashing in the highly neglected setting of hospitals.

INTRODUCTION

The motivations for ecological responsiveness are legitimacy, ecological responsibility, and competitiveness [1]. More and more firms accept this responsibility and take extensive measures to perform more environmentally friendly. For sure, besides ecological responsibility more strict environmental regulation and consumer pressure results in legitimation efforts and contributes to this development as well [2], [3]. At the same time, the green trend is also encouraging firms to develop new green market opportunities in order to gain competitive advantages and increase their benefits [4]-[6]. That profit-seeking behavior cannot be criticized as it is what business is about. However, there are some companies that behave badly and deliberately mislead their customers to gain these benefits (see [7] for various examples across all industries or [8] regarding environmental policy statements). Firms applying marketing instruments to present themselves and their activities greener than they are to gain advantages are "greenwashing". They built a corporate image that is mainly used for strategic communication, exaggerates their real environmental performance and is more symbolic than substantial in its nature [9]. Therefore, the way they are analyzing and presenting information about their performance is insincere and morally questionable. For stakeholders, such as consumers or investors, it is difficult to evaluate the truth of corporate green promises that are published via various media such as websites, sustainability reports or public statements.

GREENWASHING AND THE MISSED BENEFITS OF GREENING

The dissemination of environmental products and services is reliant on its attributed credibility. Credence is

a characteristic that can't be observed directly thus requiring trust in the producer [10]. A loss in credibility can lead to market inefficiencies and even to a breakdown for environmentally friendly products and services [11], [12] as stakeholders easily transfer greenwashing activities of single organizations to all other green products, services and companies in the market. Greenwashing reduces consumers trust directly as well as indirectly via reduced consumer confusion and perceived risk [6]. Given the urgency of measures to preserve the natural environment, greenwashing of some single companies poses a serious threat to market survival of all other environmentally pioneering and responsible companies.

However, the publication of very detailed information on corporate greening measures doesn't always mean a company is greenwashing. It is necessary to differentiate greenwashing from "green-highlighting". Whereas greenwashing companies only built a green corporate public image without performing green, green-highlighting firms combine symbolic with real substantive actions [9]. Reporting too many measures, green companies are under latent suspicion of greenwashing even if they are responsible and real good corporate citizens. Due to this predominant credibility problems, their actual environmental efforts and investments might not be appropriately assessed by their stakeholders and rewarded. Companies might even decrease their reporting in order to reduce suspicion risk [13], [14]. All in all, the uncertain perception of corporate green communication by external stakeholders (e.g. customers and the public) might discourage other organizations to follow the green trend. For society, this means a welfare loss.

Furthermore, greenwashing can have a boomerang effect and damage the corporation itself. Even if companies consider greenwashing as more flexible [15], time-saving [14], and less costly [10] in comparison to active environmental measures, greenwashing prevents them from gaining actual benefits from environmental activities. Environmental management can have a positive influence on financial performance for example via increasing revenues through better access to markets or via reduced costs for material or energy [16]. Scientific literature show evidence that it pays to be green and sustainable (for example [16]-[21]). Besides this missed benefits, greenwashing also has negative consequences for corporations, e.g. on financial performance [9].

PREVENTING GREENWASHING AND SUPPORTING TRUE GREENING

Considering the negative long-term consequences of greenwashing for society and the corporation itself, measures against it should be taken. Politics can use

legislative instruments to prevent organizations from greenwashing, i.e. for example restrict marketing with vague or incorrect promises. Nevertheless, the mere presence of laws alone proved to be not sufficient to ensure the desired corporate behavior [10]. Enforcement is necessary. In the US, Canada and Australia, prosecution is rarely exerted and focuses mainly on consumer and competition laws, thus, neglecting other facets of greenwashing [14], [10]. The failure of governments to present and pursue a clear regulatory framework facilitates bad corporate citizenship. Markham et al. [10] recommend governments to rely on partnerships, standards, and scales and to focus on information evaluation according to this. In this way, organizational behavior becomes transparent, stakeholder can compare corporations more easily and are less misled [14]. Governments should cooperate with independent stakeholders to set these standards [10]. Regarding environmental issues, some standards have been set for corporations. The most comprehensive environmental standards are ISO 14001 and the European Eco Management and Audit Scheme as they certify resp. validate corporations' environmental management systems. These two standards are not obligatory and corporations voluntary decide for implementation. Both standards require organizations to formulate an environmental policy, to set objectives, implement environmental structures and processes and to monitor their effectiveness. One major difference is the degree of obligation to disclose corporate environmental performance. While reporting according to ISO is voluntary, EMAS obliges participating companies to publish an environmental statement. With the help of this statement, corporate behavior and also its continuous improvements become more transparent and might get judged more easily by stakeholders. As Markham et al. [10] and Vos [7] propose, publicly available information, e.g. via verifiable reporting, should reduce greenwashing potential. Environmental statements published by EMAS certified corporations represent such a verifiable reporting. We test its effectiveness in this study.

METHOD

The pressures and drivers for greening are well understood and calls for industry-specific research arise (for example [22]). We expect hospitals to represent a new interesting context for service research (see also [23]) that - so far - receives comparably low pressures regarding environmental issues, even if their own bad corporate environmental performance might cause impacts on human health. Despite their mission to cure humans and prevent diseases a research gap regarding hospitals' environmental performance exists [24].

In this paper we apply a data triangulation collecting archival data in terms of information presented in environmental statements and websites and hand-collected interview data. In a first step, we evaluate hospitals environmental performance, i.e. both management and operational performance according to Trumpp et al. [25], with content-analysis of their published environmental statements. Heras-Saizarbitoria et al. [26] suspect industries with low environmental pressure to adopt EMAS superficially and to be driven by

image and social legitimacy concerns. Furthermore, an emphasis of symbolic compared to substantial actions can be a sign of greenwashing [9]. Therefore, we analyse hospitals environmental statements against this background. In a second step, to further evaluate and validate hospitals' communication strategies, we conduct interviews with environmental managers asking for hospitals greening motivation and perceived pressures. In a third step we evaluate information derived from hospital website. We synthesize these findings.

DATA

We base our analysis on case studies of all 26 German hospitals as registered in the EMAS-Register. We collected and evaluated all environmental statements. We contacted the registered hospitals and responsible environmental managers in order to ask for interviews and expect them to be interested to report on their greening efforts. We conduct the interviews with the help of a semi-standardised questionnaire. As websites can change rapidly, we saved hospitals homepages for further evaluation and coding.

CONCLUSION

Based on a sample of German EMAS validated hospitals, we present drivers for greening in a non-manufacturing setting. Thus, this study contributes to a better understanding of antecedents for a comprehensive greening activity in a low-environmental pressure setting (i.e. drivers for EMAS validation in hospitals). We add insights in EMAS certification as it has not gained much attention in literature so far [27]-[30]. Furthermore, we analyse hospitals environmental performance and present different corporate environmental performance communication approaches, i.e. we differentiate greenwashing and green-highlighting procedures.

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Supply Chain Practices at the Base of the Pyramid

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Keywords: Supply chain integration, emerging economies, base of the pyramid, quantitative, survey.

INTRODUCTION

While research on base-of-the-pyramid (BoP) issues has received increasing attention in recent years, the link to supply chain management and the inclusion of the poor into value creation process is still in its infancy. Previous work has pointed out, that particularly setting up the right supply network structure and joint supply chain partner development play a decisive role in such projects [1]. The study addresses the research question: What are antecedents and supply chain practices in base of the pyramid supply chains?

METHODOLOGY

Information was gathered through a quantitative survey of sixty small and medium enterprises in Pakistan. This was based on a conceptual model operationalizing the management of (sustainable) supply chains in emerging economies. Most constructs are taken up from established research on (sustainable) supply chain management. The constructs and their interrelations are evaluated applying structural equation modelling. Data analysis was carried out using Smart PLS (version 3).

RESULTS AND LIMITATIONS

All antecedents integrated into the model show significant impact on the supply chain processes: strategic purchasing, top management support, active communication and coordination and stakeholder management. Joint/supply chain partner development along with supply network structure are used to characterize supply chain processes, which enable respective firm performance and innovation.

One of the limitations is the sample size, which is based on sixty questionnaires only. Yet, this is still one of the first examples of a survey conducted in such a BoP business environment. However, the study provides a starting point for future researchers to explore this research avenue further.

With earlier empirical works in base of the pyramid being mainly focusing on business-to-customers linkages this paper while aiming at business-to-business interactions in emerging economies will enrich the respective scientific literature

DISCUSSION

The study is one of the first large(r) scale empirical studies at the intersection of BoP and SCM. The contribution of the paper is evaluating constructs from sustainable supply chain management in a BoP environment. The paper signifies interrelations among

(sustainable) supply chain antecedents, processes and outcomes in emerging economies. Results of the study being based on the empirical evidence provide the reader with first-hand knowledge of working of supply chains in informal market environments. Strategic purchasing stands out as the single important antecedent having an impact on both of the supply chain processes indicated in the model presented. However significance of rest of the antecedents i.e. communication and coordination, top management support and stakeholder management cannot be overlooked. At supply chain process level both the joint/supply chain partner development initiatives and supply network structure, appeared to have significant positive impact on the supply chain outcomes. Results of the study further suggest that the sustainable firm performance and innovation capabilities taken as the ultimate outcomes of the (sustainable) supply chains in base of the pyramid have a complementary relationship with each other.

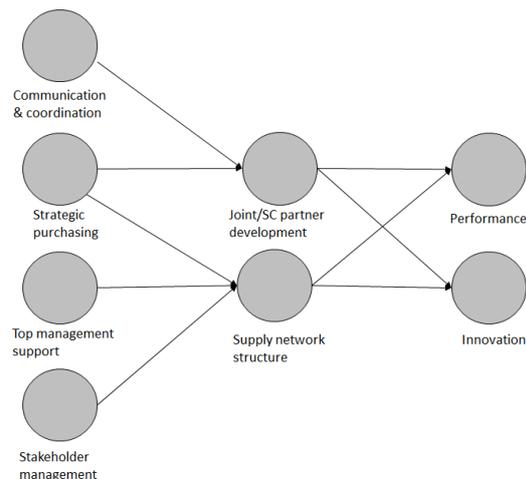


FIGURE 1: (SUSTAINABLE) SUPPLY CHAIN MANAGEMENT IN BASE OF THE PYRAMID (CONFIRMED HYPOTHESIS).

CONCLUSION

The paper evaluates SCM constructs in a BoP environment. It offers a first set of antecedents and supply chain processes which are required for developing related BoP projects in a successful manner.

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Measuring positive sustainability - A systematic literature review.

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Extended abstract: To pursue sustainable development, and measure progress towards it, companies aim to assess their sustainability contribution. So far, companies seem to have focused their sustainability assessment, valuation and performance measurement efforts on the reduction of negative sustainability impacts such as carbon emissions rather than focusing on a positive impact. By conducting a systematic literature review, we explore how current sustainability assessment, valuation and measurement approaches capture positive sustainability efforts. While positive sustainability effects seem to matter in most methods, the majority actually focuses on the reduction of negative impacts.

INTRODUCTION

Ness et al. (2007) describe that on the path to sustainability, goals need to be defined and progress be assessed. Often, sustainability impacts are measured in terms of “unsustainability”, e.g. harm done, or in terms of sustainability impacts reduced, e.g. less resources used or energy saved. While this approach is without doubt constructive and worthwhile, this paper argues that in order to measure the progress towards sustainability, we have to understand both measures of unsustainability and sustainability. This argument is underlined by the need to understand to what extent and why current actions are “unsustainable” [11:190]. Gibson (2012) identified a negative cycle towards unsustainability and identified sustainability performance management and assessment as a “vehicle” [2:13] to support the turn to sustainability.

Several authors highlight the need to measure sustainability in terms of positive contributions to sustainable development (e.g. Müller & Pflieger 2014; Lacy & Hayward 2013; Schaltegger & Burritt 2005). Hacking and Guthrie (2008) emphasise that the objective of sustainability performance management and assessment is increasingly moving from capturing the reduction of negative impacts to increasing the positive. In order to gain a better understanding of this pursuit of sustainability performance management and assessment, this paper uses a systematic literature review approach to better understand the underlying philosophies and aims of current methods to manage, measure and assess (un-)sustainability and to conceptualise the developments. Apart from providing an overview of measurement directions (i.e. negative and positive impacts measured) the paper aims to answer the research question “What sustainability performance management and assessment methods capturing positive sustainability in comparison to unsustainability have been proposed in literature?”.

METHODOLOGY

The systematic literature review follows the steps as outlined by Tranfield et al. (2003), divided into three stages; planning, conduction as well as reporting and

dissemination. Their approach has been applied by various authors [10], [1], [15], [4] in the field of sustainability accounting and management tools. To answer the research question, the academic literature on sustainability performance management and assessment is systematically reviewed and synthesized with regard to its ability to capture positive sustainability and unsustainability. The approach consists of five methodological stages, including (1) identification of research, (2) selection of studies, (3) study quality assessment, (4) data extraction and monitoring, and (5) data synthesis and reporting [12].

FINDINGS

Based on the filtering process in the literature review, different sustainability assessment, performance measurement and valuation methods have been uncovered. The methods are analysed towards their ability to capture positive and negative sustainability. The findings indicate that the measurement of positive sustainability performance has so far been discussed and mentioned in the literature; emphasis is however given to unsustainability in performance measurement, assessment and valuation. Most of the identified methods seem to have a limited ability to capture positive sustainability impacts. Even in integrated approaches, the focus is set on the reduction of negative outcome as this usually seems to be simpler and more objectively measured.

DISCUSSION

With the need and the intention of sustainability methods to capture positive sustainability contributions [3], the approaches to assess positive sustainability are analysed and synthesised. Positive sustainability has so far not been the focus of the existing literature. Rather, the potential of existing methods for measuring positive sustainability seems to be unexplored.

CONCLUSION

The systematic literature review reveals that the assessment, valuation and measurement of positive sustainability remains limited. Therefore, future research should explore how existing methods can capture positive sustainability or new approaches should be developed to measure these. This can support policy and practice substantially when pursuing decision-making aiming at sustainable development.

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Silva, S. L.; Beske-Janssen, P.*; Schaltegger, S.

Social and ethical aspects in sustainability performance measurement and assessment.

A systematic literature review.

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Extended abstract (submission as “work in progress”)

INTRODUCTION

Sustainability accounting aims to holistically consider issues of all three dimensions of sustainability, i.e. environmental, social and economic goals. However, in order to simplify assessment, measurement and accounting approaches often disintegrate different perspectives. For example, approaches such as life cycle assessment “LCA” [8], [6] or environmental management systems [4] have for decades focused on measuring environmental aspects. More recently social life cycle assessment focuses on social aspects [9], [3], however, again just taking one sustainability perspective into account. Economic and financial aspects are mainly covered by companies’ conventional financial and management accounting. For the last couple of years, some economic aspects have been picked up by life cycle thinking in the form of life cycle costing [5]. When assessing and measuring the level of (un)sustainability or impacts of a company towards sustainable development, the focus is often on environmental aspects, applying comparably easy and quantitatively measurable indicators such as greenhouse gas emissions and by applying tools such as in (environmental) LCA. Often these approaches are linked to quantitative financial measures in an add-on module or account, such as linking reduced CO₂ emissions with cost savings. While this route has without doubt increased the awareness of managers about external corporate environmental impacts and related economic consequences, this paper argues that in order to measure the progress towards sustainability, we have to better understand the social aspects of corporate sustainability and to follow an integrated sustainability approach, which includes social aspects more explicitly. Furthermore, we assume that social aspects in corporate sustainability have so far gained limited attention in terms of measurement and

assessment but that companies have instead chosen a narrative qualitative approach to report on their social issues (e.g. description of philanthropic activities in annual, integrated or sustainability reports). The consequence of the difficulty to combine qualitative information of social narratives with quantitative financial and environmental figures has resulted in separating and neglecting social sustainability issues in corporate sustainability management.

In order to gain a better understanding of the pursuit of social aspects in sustainability performance management and assessment, this paper uses a systematic literature review to better understand current methods to assess, measure and manage social aspects of sustainability. The paper aims to answer the research question: “What approaches to assess, measure and manage social aspects in sustainability performance have been proposed in the extant academic literature?”

METHODOLOGY

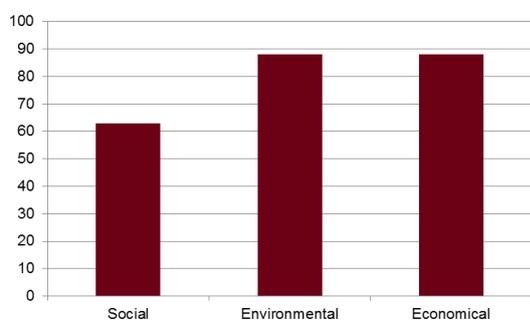
The systematic literature review is conducted according to the process proposed by Tranfield et al. (2003) which distinguishes three steps; planning, employment, as well as reporting and dissemination. Numerous authors (e.g. Johnson & Schaltegger 2015; Beske-Janssen et al. 2015) have applied this process in analysing the existing of corporate sustainability literature. In order to answer the research question, the academic body of literature on sustainability performance management and assessment is systematically reviewed and synthesized with regard to how social aspects of sustainability are captured. The approach of consists of five methodological stages, including (1) definition of research, (2) variety of studies, (3) study excellence assessment, (4) data mining and observing, and (5) data synthesis and writing [10].

The 7413 initially identified papers were narrowed down by publication type (2677 publications not in international management

journals), focus of the research area and discipline (3256 not in the management discipline), language (70 not in English), exclusion of duplicates (346) and review of title (596) and abstract (184), leaving 284 articles for in-depth review and analysis. Overall, the literature review aims to assess different points of view on social assessment and measurement, and to gain a better understanding of what these approaches can support and where they fall short.

FINDINGS

In general, we found that one of our expectations has been confirmed and the majority of proposed performance and assessment systems have a distinct focus on environmental or environmental and economic performance. Even when the approach



was presented to be integrated, a tendency exists to focus on one of the categories, mostly environmental aspects with the argument of quantitative data availability.

Figure 9: Percentage of identified performance approaches and addressed dimensions focusing on sustainability (preliminary)

Overall, we found two main categories covering social and ethical issues. One category of performance measurement and assessment methods solely focuses on social and ethical aspects, such as social life-cycle assessments. The second category is more integrated. Here, social and ethical aspects are an essential part of an integrated sustainability performance measurement and assessment approach. Environmental and economical aspects, however, are the most addressed perspectives in comparison to social and ethical aspects in sustainability performance measurement, assessment and valuation.

Furthermore, we found that social and ethical aspects cover a diverse field of issues including social welfare, philanthropy, labour standards, social responsibility towards society and even wider such as human needs and environment. Even among integrated assessment methods the majority of articles chose to neglect social aspects (though claiming that they are relevant) based on the lack of availability of data.

DISCUSSION

With the increasing need to develop and apply management systems, which integrate all aspects of sustainability to support informed decisions by managers and stakeholders, the integration of social and ethical aspects is still in its infancy. The literature review reveals a huge gap and the need to develop approaches, which integrate social and ethical with ecological and economic measurement approaches. One approach would be to further develop single focused social and ethical assessment (e.g. social life cycle assessments) and then to afterwards integrate the results into environmental and economic management accounting and control systems. Such an additive, stepwise approach has the advantage of providing information for each perspective and to make the integration transparent. However, it has the disadvantage of add-on thinking instead of integrative thinking and that one or the other perspective may be neglected.

A second finding of this literature review is that the focus of measurement approaches focusing on social aspects, such as health and safety, is predominantly characterised by a negative logic, e.g. number of work place incidents or sick leave. In some few cases more neutral measures are used, such as the percentage of women in top management positions. Attempts to capture and measure positive social contributions seem to remain in their infancy and mostly centred on add-on philanthropic activities.

CONCLUSION

The research on sustainability assessment and measurement has increased substantially for the last couple of years. While the integration of social aspects into integrated sustainability performance measurement is gaining attention, most of the literature is still focused on one sustainability perspective, either being ecological or economic issues, or the partial integration of environmental and economic aspects.

If social aspect should be considered on an equal level with environmental and economic issues in management and external accounting and reporting, then companies and researchers are challenged to experiment with new approaches to measure social aspects in quantitative terms, too, including reputational activities rather than sticking to narratives only. On a policy level, guidelines considering social aspects are on the rise. While selected standards such as SA8000:2014 (Social Accountability International 2015) address social issues, environmental standards such as EMAS [4]

and LCA in ISO 14040 / 14044 [5] seem to be far more advanced. The use of guidelines could be supported by public policy and research is challenged to develop and propose new, innovative methods on how to assess social aspects with quantitative figures, which appeal to accountants and managers to be integrated with financial and environmental measures.

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Speck, M.¹; Rohn, H.²; Engelmann, T.²; Teitscheid, P.³; Langen, N.⁴

Indicator-based assessment for meals

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INTRODUCTION

In the EU, the food sector accounts for 17% of greenhouse gas emissions and 28% of total material resource use. Thus, nutrition is responsible for a significant share of the societal resource consumption and causes considerable material footprints. To make the global resource use sustainable, it is crucial to define valid indicators to measure a sustainability performance and link them towards sustainable levels to examine a goal. In parallel, modern life's rhythms are leading people to eat out of home more often, in cafeterias, canteens, fast foods, bars and restaurants. The ongoing project *NAHGast* addresses those issues by assessing the sustainability of out of home catering. It furthermore promotes the concept of a resource-light economy through the development and testing of instruments for sustainable product innovations, which should be integrated in hospitality settings. The current paper presents indicators and introduces a short discussion on the sustainability accounting of meals.

METHODS

Within the *NAHGast* project, a triangulation of mixed methods, consisting of four steps, is applied: 1) Extensive desk research and indicator sets allocation; 2) Expert workshops to evaluate the desk research; 3) Assessment and allocation of levels for a sustainable nutrition (July – Nov. 2015); 4) Definition of the indicators set together with companies from the out of home catering industry (Jan. 2016). The study lasts 13 months (April, 2015 – May, 2016). Therefrom, first results of the evaluation process are presented within this paper very briefly.

RESULTS

Many nationally and internationally used indicators exist, such as Footprint indicators, caloric intake per meal, or regarding labour conditions and health protection at the workplace, e.g. from EU dashboard indicators to further concepts or those outlined by institution such as SERI. Several indicator sets, designed for the out-of-home catering, are available, such as the MNI concept, the SusDish concept or the Nutritional Footprint [1]-[3]. Within a qualitative comparison and with regard to the environmental performance, a convergence towards the "four footprints" of materials, land, water and GHG emissions emerges.

But it becomes also clear, that a great room for improvement in the out-of-home catering may emerge due to the fact, that a comprehensive definition of sustainable levels to assess environmental and social sustainability levels in the food sector is missing [3]. Thus, the project has formed two new indicator sets and

had also tried to link sustainable levels (maximum level per meal) with every chosen indicator (see Table 1). Finally, three indicator sets were formed, which will be presented within the conference talk in detail.

TABLE 1: SELECTED INDICATORS AND SUSTAINABLE LEVELS [4]

Dimension	Indicator	Definition of a moderate Sustainable Level per meal (Target area: reduction of 20%)
Environment	Carbon Footprint	800 (- 640) in kg/kg
Environment	Material Footprint	2670 (- 2136) in kg/kg
Environment	Water Withdrawal	640 (- 600) in kg/kg
Environment	Land Use	1,25 (- 1) in m ² *a/kg
Health	Energy intake	670 (- 600) kcal
Health	Salt intake	< 2 g/day
Health	Fibre content	8 (- 9) g
Health	Proportion of fruits and vegetables	> 217 g
Oeconomical	Popularity	>75%

CONCLUSION

The field of out-of-home nutrition represents an untapped and currently even not systematically analysed potential for tackling issues affecting health, environment and the social dimension.

Summing up the evaluation process, we propose different assessment sets – *NAHGast* Company, *NAHGast* Basis and *NAHGast* Profi. As businesses are very different from each other, we want to offer different difficulty and complexity levels: the smaller and less equipped a catering company, the less time and effort an indicator set should require to be used. The upcoming case studies in Summer 2016 will show how those theoretical-based assessments relate to the daily business in the out-of-home catering sector.

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Suutari, M.

Different materiality for different contexts: exploring sustainability related reporting trade-offs

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Extended abstract: The concept of materiality has raised different issues according to different frameworks, which in turn may have effects on overall insight and incentive frameworks. The necessary materiality assessments can be realized with varied established methodologies. A reporter may also use different boundaries for different aspects (e.g. Global Reporting Initiative GRI G4). A concern is that reporters screen out materiality issues differently and transparency and comparability may weaken. The study examines interconnectedness presented in the financial and

sustainability reporting by taking a closer look for environmental items reporting. The aim is also to study how case cooperatives see the evolving sustainability related reporting trade-offs in their everyday operational context. The study exploits both longitudinal archival data using comparative content analysis from GRI-reporting enterprises and 'The world's most sustainable cooperatives ranking' (ICA 2013) and presents findings from the semi-structured interviews.

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Sustainability assessment of products with global value chains

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Extended abstract: The global value chains of many modern products lead to specific requirements in sustainability assessment. This paper analyzes how these requirements can be addressed within commonly-used assessment methods in order to derive avenues for advancing these methods.

INTRODUCTION

Due to increasing customer expectations and stricter legislation, companies are paying more attention to the sustainability of their products. To be considered as completely sustainable, a product should fulfill diverse criteria: It uses only as much material as necessary, is produced using a minimum amount of energy and water, is safe to use and consumes as little energy as possible, is durable, can easily be repaired, and is fully recyclable. The materials used are not critical to biodiversity or come from a questionable origin, the energy is generated from renewable resources and the water originates from uncritical regions. Furthermore, working conditions are safe at all stages of the value chain and a fair wage is paid to the workers [1].

However, many modern products like electronic devices, clothing, or cars do not fulfill all of these criteria. They are rather associated with various negative impacts related to their life cycle. These impacts include the depletion of raw materials, environmental pollution, emission of greenhouse gases, unsafe work conditions, child labor, and many more. Due to differences in these impacts, some products can be considered as more sustainable than others. This comparison is not a trivial task but requires a careful analysis of the product's life cycle with regard to various impact categories. The task becomes even more intricate if the product's value chain extends over multiple countries and not only global sustainability considerations but also regional aspects matter.

The objective of this paper is to analyze the challenges in product sustainability assessment that arise from global value chains and to identify approaches how these issues can be addressed in available assessment methods. This analysis contributes to the field of product sustainability assessment by identifying shortcomings of existing methods when applied to products with global value chains as a basis for advancing these methods.

CHALLENGES RELATED TO PRODUCTS WITH GLOBAL VALUE CHAINS

Four main challenges regarding products with global value chains can be identified:

(1) *The same product may have alternative value chains, leading to different impacts.* For example, the total energy consumption and greenhouse gas emissions related to lithium manganese dioxide production (a

material needed for traction batteries in electric cars) depend on the specific value chain due to different extraction efforts and transportation impacts [2].

(2) *The relevance of certain impacts differs, depending on the location where they occur.* For example, the same amount of water appropriated into a product life cycle from one source (e.g. a desert region where little water is available) may have substantially different environmental and social consequences compared to water from another source (e.g. a mountain region with abundant freshwater).

(3) *The assessment results are affected by local reference values used in normalization procedures.* For example, an hourly wage of \$5 paid to workers may be considered as fair and sustainable in some countries but not in others, depending on the local average wage. Therefore, it's problematic to use just one global reference value.

(4) *An aggregated assessment perspective disguises trade-offs between global benefits and local disadvantages.* For example, the employment of electric powertrains in cars using lithium-ion batteries may seem beneficial from a global perspective (overall reduction of greenhouse gas emissions), but lead to local impacts (depletion of raw materials and pollution) that are immediate and outweigh the global benefits.

Based on these challenges, requirements for product sustainability assessment can be formulated (Table 1). The specific requirements resulting from global value chains must be seen in addition to the general requirements for product sustainability assessment.

TABLE 1: REQUIREMENTS FOR PRODUCT SUSTAINABILITY ASSESSMENT

General requirements	Specific requirements due to global value chains
Consideration of all three sustainability dimensions	Consideration of the specific value chain of the product
Consideration of different stages in the product life cycle	Consideration of local specifics in impact assessment
Quantification of impacts with suitable indicators	Differentiation between global and local sustainability issues

STATE-OF-THE-ART IN PRODUCT SUSTAINABILITY ASSESSMENT

Over the past decades, various methods to assess product sustainability have been developed. These methods differ in focus, scope, and data requirements. Modern assessment methods are typically built around two central ideas: life-cycle thinking and the triple bottom line concept. The concept of life-cycle thinking emphasizes the consideration of the product life cycle "from cradle to grave", ensuring that all states of the life cycle are included in the assessment and preventing from

shifting burdens from one stage to another [3]. The triple bottom line concept refers to the three pillars of sustainability, stating that environmental, economic, and social aspects have to be addressed when assessing sustainability [4]. Both of these concepts have been integrated into the framework of *Life Cycle Sustainability Assessment (LCSA)*. LCSA is an “evaluation of all environmental, social and economic negative impacts and benefits in decision-making processes towards more sustainable products throughout their life-cycle” [5].

In contrast to the LCSA framework, in which the three sustainability dimensions are addressed more or less separately, other methods combine individual results to more aggregate indicators. Examples are the *Socio-Eco-Efficiency Analysis (SEEBalance)* by BASF [6] and the *ProfitS* model which is part of the *Product Sustainability Assessment (PROSA)* toolbox [7]. The basic idea behind these concepts is to normalize and aggregate the ecological and social impacts of a product and to relate them to its life cycle costs.

The capabilities of the above methods can be illustrated on the basis of exemplary cases in which LCSA and SEEBalance have been applied. The LCSA framework has been used by *Capitano et al. (2011)* to evaluate and compare Sicilian marble products from different production processes [8] and by *Onat et al. (2014)* to analyze the full life cycle of alternatively-powered passenger vehicles [9]. A sustainability assessment based on SEEBalance has been conducted by *Shiau and Chuang (2012)* to investigate the impacts of gravel transport in Taiwan [10]. These case studies reveal that there is not one single way to assess product sustainability. In fact, the available methods allow for much flexibility in their application. While the studies by *Capitano et al.* and by *Shiau and Chuang* address only certain stages of the product life cycle, the study by *Onat et al.* is based on a “cradle-to-grave” analysis. All studies address the triple bottom line of sustainability. However, the indicators used to represent each of the sustainability dimensions differ between the studies, especially with regard to the economic and social indicators. Furthermore, different impact assessment methods are used.

The specific requirements for products with global value chains are addressed only partially in the above studies. Specific value chains are considered when only few phases of the product life cycle are in the scope of the analysis. With a broader scope, the value chains are modeled with less detail. Local specifics in impact assessment are only considered to some extent, for example region-specific minimum wages. Other impacts, such as water withdrawal, are not reported with regard to local water availability, though. Finally, none of the studies analyzes the geographic distribution of sustainability impacts, partly due to their limited scope and partly because the models do not allow for such level of detail.

CONCLUSIONS AND OUTLOOK

The sustainability assessment of products with global value chains brings specific requirements, which have

been addressed only partially in existing studies. As a consequence, incomplete or distorted information may be available to decision makers, increasing the chance of decisions that do not result in true improvements in product sustainability but rather shift burdens to other stages in the product’s life cycle or to other regions in the product’s value chain.

Potential approaches to address these issue include the use of multi-criteria decision making methods to evaluate a set of diverse indicators representing the triple bottom line of sustainability, the use of monetary valuation methods to transform environmental and social impacts of products to a common monetary scale that facilitates interpretation and comparison, and the use of efficiency measurement methods to support the assessment of a products eco-efficiency and socio-efficiency.

Further research should focus on the systematic analysis of these approaches in order to identify their benefits and limitations. From this, a method that addresses the previously defined requirements shall be derived.

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Integrated Reporting & Sustainability: Perceptions of the Accounting Profession

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ABSTRACT

This study investigates Integrated Reporting (IR) in Australia, as a developed country and leader in this area, and compares it with Hong Kong as an Asian and lesser developed, country but which has a developed capital market. The study compares the perceptions of IR readiness and acceptance in Australia and in Hong Kong through interviewing accounting professional associations and firms regarding their awareness of, and attitudes towards, IR. In particular, the study considers the perceptions of interviewees about the relationship between IR and Sustainability Reporting. The study is among the first to investigate perceptions of IR and has significance for policy makers and standard setters as findings suggest the profession is taking a narrow, and explicitly financial, interpretation of the IIRC framework.

INTRODUCTION

While social and environmental reporting (or Triple Bottom Line Reporting) has been investigated for some years, Integrated Reporting (IR) is a new term [17] being used to promote reporting in a wider context than simply financial, in order to report on all aspects of a firm's operations which add value. Professional accounting bodies and 'Big 4' accounting firms are actively involved in the development and study of IR.

The adoption of Social and Environmental reporting has been predominantly in Europe, the UK, the US and Australia/NZ, [4] with only recent research considering reporting in developing countries [13]. Only a small amount of research has considered it in Asia (although there has been a recent trend of considering environmental issues in China – see, for example [14]. IR is being promoted globally, but its emphasis on 'value creation' (firm based) rather than on 'sustainability' (society based) means that it is likely to be adopted more readily in developed countries, or countries where the financial markets are more sophisticated [15], [16], [13].

This study investigates IR in Australia, as a developed country and leader in this area, and Hong Kong as an Asian and lesser developed, country but which has a developed capital market. The study aims to compare the perceptions of IR in Australia and in Hong Kong.

BACKGROUND

At the heart of Integrated Reporting is the growing realization that a wide range of factors determine the value of an organization – some of these are financial or tangible in nature and are easy to account for in financial statements (e.g. property, cash), while many are not (e.g. people, natural resources, intellectual capital, market and regulatory context, competition, energy security) [10]. Integrated Reporting demonstrates the broad and longer-term outcomes of the decisions organizations make, based on a wide range of factors, in order to generate value over time. It helps an organization to communicate in a clear, articulate way how it is reporting on all the resources and relationships it utilizes to create value in the short, medium and long term, helping investors to manage risks and allocate resources most efficiently.

Capital, in the IR context, includes Financial, Manufactured, Intellectual, Human, Social and relationship, and Natural capital. Thus, the overlap with traditional Triple Bottom Line (TBL) [16] and Sustainability reporting is clear, but little has been done to date to investigate the relationship [5], [Jensen and Berg 2012], [14]. The International Integrated Reporting Council's (IIRC) long-term vision is 'a world in which *integrated thinking* is implanted within mainstream business practice in the public and private sectors, enhanced by Integrated Reporting (IR) as the corporate reporting norm' ([10], emphasis added).

CRITICISM OF REPORTING

While research indicates a growing incidence of social and environmental and sustainability reporting world-wide, increasingly critiques of such reports have indicated that the growth in quantity of non-financial reporting does not correlate with high standards of quality in the information provided to stakeholders. A substantial literature has developed emphasizing the inadequacies of most existing non-financial reporting and suggesting that such reporting has largely failed in its purpose of providing useful information to stakeholders that would drive improved corporate social and environmental behaviour (See for example, Barone, Ranamagar and Solomon, 2013; Milne, Tregidga, and Walton, 2009; Wild, 2008; Cooper and Owen, 2007; Gray and Milne, 2002; Bebbington and Gray, 2001). Most voluntary and non- assured, and lacks internationally imposed common guidelines or mandatory standards [11]. In the context of a lack of regulation, there is strong motivation for firms to utilize such reporting for legitimizing strategies and reputation management (See for example, [1], [12] [8]).

Integrated Reporting was seen as having potential to overcome these deficiencies, but recent criticisms of IR suggest this is unlikely to be the case as the sustainability aspect of IR has been diluted [7]. Wild and van Staden (2013) note that the majority of the companies in the IIRC pilot programme database operate in the Financial Services industry and therefore it is not dominated by industries with high social and environmental impacts. They also noted that the large accounting firms appear to have a significant influence over the auditing and assurance of the integrated reports [19].

METHOD

The person in charge of IR for three major professional accounting bodies operating in Australia and Hong Kong were interviewed along with the IR managers of three 'Big 4' accounting firms (names are not identified for confidentiality reasons). Semi-structured interviews were used to ensure comparability but also allow participants to express their views and attitudes towards IR freely.

FINDINGS AND CONCLUSION

In Australia, the interviewees from both professional body and the Big 4 accounting firm strongly supported the introduction of IR and championed its use. They clearly consider, however, IR and Sustainability/Social and Environmental reporting to be distinct things. They affirmed their perception of IR as being about financial viability, and stakeholders of IR being financial stakeholders, or investors, one big 4 respondent noting that "The primary audience of an integrated report under the IRC framework is financial investors", even making it clear that until investors require it, there will be little demand for IR: "There's not a huge chorus out there saying, 'give me integrated reports' because the investors aren't saying we want them yet".

The interviewee from a professional body made similar comments, and cited materiality as the only factor that may link IR with sustainability. Interestingly, although IR is touted as a comprehensive form of reporting, the notion that IR could replace other forms of reporting, including sustainability reporting, was not supported, all respondents expressing the view that there will always be a place for special purpose reports, such as sustainability reports, for specific stakeholders.

Australian interviewees noted that interest in IR was still emerging, but may have waned recently, but all saw themselves as having a role in promotion and education around what IR can do for firms, and suggested the concept will evolve as this happens.

In Hong Kong, respondents seemed more familiar with the IIRC and noted they had been to workshops and events with Paul Druckman. They also saw IR as focused on investors but there seemed to be more openness to a stronger link with CSR and sustainability, suggesting the focus is "the group who are interested in Corporate Reporting" (prof body) rather than broader shareholders who are yet to indicate an interest in this type of information. Similarly, HK respondents spoke much more about stakeholders and communicating with them, stating that there is "a

genuine move from the Big Firms in HK towards more stakeholder engagement" (big 4).

In summary, while all respondents clearly see IR as investor focused, those who appeared to have worked more closely with the IIRC had a somewhat broader view of what IR can and should be. Interestingly, this was more noticeable in Hong Kong where respondents emphasized the notions of 'interconnectedness', 'integrated thinking' and 'stakeholder engagement'. This may reflect that the more Western markets depend less on guidance from the IIRC and are confident enough to develop their own versions of what they consider IR should be. If IR is to maintain a link with broader notions of sustainability that are implied by an integrated thinking approach, the challenge will be for the IIRC and its board to provide thought leadership in this regard.

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Paradigms of environmental damage in reviews on CEMIS, SPMS, Green IT, Green IS and sustainability reporting

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Extended abstract: The bachelor thesis "Disciplinary Paradigms of environmental damage in reviews on corporate environmental information systems (CEMIS) and environmental and sustainability reporting from 2012-2015" applies the concept of environmental damage paradigms to recent streams of literature reviews on Green IS, Green IT, CEMIS, Sustainability Reporting, and Sustainability Process Measurement Systems (SPMS).

INTRODUCTION

When creating environmental reporting or designing environmental information systems, Experts trip over different paradigms of "environmental damage". The paradigms lead to mutual misunderstanding. In the controversy over designing experts become prisoners of their version of environmental damage paradigm. Mainly four can be observed: Toxic, Balance, Entopic and Conviviality Paradigm [1]. Do researchers, who frame the debate on IT for sustainability with a variety of terms use different paradigms of environmental damage, as suggested by the theory of paradigms of environmental damage?

The underlying bachelor thesis [2] contains a deductive qualitative content analysis of 10 literature reviews. It suggests, that research fields are differently developed and that mostly energy and material topics are reported to be of environmental importance. Hence, a focus on the entropic paradigm can be observed. Scientific studies reviewing corporate IT systems primarily address material and energy related issues.

RECENT CONTROVERSIES

The survey and intern use of data concerning the environment is called environmental accounting, meanwhile the publication of environmental data is called sustainability reporting [3]. "The choice of a set of adequate tools is required to assist managers with responsibility for achieving purposive sustainability goals [...]" [4]. In Europe by the introduction of new EU directives (2014/95/EU), pressure on small and medium enterprises to use sustainability reporting will increase [5]. These laws bring together the idea history of enforcing material consideration on the one hand and an organizational requirements perspective on the other [6].

Certainly, looking at selected market reviews from consultancy agents the impression is created, that the question is vital. By 2013, among 93% of the 250 biggest customers of KPMG had an sustainability report and 59% of these had invested in external assurance [7]. In Contrast, only 38% of multinationals CEO's believe that the sustainability reporting systems reflect the effort put to reporting according to an

Accenture Survey [8]. Especially in Germany the impression is given, that sustainability reporting is mainly a Public-Relation tool and some kind of "greenwashing" [9]. In contrast, others describe it as the ends of a systematic management process. Never the less, they point out, Research fields on the internal processes of the structure and development of corporate Sustainability reporting are yet underdeveloped [10].

The financial and technological challenge should be acknowledged, because Sustainability reporting comes with financial and technological efforts, especially when oriented on standards by the Global Reporting Initiative (GRI) [11]. Informatics and especially software, which is discussed under the term – green IS, can be a support to CSR [12]. There is influence on the relationship towards the environment by IT, and it is supposed to be change by Information Systems further [13].

IT FOR SUSTAINABILITY MANAGEMENT IN SCIENTIFIC REVIEWS

Since environmental reporting becomes a duty for companies, the importance of CEMIS is also growing in industrial practice [14]. The Software for sustainability Management is described as a new market. Yet dispersed, different toolkits exist from small scale, free-ware web-applications to detailed and cost intensive programs [15]. And it is developing rapidly. More than 75% of technologies were introduced after 2008 by 2012 [16] Accordingly, Green IS refers to initiatives to utilize IT infrastructure to improve energy efficiency, or reduce the environmental impacts of products or services.[13].

In the context of IT support, it is argued, that in scientific reflection, it is often mixed whether technology is meant to be more environmental friendly itself, or technology support to manage and report environmental damages. A key issue of uncertainty is: What is meant by environmental sustainability in the context? [17] For this uncertainty, paradigms of environmental damage were used as a structuring. To challenge the claim, Green IT, GBPM, Green IS and CEMIS were sharing a topic under various umbrella terms [18] it was asked, whether the research areas use similar paradigms of environmental damage?

PARADIGMS OF ENVIRONMENTAL DAMAGE APPLIED

The concept of paradigms of environmental damage, proposes that there exist four overlapping and at the same time exclusive understandings of “environmental damage”. A chemical toxics understanding (Toxic Paradigm), a species balance idea (Balance Paradigm), an energy and material focused entropic paradigm (Entropic Paradigm) and an ethical version in a sense of “conviviality” (Conviviality Paradigm). Each has his own line of arguments. Only combined they depict fully what is societal said to be environmental damage [1].

After doing a snowballing literature search [19] on reviews plus content analysis, multiple understandings of environmental damage in each literature review were found. Starting points were edited volumes and reviews on the terms. Several connected reviews published between 2012 and 2015 were found for Green IS/ Green IT (5) [12,18], for Sustainability- & CSR Reporting (3) [3, 15]. CEMIS (1) [15] and Sustainability Process Measurement Systems appeared once (SPMS) (1) [20], but Green Business Process Management (0) did not.

RESULTS

Within the papers one could find, that often it was only spoken of “environmental impacts” or “ecological sustainability”, not showing in any case, what was meant by it. Never the less, more often it can be analysed, that notions were following an entropic paradigm. Especially, the concern on energy loss dominated the translation from “environmental impact” into concrete paradigms. Mainly fuel based emissions are deplored and material recycling ideas are developed.

Yet, it tells a story of the main focus of IT support systems. A narrow concentration in reviews on environmental damage as the loss and saving of energy and materials. Hence, Academia is debating mostly over resource efficiency. Environmental damage paradigms instead suggest four areas, to be reported on for satisfying societal needs. The content analysis of groups of reviews, snowballed by different key words and publication backgrounds of authors, revealed no change of the picture. Though, informatics driven papers tend to have the broadest view, looking at most paradigms within a review. Regardless the basic format of IT support for reporting or Information systems, all paradigms appeared but in an unstructured way.

It is stunning, that the scientific literature oversimplifies topics of “environmental damage” on review publication level., when one uses the “environmental damage paradigm” – view. The class of objects spoken about at Green IT, IS and sustainability reporting publications is torn between multiple meanings of environmental damage on the one hand, and a narrow entropic paradigm perspective prevailing.

CONCLUSION

These findings connect with the discontent to reporting [8] and the desire for better Tools to

sustainability management [4]. These findings reinforce the question, put in a software market review: How can software support sustainability reporting? [15]. We can further ask: How can reviews better look at the several meanings of environmental damage? When reflecting literature on IT Support for SPMS, Green IT/ IS, CEMIS or sustainability reporting, environmental damage paradigms can structure the environmental impact.

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How prestige kills accounting innovation opportunities and social responsibility of producers : the case of Bordeaux wines

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Extended abstract: New methods allowing the use of accounting data for assessing the level of environmental sustainability and social responsibility of the wine-producing properties are available. However, they are still not mobilized. Several reasons can be advanced to explain this finding from a theoretical point of view: social isomorphism, available resources, stakeholder's expectations, marketing, sociology of networks and strategies of stakeholders. In this paper, we study the case of Bordeaux wines to test the effective influence of the different factors in a limited regional framework, characterized by its prestigious image. After reviewing the different available methodologies for implementing environmental and social indicators into new accounting system, we propose a specific approach in the case of Bordeaux wine and we identify the obstacles to setting up this approach. The case study raises the question of the social responsibility of Bordeaux wines, and leads us to analyze the interaction between strategy and responsibility.

INTRODUCTION

Societal concerns on the necessity to move towards circular economy radically modified the expectations of accounting information users (Lintott, 1996). However, some of them still follow pure economic considerations and others are still disorganized. Accounting seems to be a neutral technique for recording financial fluxes (Lehman, 1999), but in reality it relies on a model that lacks neutrality and completeness because of two main reasons. First, the negative externalities are not integrated (Herbohn, 2005). Second, the intangible capital such as human or natural capital is not accounted for or is incomplete. It leads to a misconception of the reality, from an economical point of view, but also from social and environmental points of view (Colasse, 2011). It is important to question the policy implications of such a lack of information, and also the reasons for such a perpetuation of the situation.

The inclusion of natural capital, or the health of employees, does not appear as crucial depending on the business sectors. These concerns are unavoidable in the context of agricultural properties and in the food sector, involving health issues with, for example, the use of pesticides. The use of farm equipment also represents a significant source of emissions of greenhouse gases. Other practices have a huge impact on biodiversity. These issues can be handled outside of accounting. We can cite the evaluation of risk and safety of chemicals put on sale, or the calculation of the carbon footprint of a farm. However, these results appear expensive, very punctual and intervene ex post. They do not allow a continuous monitoring which can be integrated into decision support systems (Lozano, 2012). To explore

these issues, we choose the interesting sector of wine properties as mentioned by Christ & Burritt (2013), and more precisely the Bordeaux region. First of all, we present the various methodologies available to set up such an accounting system. Secondly, we study the possibilities of updating the accounting system of Bordeaux wine Properties to include social and environmental criteria, and we also identify the obstacles of such an implementation.

INITIATIVES FOR AN ACCOUNTING SYSTEM INCLUDING SUSTAINABILITY MEASURES

Before considering a change in the accounting practices, it is necessary to review the different solutions that could be envisaged. We will first address the initiatives from the accountants and then from the non-accountants.

A. *Approaches from the accountants*

The transformation of accounting is dependent on how we perceive it (Lafontaine, 2003). We first should define the boundaries of accounting information. Concerning this point, opinions diverge (Gray, 2010; Lamberton, 2005). First, accounting can be seen only as a double-entry bookkeeping system. New information has to be recorded so that it can be reproduced in financial statements. Therefore, the analytical framework relies on cost/income and assets/liabilities which requires a logic of monetization and classification of any payment. However other approaches seem possible: accounting systems can also be extended to dashboard and indicators relative to management control systems (Antheaume, 2013). We can cite the "Global Reporting Initiative" (Brown, HS; Jong, Martin; Lessidrenska, 2009) or the IDEA methodology (Zahm et al., 2008).

B. *Approaches from the non-accountants*

Providing accounting information extended to social and environmental aspects can lead to benefits in terms of marketing. With the communication of such information, companies prove the existence of a global management system integrating social and sustainable responsibility. For this matter other actors than accountants can intervene. The adoption of quality and environmental management systems through the international standards ISO 14001 or ISO 26000 is a good example. However, the implementation of such systems seems disconnected from the financial accounting and is generally done by the Quality Safety Environment (QSE) engineers.

In this context, several methods to account for social

and environmental impacts have been developed in the last decades. One of most adopted in companies is the carbon footprint approach that aims to account for greenhouse gas emissions from all inputs (energy, materials, infrastructures, transportation, etc.) and outputs (direct emissions, waste treatment, etc.). However, the procedure to collect data is not specified and can be time consuming. Also, this is a mono criteria approach because it is only related to climate change impact. In order to include several environmental impact categories (such as water deprivation, toxicity, resources depletion, ozone depletion, etc.) and therefore avoid burden shifting between different impacts, a multicriteria approach is needed. In this context, Life Cycle Assessment (LCA) is a widely accepted and standardized approach to compute environmental impacts (and social with social LCA) of products from cradle to grave including several impact categories (Guinée et al., 2011). It has first been developed for eco-designing products. Several databases and software are available to perform such studies but are not directly connected to accounting software.

Therefore, there is a separation between these tools and classical accounting and financial approaches. However, the development of enterprise resource planning (ERP) tools enables the integration of modules related to sales, customer services, production, human resources, accounting, etc. Some companies such as Lafuma or Danone have already integrated environmental information within their information system (Graf, 2010). These approaches still lack transparency on how the calculations are done and this kind of experimentation still seem isolated.

RESPONSIBLE ACCOUNTING PERSPECTIVES FOR WINE PROPERTIES

As it has been explained here before, generalized approaches integrating LCA and existing accounting systems are not yet possible but could be developed in the future. In this second section we will explain the possible modalities of the implementation of such accounting but also the presumed difficulties in implementing it within the Bordeaux wine sector.

C. Opportunities for new accounting systems for wine properties

Even if methodologies to implement environmental and social accounting are available, they are not yet adapted to the wine sector. When an invoice is processed in the accounting system, it is possible to convert the data (i.e., mass of material, quantity energy) into environmental or social impacts using generic LCA databases. The development of such a system may be time consuming but is feasible. However, on a practical level, the only accounting information seems insufficient. In order to differentiate the impact on several wines, each input needs to be traced in order to know for which product or which culture it has been used. The system must be coupled with a traceability tool in order to have sufficiently

precise analytical data. We also see that such a system would benefit from relying on a new accounting plan that would provide more precise data.

Such a system could be operated in real time and the company could follow its impact over time. LCA enables users to compute several indicators that can be reported on a dashboard and on which improvement objectives can be set to follow a sustainable performance logic. We can also imagine that such a system could enable users to compare alternatives when choosing different supplies or work techniques.

The usage of the resulting environmental and social information still remains unclear and should be clarified. First, as stated previously, the information can be used internally for improving the performance of the company. It could also be shared with different properties in order to compare their impacts. Such information could also be communicated to the stakeholders, both at the global level of the property but also at the product level. In this context, it can lead to environmental and social labelling of products (François-Lecomte et al., 2013).

D. Obstacles for accounting innovation within wine properties

Although the usefulness of a new accounting system for wine properties has been proved, it is not certain that its implementation would be successful. Several obstacles have been identified from interviews with different actors of the Bordeaux wine sector.

Our first observation is the absence of spontaneous demand for such developments in this sector. Wine producers are mostly concerned about taste quality issues and business and financial management. Investment in management tools do not appear to be a priority. The organization of information is not necessarily optimal, even in the case of prestigious Chateaux. Human resources seem limited in terms of expertise and available time. Therefore, it seems highly unlikely that an innovative accounting system may emerge in these conditions. The Grands Crus classes de Bordeaux have such a high-end positioning that the search of new commercial arguments appears superfluous. The strategic theme of corporate social responsibility appears in the properties positioned in mid-range. Sustainable development is mostly addressed through the organic label products.

Also, the accountants, including the “ordre des experts-comptables” does not appear as a source of normative pressure and innovation (Schaltegger and Zvezdov, 2013). Some interprofessional organizations tend to favor collective actions with the implementation of Environmental Management Systems or the calculations of carbon footprints for a specific sector (and not on an individual level). Although there is growing pressure from media and critics concerning the use of pesticides, customers continue to remain fairly insensitive to this theme since it does not seem to be a priority for wine which is considered as a product of pleasure.

CONCLUSION

According to some actors at the collective level, ranking properties on social and environmental criteria could have a counterproductive effect, especially for the cooperative strategies that can be put in place and can be used to improve practices. At the level of properties, actors also seem to promote a global management of the sector with the provision of good practices. The improvements in terms of social and environmental footprints also appear uncertain, with a weak external pressure to innovate (Schaltegger & Burritt, 2015). At this stage, no research has been started in Bordeaux about water accounting of material flow cost accounting (Christ & Burritt, 2015).

Nevertheless, it seems possible to achieve a common ground among all these actors with divergent interests. The task might be delicate because it can result in contradictory reasoning that is made on a short term scale. It would lead to cooperation between the local actors of the sector in order to maintain a technological advance in a context of global scale concurrence in the wine industry. Also, customers are more and more sensitive to sustainable development in their consumption choices. Bordeaux wine properties should integrate and attest their sustainable performance, especially if other producing regions develop their own social and environmental accounting systems. The recent implementation of an ERP software (Process2wine) specialized in the wine sector of Bordeaux is a great opportunity. Some Chateaux already implement this technology. Therefore, they have access to structured databases that are useful for conducting LCA studies. It is necessary to test such an implementation and to determine how the obstacles previously cited can be tackled.

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Methodology proposal to identify possible rebound effects through the prospective strategic and consequential LCA

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ABSTRACT

This paper aims to show the natural link between the prospective and the consequential life cycle assessment furthermore the intention is to give some updated review about the state of art about the rebound effect with the consequential life cycle assessment approach, also this paper gives an introduction of the prospective strategic proposal by Michael Godet; with this ideas the intention is to give an early methodological proposal to identify potential rebound effects caused by the market forces and a policy through the Mophol tool for modeling different scenarios that can be used to identify the critical variables and input data to model the rebound effect.

INTRODUCTION

The Life Cycle Analysis (LCA) is a methodological tool based on a holistic approach designed to assess, to control and to mitigate the impacts on the environment by studying the different stages involved in the production of goods and services processing from procurement of raw materials to final disposition. In this realm, two different approaches can be applied: (1) Attributional life cycle assessment ALCA, (2) Consequential life cycle assessment, CLCA. The CLCA has emerged over past two decades as a convergence between the ALCA, which capture environmental impacts of product systems through the physical relationships, and the economic modeling approach; with the aim to describe how the physical flows may change as a consequence of modifications in the demand of a product. In simple words, the CLCA focuses on assessing the environmental consequences of an action/decision (e.g. energy policy implementations), integrating economic models to include market information such as marginal production costs, elasticity of supply and demand, etc. [1]. In this sense, the CLCA appears in the literature as a discussion when [2] claimed to the need of adding market information in the life cycle inventory (LCI). Since that, the CLCA approach has gained importance and different methodologies and tools have been developed to describe the environmental consequences caused by technological, environmental or economic decisions.

The partial equilibrium (PE) and the more sophisticated Computable General Equilibrium models (CGE) are some of those techniques that have gained importance to model and analyze in the macroeconomics field the possible effects of a given policy on a market or set of markets. In the realm of microeconomics, CLCA permits the investigation of substitutable and complementary goods relating to a change in price. In other methodologies, Sanden and Karlström [3] incorporate experience curves and learning effects into

CLCA. Moreover, CLCA models can reveal valuable information regarding “rebound effects”. They can be highly relevant when calculating environmental impacts due to a change in production, also known as environmental rebound effects (ERE) [4]. Following the line of the rebound effects Zamagi et al [5] identified nine types of outcomes as rebound effects in the realm of CLCA and identified different approaches to quantify them, such as the own price elasticity of demand, the cross prices elasticity of demand, Computable general equilibrium CGE, the concept of marginal consumption, and the step wise procedure presented by Hofstetter et al. [6]. Most recently, other approaches have gained importance like the Input Output analysis IOA LCA, and the IPAT LCA that used the IPAT equation introduced by Ehrlich and Holdren as input to use in the life cycle assessment [5], [7], [8].

However the rebound effect is an open field of research especially because it includes various types of cause and effect relationships that need to be understood and modeled. As Zamagni argues, the rebound effects are methodologically immature because no method has been found to quantify the effect and even if a first approach has been presented further research and development is also required when established tools such as price elasticity and computable general equilibrium (CGE) can be applied [5]. In this sense a way to reduce this gap is generating debate in the scientific community with more studies and research

This paper provides a methodology proposal to identify the interaction of variables that in the present are hard to map and can cause in the future rebound effects yet unknown using the prospective strategic proposed by Michael Godet into the consequential life cycle assessment to get a more accurate understanding of the rebound effect cause to a decision and the market forces such as price, cost, technology, wealth and preferences

1. CONSEQUENTIAL LIFE CYCLE ASSESSMENT

The CLCA has emerged over the past two decades as a convergence between the attributional life cycle assessment (ALCA) and the economic modeling approach, while the ALCA aims to describe the physical flows through the life cycle of the product, the CLCA aims to describe how the physical flows can change as a consequence of modifications in the demand of a product under the study CLCA [3], [9], [10]. The CLCA focus on assessing the environmental consequences of an action/decision (e.g., energy policy

implementations) by including market mechanisms into the analysis [11]. It does this by integrating economic models with market information such as marginal production costs, elasticity of supply and demand, etc. This aggregation makes the CLCA methodologically more complex than the ALCA [1]

“The environmental consequences of a decision depend on a variety of environmental, technological, and economic mechanisms. Different concepts, approaches, and models have been developed to describe and analyze different mechanisms” [1, p. 4] in this line Alessandra Zamagni et al., (2012) in her paper *Lights and shadows in consequential LCA* states that 60 papers have been published over a period of approximately 18 years, and addressing both methodological issues and applications. In her paper *Consequential life cycle assessment: a review* Earles & Halog [9] give us a detailed historic review of the CLCA and argue that the CLCA appears in the literature as a/under? discussion when Weidema [2] outlined the need to consider market information in life cycle inventory (LCI); additionally in a study of municipal wastewater systems, Tillman et al. in 1998, performed a comparative LCA study utilizing system boundary expansion to evaluate the environmental consequences of changing wastewater treatment system in two Swedish villages. Bouman et al. in [12] began to investigate the similarities and differences between LCA and an economic technique called partial equilibrium (PE) modeling. PE models are typically used to analyze the possible effects of a policy on a market or set of markets. PE modeling permits the investigation of substitutable and complementary

goods as they relate to a change in price. Borrowing the microeconomic concept of price elasticity of supply and demand Ekvall [13] developed a quantitative technique for estimating indirect impacts in LCA using a simple two goods PE model. In another research Ekvall et al. [14] developed a simple, soft linked PE and LCA model to know what is the impact in the category of global warming potential of a ban of lead solder in the electronics industry. Since then, Earles & Halog [9] argue that other studies have applied a similar technique in the context of agricultural, energy, and real estate sectors. Similar to PE modeling, Computable General Equilibrium (CGE) models are typically used to model policy effects via the assumption of maximizing agents. CGE includes all sectors within the economic system. Kløverpris et al. [15] developed a framework to soft link a CGE model called the Global Trade Analysis Project (GTAP) with LCA to estimate indirect land-use change impacts with respect to agricultural markets. Other economic tools have been integrated with CLCA techniques to create hybrid methodologies.[3], incorporate experience curves and learning effects into CLCA. Moreover, CLCA models can reveal valuable information regarding “rebound effects” It can be highly relevant when calculating environmental impacts due to a change in production, also known as environmental rebound effects (ERE) [4]. In the literature, rebound effects are likely grouped under CLCA because they occur as a consequence of a decision and are determined using market information [9]. In the figure 1 we can see how it has increased the publications on CLCA since Weidema outlined the first steps on this topic according with [16] see fig.1.

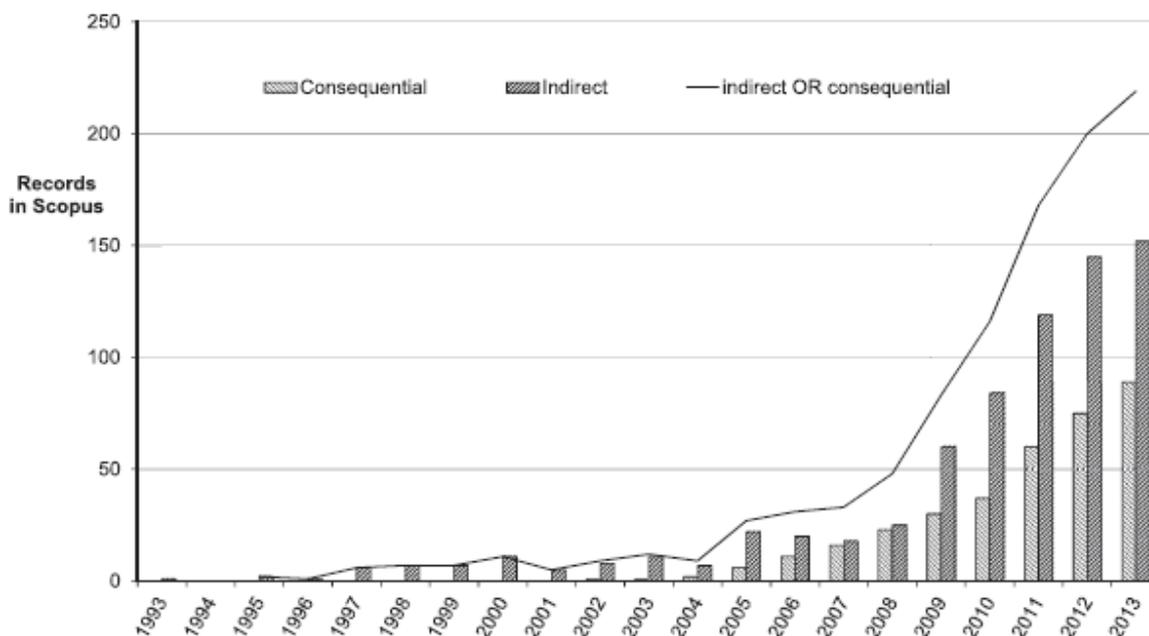


Figure 1. Annual LCA publications using or about consequential analysis
Source. [16]

A Zamagni et al. [5] identified nine types of effects as rebound effects in the realm of the CLCA and identified different approaches to quantify them like

the own price elasticity of demand that is useful to analyse how a change in price for a product can affect the demand of this specific product, the cross prices

elasticity of demand that can be useful on how a change in price for a product affects the demand for a small number of other (competing and complementary) products, CGE is a good tool when we wish to estimate the effect of the price of a product on the general demand for other products or the effect of the price of a product on the economic growth, the concept of marginal consumption serves to analyse the consequences of a change in the money available for consumers to spend on other products, and the step wise procedure presented by Hofstetter et al [6] is useful to understand the relation between the fulfillment of needs and the enhancement of happiness of consumers, and argue that the even a method can be applied the quantification of rebound effects depends on important subjective methodological choices that add considerable uncertainties to the evaluation of their magnitude.

1.1 Types of rebound effects:

The existence and relevance of the rebound effect has been acknowledged by many credible sources from both the academic and the public policy domains. Dozens of research studies have identified and empirically analyzed the rebound effect since, likewise, various intergovernmental organizations and international agencies have also echoed concerns about the impact of the rebound effect on global sustainability. Some examples of concerned entities according to Vivanco et al [17] include the United Nations Environment Programme (UNEP), , the International Energy Agency (IEA), the European Commission (EC) and the European Environment Agency (EEA)

Different definitions of rebound effects can be found in [18]–[23]. A definition that can encompass all of them is the following: “The rebound effect is the change in overall consumption and production due to the behavioral or other systemic response to changes in economic variables (income, price and financial gains or costs of product and material substitution) induced by a change in the technical efficiency of providing an energy service” [24, p. 2]. Follow this line Greening et al.,(2000) provided four different types of rebound effect: (1) direct effect, (2) indirect effect, (3) economy-wide or structural effect and (4) transformational effect. These can be defining following Vivanco & Voet (2014) as:

“Direct effect: Change in the individual consumption or production of an energy service as a behavioral response to a change in economic variables induced by a change in the technical efficiency of providing the same energy service.

Indirect effect: Change in the individual consumption or production of other goods and services (different from the improved energy service) as a behavioral response to a change in economic variables induced by a change in

the technical efficiency of providing an energy service.

Economy-wide structural effect: Change in the overall consumption and production as a systemic market response to changes in aggregated total demand induced by a change in the technical efficiency of providing an energy service.

Transformational effect: Change in the overall consumption and production as a systemic societal response to changes in consumers’ preferences, social institutions or the organization of production induced by a change in the technical efficiency of providing an energy service.” [24, pp. 2–3]

The direct and indirect effects refer to the microeconomics field and according to [25] are currently the most studied due to the lack of tools and the difficulty to measure the other types of rebound effect that have significant impact in the field of macroeconomics. In this sense according to González [26] there are two types of approaches to estimate the direct rebound effect: (1) direct approach based on primary data collected by surveys, and (2) the indirect approach based on indirect data provided by the econometrics studies. He also argues that in the literature there are four types to empirical studies that have evaluated the indirect rebound effect like: (1) Elasticity of substitution studies, (2) Computable general equilibrium models, (3) Macro econometrics, (4) Studies on energy, productivity and economic growth.

Furthermore, according to Weidema the rebound effects can be defined according to Weidema as “[...] the derived changes in production and consumption when the implementation of an improvement option liberates or binds a scarce production or consumption factor, such as: (a) money (when the improvement is more or less costly than the current technology); (b) time (when the improvement is more or less time consuming than the current technology); (c) space (when the improvement takes up more or less space than the current technology), or d) technology (when the improvement affects the availability of specific technologies or raw materials)” [27, p. 1], moreover, he distinguishes between three types of rebound effect: (1) “specific”, occurring when production and consumption of the product analyzed changes; (2) “general”, which takes place when the overall production and consumption changes; and (3) “behavioral”, when the organization of production and consumption changes, affecting both the product under study and other related products.[27, p. 1] In the same way other definition can be “the consumption feedback loops of product modification [...] or replacement” [28, p. 3].

1.2 Scenarios

Studying the future has an important role in the world because it allows e.g. to adapt to coming events or to explore how it is possible to influence a development. In that sense scenario work is conducted at a wide range of instances in society such as universities, special research institutes and as an integrated part of the work of authorities and companies. This field is multidisciplinary and concerns areas such as economy, technology and planning[29]

According to Hojer et al., “In the futures studies literature, the term scenario is sometimes used for explorations of a broad field of possible futures”[29, p. 2], however the term scenario has a wider definition and includes, for example predictive approaches with sensitivity testing as argue Börjeson et al. [30]. Scenarios can be generated in a number of different ways and with several different objectives and starting points. In the guide developed by Börjeson et al. [30] three main categories of scenarios are distinguished; predictive, explorative and normative (see Fig. 2). The three scenario categories respond to different kinds of questions, as is described below. Each of the three categories contains two scenario types. The classification is based on three questions. These are What will happen?, What can happen? and How can a specific target be reached?. According to Börjeson et al:

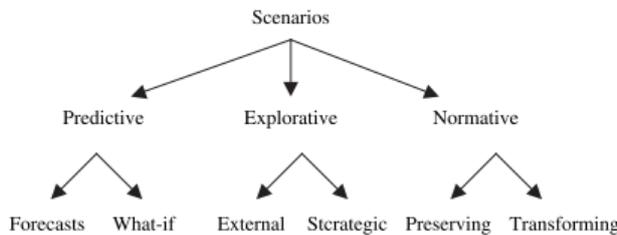


Figure 2. Scenario typology with three categories and six types

Source. [30]

“The first of the questions above, What will happen?, is responded to by Predictive scenarios. These scenarios have two different types, distinguished by the conditions they

place on what will happen. Forecasts respond to the question: What will happen, on the condition that the likely development unfolds? What-if scenarios So-called probabilistic scenarios respond to the question: What will happen, on the condition of some specified events?. The aim of predictive scenarios is to make an attempt to predict what is going to happen in the future. The concepts of probability and likelihood are closely related to predictive scenarios since trying to foresee what will happen in the future in one way or another has to relate to the (subjectively) estimated likelihood of the outcome.

The explorative scenarios are defined by the fact that they respond to the question what can happen? We distinguish between the two types, external scenarios and strategic scenarios. External scenarios respond to the user’s question: What can happen to the development of external factors? Strategic scenarios respond to the question: What can happen if we act in a certain way? The aim with explorative scenarios is to explore situations or developments that are regarded as possible to happen, usually from a variety of perspectives. External scenarios focus only on factors beyond the control of the relevant actors. They are typically used to inform strategy development of a planning entity while the aim of strategic scenarios is to describe a range of possible consequences of strategic decisions.

Finally How can a specific target be reached?, is responded to by Normative scenarios. Normative scenarios consist of two different types, distinguished by how the system structure is treated. Preserving scenarios respond to the question: How can the target be reached, by adjustments to current situation? Transforming scenarios respond to the question: How can the target be reached, when the prevailing structure blocks necessary changes?”[30, pp. 4–6]

Börjeson et al., give us an interest summary of the key aspect of the scenarios types as can be seen below in the table 1.

Table 1. Summary of key aspects of scenario types

Scenario category/type	Quantitative/qualitative	Time frame	System structure	Focus on internal or external factors
Predictive – what will happen?				
Forecasts	Typically quantitative, sometimes qualitative	Often short	Typically one	Typically external
What-if	Typically quantitative, sometimes qualitative	Often short	One to several	External and possibly internal
Explorative – what can happen?				
External	Typically qualitative, quantitative possible	Often long	Often several	External
Strategic	Qualitative and quantitative	Often long	Often several	Internal under influence of the external
Normative – how can a certain target be reached?				
Preserving	Typically quantitative	Often long	One	Both external and internal
Transforming	Typically qualitative with quantitative elements	Often very long	Changing, can be several	Not applicable

Source. [30]

As said above the CLCA aims to describe how the physical flows can change as a consequence of modifications in the demand of a product under the CLCA study, in that sense the use of scenarios in LCA seems very relevant, in some cases due the fact that the LCA are still based on input data that were measured several years ago and also the LCA studies often requires the collection of thousands of data that with the scenario development can be overcome and used to generate an important part of the input data. Also the scenarios development is useful to show the variation in the results as consequence of different decisions made. For example an LCA that focusses on waste management sometimes includes different scenarios for the fuel that is replaced by incinerated waste or to describe the possible effect on the electricity system of different technologies for producing district heat in some place [29]. An interesting case of the use of external scenarios in a prospective LCA is the case study by Spielmann et al. [31] who developed four external scenarios in an LCA where railroad was compared to bus and car transports. The scenarios were based on different assumptions regarding future transport policy, significance of environmental issues, national and international climate policy and price of fuel and electricity [29]. Furthermore, in the realm of the uncertainties the use of scenarios can be useful. According to Spielman et al. “Funtowicz (1990) distinguished three levels of uncertainty, which can be identified in the LCA model defined by Heijungs (1992). Firstly, technical uncertainties, which are connected with quality and appropriateness of the data used to describe the system. Secondly, methodological uncertainties are caused by the model layout and structure, e.g. the allocation method. Finally, epistemological uncertainties concern the conception of a phenomenon (whether and how a model represents the system being studied).” [31, p. 325] in this sense epistemological uncertainties are particularly important for prospective LCA due to the unpredictability of the future development of the system under investigation. Other possible applications of the different types of scenarios in the field of the LCA approaches are given by Höjer et al., [30]

2. PROSPECTIVE STRATEGIC

The prospective school, better known as the French school of the prospective, born in the late 60s with the ideas and desertions of a number of thinkers and philosophers such as Gaston Berger, Bertrand de Jouvenel, Pierre Massé and Jérôme Monod worried about the destiny and the future in our lives. It was not until the late 80 when Michael Godet became in catedratic professor of the industrial prospective that began to emerge consulting projects in companies like Renault, EDF, AXA, Lafarge, among others, at the same time the journal *futuribles* became more important under the direction of Hugues de Jouvenel. Both Godet and Jouvenel started giving courses and seminars increasing more and more interest on this discipline. Then in the 90s the Lipsor (Laboratoire d’investigation en Prospective, stratégie et Organisation) born and currently has a PhD school and a MSc degree with different areas of research such as territories, environment, innovation, Public Management, among others, in the CNAM (Conservatoire National d’Arts et Métiers) training professionals in the field of the prospective that work in the companies and the territories in the construction of the possible futures.[32]

In this sense the prospective strategic is an emerging tool that has the purpose to design scenarios and know the varieties that can influence in these scenarios to take a better decision knowing the fact that the future is unpredictable but it is better to have a prevision on how can evolve the future than having none. According to Godet et al.[33] the prospective seeks to answer what may happen when we take a certain decision. To give answer to this question Godet et al gives us a set of tools that have as a purpose to stimulate the imagination, reduce inconsistencies, create a common language, structure collective reflection and allow the appropriation, these set of tools are in the same line of Godet et al. A way to appreciate objectively the multiple unknown realities that can happen because of a decision. These tools have the intention to help to solve a set of typology problems such as start and simulate the whole process of strategic foresight,

propose good questions and identify key variables, analyze the game of actors, mark out the field of possibilities and reduce uncertainty, establish a complete diagnosis of the company against its environment, identify and evaluate strategic choices and options. Below we can see a brief summary of the tool proposal by Godet et al.

2.1 Structural analysis Micmac: Structural analysis is a tool for structuring a collective reflection. It offers the possibility to describe a system using a matrix that relates all its constituent elements. Based on this description, this method aims to bring up the main influential and dependent variables and therefore the essential variables to the evolution of the system.

2.2 Analysis of strategies actors MACTOR: The morphological analysis was formalized by the American researcher F. Zwicky during the Second World War. Morphological analysis was launched from the Morphol program, and comprises two phases. It seeks to assess the balance of power between actors and study their convergences and divergences with respect to a number of positions and objectives. The objective of using Mactor method is to facilitate an aid to the decision of the implementation of its policy of alliances and conflicts.

2.3 Morphological analysis Morphol: The morphological analysis tends to systematically explore possible future from studying all the combinations resulting from the decomposition of a system. The aim of morphological analysis is to show the behavior of new products in technology foresight but also the construction of scenarios. The Morphological analysis comprises two phases, the first stage involves breaking down the system (or function) into subsystems or components, either as a result of a prospective workshop and its factors of change and inertia or as a result of structural analysis. Breaking down a system is a delicate operation and requires serious consideration if this method is to be useful. The components must be as independent as possible and taken together must comprise the entire system under study. A certain balance is required as too many components will render the analysis impossible; too few components will result in a poor analysis. The second phase of the work is therefore reducing the initial morphological space to a useful subspace, by introducing exclusion criteria, selection criteria (demography, economic, technical, social) from which the relevant combinations they may be examined. See fig. 3

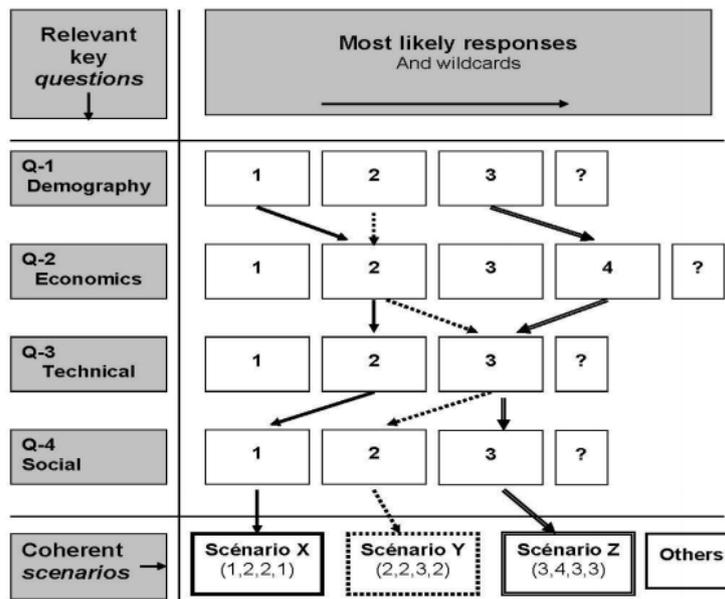


Figure 3. Morphological approach to model scenarios with different variables

Source. [33]

2.4 Cross-impact probabilistic: SMIC-Prob-expert: Probabilistic methods determining cross impacts are simple and conditional probabilities of hypotheses or events as well as the probabilities of combinations of the latter, taking into account the interactions between events and / or scenarios. The goal of these methods is not only highlighting the most likely, but also to examine combinations of hypotheses that will be excluded a priori scenarios.

From the prospective strategic the scenario method aims to construct representations of possible futures, and the path leading to their achievement. His elaboration has 3 phases:

Phase 1: Build the base: consists of building a set of representations of the current state of the system consisting of the company and its environment. The base is the expression of a dynamic system elements connected to each other, the system in turn, linked to the external environment. In this step the structural analysis will be useful to determine the critical variables of the study, in this phase may be convenient determine the authors and his strategies

Phase 2: Mark out the field of possibilities and reduce uncertainty: The key variables are identified, game players analyzed, and there can be prepared a possible future through a list of hypotheses reflecting perhaps maintaining a trend, or conversely, rupture. In this phase it is useful to use the morphological analysis to decompose the system studied in essential dimensions and study the possible combinations of these different dimensions.

Phase 3: Develop scenarios: At this stage, the scenarios are still in an embryonic state, as they are limited to two sets of assumptions made or not. It is then described the road leading from the current situation to the final images.

3. METHODOLOGY PROPOSED TO MODEL THE REBOUND EFFECT CAUSED BY THE MARKET FORCES USING PROSPECTIVE STRATEGY

The technology has an important role in socioeconomic situation of the countries, in fact any decision that has made taken in this field can affected significantly in a short and long term the industries, the economy and the quality of life of the people, in this sense the polices that have the intension to promote a better technologies to improve the conditions of the environment, necessary needs to be taken with special careful so that decisions made today have a positive impact on the economies and the environment..

Know what could be the impact of the implementations of energy or environmental policies and which varieties can influence on these is the core issue of both CLCA and prospective strategic. In this sense the purpose is use MORPHOL to identify the interaction of variables that in the present are hard to mapping and can cause in the future rebound effects yet unknown and get a more accurate understanding of the rebound effect cause to a decision cause to the introduction of an energy of

environmental policy and the interaction the market forces such as price, cost, technology, wealth and preferences.

4. DISCUSSION

Agreeing with other authors like [11] and [25] still are many questions about rebound effects that need more research. On one hand, delineating a common framework in harmony with the core mechanisms behind the rebound effect is needed. This framework would help the LCA community to consistently integrate the rebound effect as well as to create a common language with other disciplines, favoring learning and co-evolution. On the other hand, developing a more comprehensive and accurate practical viewpoint the rebound effects on CLCA with the aim of describing how the environmental flows can change due to decisions or chooses is required, however this could add more complexity and cost to a study as well as reducing the precision of the analysis. The rebound effect is an open field especially because the rebound effects include various types of cause and effect relationships that need to be understanding and modeling. Zamagni stated that rebound effects are methodologically immature because for several rebound effects no method has been found to quantify the effects and, even when established tools (price elasticity, general equilibrium models) can be applied, further research is necessary, because the quantification of rebound effects depends on important subjective methodological choices that add uncertainties to the evaluation[5]

On the other hand it is clear that there is a need for more prospective thinking in the LCA for environmental systems analysis; this suggests that further research in this area is required, including both methodology development and practical case studies. However the LCA require large amounts of quantitative data in these sense predictive and explorative scenarios can be useful to make these data relevant to describe future situations. Also normative scenarios can be interest, but it is difficult to produce quantitative input data that are valid in a scenario with large changes, for example in a transforming normative scenario. Furthermore LCA require quantitative data and the futures study methods that produce quantitative data are mainly suitable for short time periods without significant trend breaks. This means that the use of futures studies in environmental systems analysis in long-term application for strategic decision-making can be problematic; however, further developing approaches in which quantitative methods can be used in the development of structurally different scenarios will enhance the value and usefulness of these. Such approaches would probably require combinations of quantitative methods and mainly qualitative scenario techniques.

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Integrated Reporting: Current state of empirical research, limitations and future research implications

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ABSTRACT SUMMARY

In view of the increased demand on non-financial reporting after the financial crisis 2008/09, Integrated reporting (IR) plays a key role in management control and stakeholder management. As a consequence of “integrated thinking” IR combines traditional financial accounting with sustainability and corporate governance related issues in one report to enhance the decision-usefulness of modern business reporting. Although there is a steady growth in awareness of IR research the current state of empirical IR-research activities is not well described so far. This literature review evaluates 44 empirical studies on IR, which have been published especially after the IR framework by the International Integrated Reporting Council (IIRC). We will briefly introduce the IR framework that provides a clear structure for the current empirical research activities in this field. For the market, organization and individual/group decision level we show which factors contribute to IR implementation and IR quality. Furthermore, empirical research focuses on market reactions of IR. We also stress the limitations of the studies and give useful recommendation for future IR research activities for each level of analysis.

EXTENDED ABSTRACT

Organizations have come under pressure to adapt their business practices to adhere to an increasing public awareness of environmental, social and governance (ESG) issues [1], [2]. Stakeholders demand that an organization’s ESG performance must be transparent, and corporate social responsibility (CSR) reports proved vital in meeting those demands. The number of organizations utilizing voluntary CSR reports worldwide has substantially increased since the financial crisis in 2008/09 [3], and CSR reporting has been subject to increasing standardization (e.g. Global Reporting Initiative), regulation (e.g. EU directive 2014/95) and research activity [4]. Nevertheless, it is often difficult to integrate CSR content with traditional financial reporting within a single integrated report.

In view of these circumstances, the International Integrated Reporting Council (IIRC) has adopted a principle-based framework concept for integrated reporting (IR) [5]. It requires an integrated presentation of financial and non-financial information [6]. CSR reporting and IR differ both in their reporting structure and target group. CSR reporting qualifying as a classical stakeholder tool in both business practice and research is beyond dispute. Meanwhile, the IIRC explicitly states in the IR framework that IR should primarily address investors, as this would help the management avoiding a conflict of objectives arising from the consideration of heterogeneous target groups. Nevertheless, IR should be a key information instrument for all stakeholders, not only for shareholders [7]. Insofar IR is classified as a useful

new development of business reporting so that it might replace CSR reporting in the long run.

IR is ideally based upon an interconnected internal regulation of owner and socially related value creation process of a company [8]. This new type of reporting framework also known as integrated thinking proceeds on the assumption that IR represents an external communication medium regarding ESG activities of a company within the reporting period and the respective interdependencies on one hand as well as company’s orientation towards long-term financial and non-financial objectives on the other hand [9]. A sustainable implementation of this framework requires a company-wide interlocking of the individual corporate areas, which often operate in isolation. This is especially relevant to the design and function of external and internal reporting systems. The implementation of this framework would result in a holistic management of a company [10]. Furthermore this would provide the addressees with a holistic picture of owner and socially related value creation process of a company within a centralized single reporting tool as opposed to the financial and sustainability reporting.

IR has gained popularity in business practice and recently gained great importance in empirical research. Therefore, the objective of our paper is to evaluate 44 empirical studies (archival, experimental, surveys, case studies, interviews) on IR. We create an IR framework based on three different levels of analysis (market, organizational and individual/group decision making levels) considering basic theories and research contents. Although some studies concentrate on the influencing factors of IR implementation and IR quality (e.g. firm characteristics, corporate governance, firm processes), also market reactions (e.g. influence on firm valuation) are analyzed. By summarizing the currently examined cause-and-effect-coherencies in the context of empirical IR research, this paper offers the first systematic literature review on IR, portrays the limitations and reveals the possible directions for further research endeavors. Although the exploration of motives for the initial preparation of IR predominate the present scientific discussion, an analysis of long-term incentive effects induced by IR and the subsequent regulatory implications for standard setter, reporting entities, auditors and addressees should be focused. The deployment of qualitative empirical research designs increasingly applied in CSR research (e.g. experiments, interviews) will be of special interest for the exploration of current development within IR and subsequent implications for the assurance.

By providing starting points for future empirical IR-research activities this literature review is primarily aimed at researchers. Empirical IR research grows rapidly

in 2015 so that it is necessary to show current tendencies and identify important research gaps from an international view. Additionally the consolidated current research results illustrating the main effects of IR are also beneficial for practitioners raising their awareness of the reactions to the publication of an integrated report. Furthermore the results of this literature review might be interesting for regulators and the IIRC regarding a possible implementation of mandatory IR or establish a modified version of the IR framework.

Our analysis is structured as follows. First, the IR framework with the different levels of analysis (market, organizational and individual level, the corresponding main theories and central research topics are described. In this context we modify the approach by Cohen and Simnett [11] that is based on CSR and CSR assurance. This is followed by an appraisal of the empirical findings, whereby an introductory presentation of the methodology precedes a discussion of the underlying factors and the consequences of IR regarding the three mentioned levels. Archival studies have confirmed that the market is affected by company specific factors as well as corporate governance issues, and it leads to positive market reactions (e.g. firm valuation). Studies on the organizational level, consisting mainly of interviews, case studies and surveys, designed to determine management motivation and perceptions for the introduction of IR and IR quality. The focus of experiments and interviews on individual or group decision levels is similar to the market level studies, examining stakeholder reactions to IR, mainly with a focus on investors. Finally, the review considers restrictions of existing empirical research, and

makes a useful contribution for future research activities in this field.

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How A New Vision of Value changes the agenda for CFOs

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Summary: Since the early 1990s, organizations try to connect corporate and societal value by a wide range of tools. The main aim is to make externalities visible for business, creating awareness for new opportunities and new risks with significant implications for corporate value creation. KPMG has introduced the KPMG True Value methodology to help businesses relating financial earnings to monetized externalities and assess future earnings at risk.

Keywords: Corporate Value Creation, Societal Value, Externalities, True Value, Future Earnings at Risk

INTRODUCTION

In the course of doing business, companies create societal value by providing people with the goods and services they need or enhancing the economy by creating jobs and wealth. However, all positive societal contributions come at a price such as the use of scarce natural resources or the contribution to global warming by producing emissions. Nowadays, companies are operating in a dynamic business environment influenced by global megatrends, such as population growth, rapid urbanization, climate change and increasing scarcity of resources. Furthermore, the creation or reduction of societal value increasingly has direct impact on drivers of corporate value, namely revenue, costs and risk. KPMG describes this phenomenon as ‘the disappearing disconnect’ between corporate and societal value. Companies need to better understand the effect of doing business on the society. The externalities created¹⁷ are increasingly internalized by drivers such as regulations or taxes affecting the company’s financial performance. KPMG recognized the need of executives to understand and quantify externalities and their impact on value creation. KPMG’s methodology, called KPMG True Value, represents a tool for businesses to relate financial earnings with monetized externalities and quantify the likelihood and potential impact of an internalization of these externalities.

BACKGROUND

Historically, externalities have had little impact on drivers of corporate value, such as revenue, costs and risk and therefore did not affect cash flows or risk profiles. Societal value and corporate value creation have been largely separated concepts. Therefore, companies have neither been compensated for positive externalities nor had to pay the price for imposing costs on society. However, the effects of negative externalities such as carbon emissions and ecosystem damage have become impossible to ignore. Their effects are further intensified by a set of interlinked social and environmental megatrends. While these megatrends are the underlying

cause of internalization, the actual drivers can be categorized into three interconnected drivers with significant implications on corporate value creation (see Figure 1).

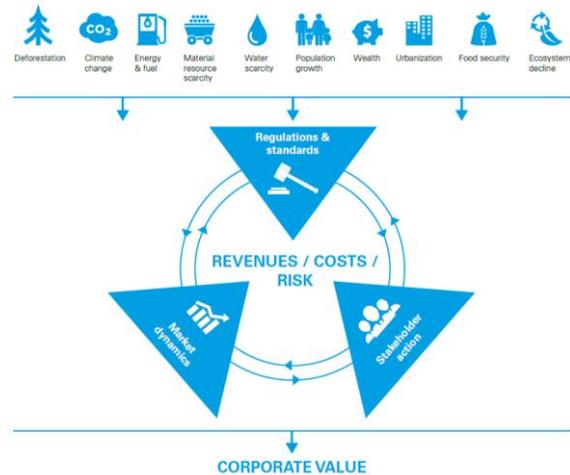


FIGURE 1: THREE DRIVERS OF INTERNALIZATION

The first driver includes regulations and standards such as government legislation, tax instruments and pricing mechanisms that require companies to pay more of the costs they impose on society and create incentives for companies to generate positive externalities by financial rewards. A growing number of reporting and disclosure regulations and certification standards are increasing corporate transparency, which is driving internalization indirectly. The second driver includes the actions taken by stakeholders such as NGOs, civil society groups, communities and workers to protect their interests. The third driver includes market dynamics such as resource scarcity, extreme weather events and new or transformed markets that are driving internationalization by disrupting historical patterns of supply and demand. Companies need to understand the externalities they create and which forces of internalization are most likely to affect them and what the potential impact will be. KPMG has developed the KPMG True Value methodology to support companies in the process of clarifying their exposure to internalization and to develop strategies that capture value creation opportunities and reduce risk and therefore achieve a stronger position compared to competitors.

¹⁷ An externality can be a cost or a benefit – in the form of an actual or theoretical cash flow – that hasn’t been priced into the market, and which affect a party who did not choose to incur this cost or benefit.

DESCRIPTION OF THE APPROACH

The KPMG True Value approach is a three-step process (see figure 2).

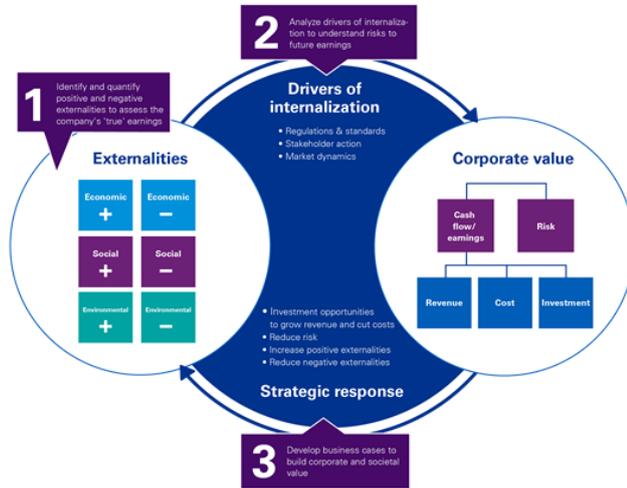


FIGURE 2: KPMG'S THREE STEP TRUE VALUE METHODOLOGY

The first step is to assess the company's 'true earnings' by identifying its positive and negative externalities and to monetize them. This step provides a strategic lens of corporate and societal value creation by creating a clearer view of the company's externalities. A broader view on value enables companies to have more balanced conversations with stakeholders based on true earnings. The next step of the KPMG True Value methodology is to assess both the risk and opportunity of internalization of each of these externalities and the potential impact on the company's earnings. This enables companies to have a better understanding of its exposure to internalization resulting from both positive and negative externalities. The potential risk for future earnings, such as reduced revenues, increased costs or increased risk costs, can be quantified and provides a basis for risk-reduction strategies. The third step in KPMG's True Value methodology provides guidance for companies to act and create both corporate and social value based on the information gained in the first two steps. This step generates a more complete view of the potential value creation of an investment and quantifies the Net Present Value of investments both for the company and the society. Based on the information gained, the KPMG

True Value approach provides companies insights to make balanced investment decisions on the basis of both corporate and societal value.

CASE STUDIES

KPMG already supported several leading companies, which choose to quantify their true value created by their business. The first pilot company to apply KPMG's True Value Methodology was the Holcim subsidiary Ambuja Cement, who identified risks to its future profitability. As a result, Ambuja has identified projects that will benefit society and boost future profitability. Since then Holcim has also applied the KPMG True Value methodology at other subsidiaries and at corporate level and published the world's first socio-economic profit and loss statement. Another recent example is the Volvo Group, which decided to show leadership in the transport sector and the global sustainable development movement by quantifying the environmental and social value created by electric buses. In order to do so, the Volvo Group partnered with KPMG and used KPMG's True Value quantification methodology to compute the True Total Cost of Ownership (*TrueTCO*). The analysis supports Volvo Group's vision to be the world leader in sustainable transport solutions. It contributes to a number of the UN Sustainable Development Goals and is also aligned with the WWF Climate Savers program.

CONCLUSIONS AND OUTLOOK

Nowadays, companies are operating in a dynamic business environment influenced by global megatrends, which create drivers that intensifies the internalization of externalities. Therefore, the creation or reduction of societal value increasingly has direct impact on drivers of corporate value, namely revenue, costs and risks. The KPMG True Value is a tool to understand how the value a business creates or reduces for society is likely to affect the value it creates for shareholders. This knowledge provides a new lens for decision-making to improve performance, inform strategy and increase influence – not only for the CFO.

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Accounting for resource efficiency

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Summary: Accounting for resource efficiency assesses economic and ecological performance in an integrative manner. It roots in industrial ecology as well as in environmental management and comprises approaches such as resource efficiency indicators, material flow-based cost accounting, material flow cost accounting, and eco-efficiency analysis. The paper explores these major approaches, and elaborates the history, schools of thought, and practical relevance of accounting for resource efficiency.

Keywords: resource efficiency, eco-efficiency, material flows, material flow cost accounting, industrial ecology

INTRODUCTION

Due to globally increasing resource consumption and the concomitant shrinking stock of natural resources which are one of the most critical environmental megatrends worldwide [14], resource efficiency has become one of the main sustainability related topics.

Reducing the quantities of used natural resources is viewed as a key determining factor for an ecological sustainable development [18] and the efficient and sparing use of natural resources is seen as a key strategy in order to respond to this megatrend [12].

The most condensed and noncontroversial definition of resource efficiency is the ratio of a received benefit/value to the required use of natural resources (e.g. European Commission 2011; VDI 4800-1:2016). In this context, natural resources include all types of services that natural systems provide to human activities, i.e. renewable and non-renewable raw materials, energy resources, air, water, land and even biodiversity (ibid.). This broad understanding of natural resources makes it difficult to clearly separate resource efficiency from eco-efficiency. Eco-efficiency describes the ratio of a received benefit/value to the environmental damage caused [43]. It can be argued that eco-efficiency focuses on reductions on the natural output side (ecological impacts) while resource efficiency emphasizes reductions of the natural input side with closer linked economic consequences. The differences are fuzzy, though. For instance, the use of natural resources is a common category in environmental impact assessments while greenhouse gas emissions (an ecological damage) affects natural resources such as air or biodiversity, too. Therefore, the terms eco-efficiency and resource efficiency are often used interchangeably in practice.

Resource efficiency is applied on macro and micro levels within economies. At the macro level, increasing resource efficiency helps saving resources over the long-term and has led to the launch of initiatives such as 'A resource-efficient Europe – Flagship initiative under the Europe

2020 Strategy' [11]. The aims of the flagship initiative are to decouple economic growth from using natural resources, to secure the supply of essential resources and to reach a low-carbon economy with limited environmental impacts [12].

Economy-wide indicators referring to resource use and resource efficiency are frequently measured by Eurostat and national statistical offices and include at least the headline indicators domestic material consumption (DMC) and resource productivity which is the ratio of gross domestic product and DMC (GDP/DMC) [11], [38]. Occasionally, the indicator raw material consumption (RMC) which also accounts for raw material equivalents (RME) for imports and exports is calculated [11], [13].

The main focus of this review is to describe accounting for resource efficiency for the corporate level, though. At the micro level, resource efficiency is viewed as a strategy aimed both at reducing material costs and negative environmental impacts, particularly the use of natural resources.

The following sections elaborate a short history of accounting for resource efficiency on the corporate level, introduce important tools and methods and highlight its relevance for practice.

HISTORY AND SCHOOL OF THOUGHT

Industrial Ecology provides an important philosophical and scientific backbone of accounting for resource efficiency. It highlights the strong interlinkage and inseparability of industrial activities, resource demand and environmental impacts [17], [25]. Accounting for resource efficiency operationalises this school of thought into quantitative indicators for decision making and reporting.

Within industrial ecology, tools and methods such as life cycle assessment (LCA) and material flow analysis (MFA) deliver the basis for calculating the resource use and environmental impact part of the resource efficiency ratio.

Already in the 1920s some economists emphasized the importance of combining physical and monetary information to assess resource use and productivity, but did not get much attention thereafter [46]. The early 1990s mark the starting point of accounting for resource efficiency on the corporate level. Here, first definitions and conceptualisations of eco-efficiency were developed (cp. e.g. Schaltegger and Sturm 1990 and 1998; WBCSD 2000), and case studies on the economic importance of corporate environmental protection [8], and the monetary relevance of wasted materials [30] got published.

Since that time, the field has constantly developed further and even led to international standards on eco-efficiency analysis (ISO 14045:2012) and material flow cost accounting (ISO 14051:2011).

Another driving force for accounting for resource efficiency is corporate sustainability management, especially environmental management systems and corporate environmental reporting and accountability. Both require physical/ecological indicators in the first place, but have started to better integrate these with economic indicators in recent years.

CLASSIFICATION, METHODS AND TOOLS

Within sustainability accounting, accounting for resource efficiency helps to assess the economic and ecological dimension, while not considering social aspects. During the past decades of the emergence of environmental accounting diverse tools and methods have been developed which can generally be classified into three basic “schools” or approaches that are differentiated by the provided information, the addressed stakeholders and the targeting. According to Schaltegger and Burritt (2000) these three schools are:

- environmentally differentiated conventional accounting which is part of conventional accounting and addresses the influence of environmental issues on the corporate financial performance in monetary terms,
- ecological accounting which assesses the environmental impacts of corporate activities, and
- the integration of both approaches which constitutes the umbrella term for both previous accounting categories and which is called environmental accounting.

Similar approaches categorize environmental accounting methods and tools according to the understanding of controlling and by the way how to solve environmental protection issues respective from which angle environmental issues are viewed. They are classified into monetary-oriented approaches, ecological-oriented approaches and integrated approaches (e.g. Burschel, Losen and Wiendl 2004; Baum, Albrecht and Raffler 2007). In the following, four important approaches to account for resource efficiency are introduced. To the authors’ knowledge and experience these approaches are the most relevant ones. They have emerged out of different directions and motivations; however, what they have in common is their integrative nature (Figure 1).

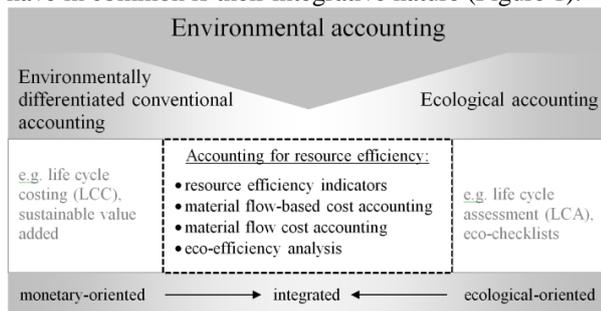


FIGURE 1: CLASSIFICATION OF METHODS AND TOOLS FOR MEASURING AND ASSESSING RESOURCE EFFICIENCY

Starting with the most straightforward possibility to account for resource efficiency, simple indicators that are part of international guidelines, standards and regulations are presented, followed by material flow-based cost accounting approaches which constitute a more sophisticated accounting method. Among these flow-based cost accounting approaches, material flow cost accounting can be highlighted as a specific method which is seen as the most promising environmental management accounting tool to enhance corporate resource efficiency [27]. Finally, eco-efficiency analysis is described.

Resource efficiency indicators according to international guidelines, standards and regulations

As stated earlier, resource efficiency can be generally defined as the ratio of a specific benefit or result and the related required input of natural resources (VDI 4800-1:2016). If the components of this formula are operationalised into quantifiable input and output dimensions, it is possible to calculate indicators that reflect resource efficiency.

Building environmental-related or ecological indicators has already a long tradition within environmental management, environmental performance evaluation or sustainability reporting. In general, ecological indicators can be defined as the “...quantifiable measures used to gauge, record and effectively communicate ecological conditions in physical terms” [40]. According to Schaltegger and Burritt (2000) ecological indicators aim to support the internal control of corporate environmental aspects and vary in terms of different environmental media they address (e.g. impacts on air, water, land), which aspects they cover (e.g. materials use, energy use, water use, emissions, waste), whether they are calculated as absolute or relative measures and for which system boundary they are built (e.g. process, site, product life cycle).

Since natural resources include raw materials, energy (carriers), air, water, land, biodiversity and ecosystem services (VDI 4800-1:2016), resource efficiency indicators can be seen as a subcategory of environmental-related indicators, focusing on the use of natural resources.

There exist different international standards, guidelines and regulations that already include resource efficiency indicators and which are described in the following subsections.

Since November 2009, the regulation **EMAS III** intends to mandatorily calculate so-called “core indicators” for corporations that participate in the Eco Management and Audit Scheme (EMAS III 2009). Whereas in the past the calculation of environmental performance indicators within the environmental management systems EMAS and ISO 14001 was just implicitly required, the mandatory inclusion of indicators is a new development. The core indicators should be composed of the total annual input or impact in physical units, and the overall annual output of the organisation which altogether constitutes a ratio of environmental and economic

dimensions. In regards to resource efficiency, the core indicators explicitly include energy efficiency, material efficiency, and water indicators (EMAS III 2009). This development can be seen as a key step towards an increased transparency and better comparability in terms of corporate resource efficiency.

The **ISO standard 14031** for environmental performance evaluation was first issued the year 2000 and provides accompanying tools for environmental management in terms of environmental indicators. The aim of this international standard is to describe a process for environmental performance evaluation (EPE), which should enable organizations to “...measure, evaluate and communicate their environmental performance using key performance indicators (KPIs), based on reliable and verifiable information” (ISO 14031:2013). Beside environmental condition indicators and management performance indicators, environmental performance indicators may be used to assess the corporate resource efficiency and include indicators such as materials used per product unit or water used per unit of product (14031:2013).

The Global Reporting Initiative (GRI) is an international independent organization that published its first standard for sustainability reporting in the year 2000. The latest version was published in August 2015 and is called **G4 Sustainability Reporting Guidelines – Reporting Principles and Standard Disclosures (GRI 2015)**. In chapter 5.2 of this document, different indicators for the categories “Economy”, “Environmental” and “Social” are proposed to be included into a sustainability report. The category “Environmental” itself is divided into specific aspects, among them covering materials, energy, water and biodiversity (GRI 2015). Whereas most of the indicators are intended to be measured as absolute indicators and thus do not perfectly reflect resource efficiency but rather simply resource usage, some have to be given as ratios (e.g. energy intensity) which at least partly reflects a resource efficiency idea.

Material flow-based cost accounting approaches

Whereas the before mentioned resource efficiency indicators are mostly focused on corporate environmental performance and thus, are often based on corporate input-output balances that blank out what is happening inside the black box of the company, the following resource efficiency accounting approaches try to enhance the transparency of material flows inside the corporation and integrate the cost dimension more consistently.

In the late 1980s the understanding of the term “environmental costs” changed from merely focusing on end-of-pipe-related environmental protection costs to the perception that environmental impacts are always related to material and energy flows [3], [15]. This allowed to identify resource efficiency potentials and was the time when the first approaches of material and energy flow-based cost accounting were developed (for the sake of simplicity, they are referred to as material flow-based cost accounting), including

- residues cost accounting by Fischer and Blasius (also termed as “environmental cost accounting”) [3],
- flow cost accounting developed at the IMU Augsburg [50] in the course of a project at the Kunert AG in the years 1994 and 1995 [33],
- material flow based cost accounting [45], [36],
- materials-only costing according to Lucent Technologies, and
- resource cost accounting [32].

Furthermore, some specific environmental-related process-oriented cost accounting approaches exist, like material flow-oriented activity-based costing [40] environmental-oriented cost accounting [31] or material flow based environmental cost accounting [49].

Most of these material flow-based cost accounting approaches and case studies (e.g. [8]) highlight the cost effects of material and energy flows, consider material flows as cost collectors and thus, help to identify corporate resource efficiency potentials by considering the reduction of the undesirable production output.

The main difference to conventional environmental cost accounting approaches is the missing breakdown into costs that are related to environmental protection and those costs that are not, as all costs are related to material and energy flows [15].

Material flow cost accounting according to ISO 14051

Material flow cost accounting (MFCA) is a specific approach within material flow-based cost accounting and has recently reached greater attention. Its main characteristic is the handling of material losses (wasted materials, non-product outputs) as cost collector. The first publication covering conceptual elements of MFCA appeared in Germany [3], see also [53].

Following the developments in Germany, the Japanese Ministry of Trade and Industry (METI) promoted MFCA in Japanese companies [28], [37] and published a “Guide for Material Flow Cost Accounting” [35]. This marked the start of the further international dissemination of MFCA, which led to the release of an ISO standard in 2011 (ISO 14051:2011).

MFCA is seen as one of the most promising, well-developed and most specifically described and standardized EMA methods [4], [27], [29], [23], [44], because it seeks to improve resource efficiency by simultaneously reducing the material consumption and lowering production costs [34].

The main purpose of MFCA is

1. to trace the material and energy flows through the organization in order to enhance transparency,
2. to then allocate the related production costs (material costs, energy costs, system costs and waste management costs) to these material and energy flows (ISO 14051:2011), and
3. to finally split them into costs related to the product output and costs that are asserted to the

material loss in order to identify efficiency potentials.

Based on the identified inefficiencies expressed in monetary terms, improvement measures can be implemented in the company in order to enhance the resource efficiency on the mid and long term.

However, it is claimed that knowledge concerning MFCA in practice still remains under-developed [6] and there is still place for further development of different MFCA approaches [44], [47], e.g. the expansion to supply chains with an own follow-up ISO standard 14052 which is currently under development.

ECO-EFFICIENCY ANALYSIS

The general definition and meaning of eco-efficiency has been discussed in the introductory section and provided the basis for the development of the more specific eco-efficiency analysis, which has recently been standardized internationally (ISO 14045). An eco-efficiency analysis combines the ecological and economic assessment of a product's life cycle. Eco-efficiency analysis is often attributed to the chemical company BASF, which has popularized and commercialized the method successfully and has been applying and developing the method further since the 1990s [39], [26]. In essence, an eco-efficiency analysis combines the results of an environmental life cycle assessment (LCA) and the results of a life cycle costing (LCC) into one indicator which can also be depicted on a two-dimensional matrix with environmental performance and cost performance on either axis (Figure 2). The resulting indicator and matrix can be used for comparisons of and decisions on product and technology innovations and improvements (in Figure 2, option B is the most and A the least eco-efficient option, despite A showing highest economic profitability and C lowest environmental impacts).

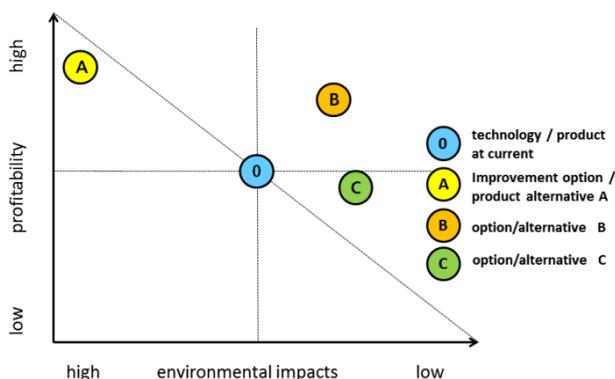


FIGURE 2: ECO-EFFICIENCY PORTFOLIO (SIMILAR TO SCHALTEGGER AND STURM 1998; KICHERER ET AL. 2007)

All tools and approaches explained above have particular importance for accounting for resource efficiency. Computing resource efficiency indicators is most likely the most widespread resource efficiency accounting approach. Material-flow based cost accounting approaches allow the comprehensive integration of the physical and the monetary dimension and provide a basis for further resource efficiency-oriented assessments including investment appraisals or total cost of ownership

calculations. MFCA is a very specific attempt to highlight the economic importance of minimizing waste and material losses. Finally, eco-efficiency analysis is the most comprehensive approach to integrate and visualise the ecological and economic dimension in a whole life cycle perspective.

RELEVANCE TO PRACTICE

Since the early 1970s resource efficiency strategies and measures have been recognized with the potential to significantly reduce costs and act as a driver of environmental innovations [7].

In German manufacturing companies, material costs constitute a share of 42,9% of the total costs and, thus, are the highest pool of costs, followed by personnel costs with only 20,5% [2]. Hence, the pressure and incentive to reduce these costs is or should be rather high. Moreover, in recent years rapid price increases and fluctuations on the commodity markets as well as high dependencies of manufacturing industries on specific (critical) raw materials have gained attention.

Facing global competition, lower production costs and risks due to resource efficiency improvements can lead to substantial competitive advantages. According to a Fraunhofer ISI (2011) study, companies in the German manufacturing industry estimate saving potentials up to 7% of their material consumption on average, which equals a hypothetical annual production cost decrease of about 48 billion Euro. Delmas and Pekovic (2015) found out that only about 10% of the companies they surveyed invest in resource efficiency strategies in down market conditions, whereas about 26% use resource efficiency strategies in steady market conditions. This is somehow a paradox as it could be assumed that identifying cost saving potentials in economic periods of crisis is more essential.

This shows that - even for economic reasons only - accounting for resource efficiency is an area of sustainability accounting with high practical relevance. By bridging economic and ecological performance it also helps to raise the awareness of various business functions for environmental concerns.

CONCLUSIONS AND OUTLOOK

Decoupling economic growth from resource use and environmental impacts is a major sustainable development challenge [51]. Accounting for resource efficiency contributes to corporate sustainable development by steering management attention to the benefits of decoupling economic success from resource use and environmental impacts. Thereby, accounting for resource efficiency also addresses two of the major challenges of corporate sustainability according to Schaltegger & Burritt (2005). It integrates economic and ecological effectiveness and, given its relevance for production planning, engineering, cost control etc., it supports the further integration of corporate sustainability measures into conventional business operations.

Resource efficiency indicators, material flow based cost accounting, and eco-efficiency analysis are major

approaches in that field, which constitutes a pragmatic or managerial part of sustainability accounting. Monetary saving potentials alone provide incentives for companies to account for resource efficiency. In practice, though, a huge number of companies do still not pay attention to these incentives for various reasons.

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Corporate environmental disclosures: A case of listed companies in two high profile industries in Thailand

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Extended abstract: This study examines the environmental disclosures of listed companies in two high profile industries in Thailand to assess the determinants and relationships including the effect of the guidelines adoption. Content analysis by checklist and un-weighted score have been used. Panel data models have been used for the analysis. The results show increasing trends of GRI based voluntary reporting, diversified nature of information, and significant factors which differ between industries.

INTRODUCTION

Corporate responsibility has faced a paradigm shift from economic performance to environmental and social concerns [1]. Thailand is located in the 2nd most diversified biogeographic region and ranked in the top 20 most biodiversity abundant in the world [2]. Thai economic system has transformed from agricultural to industrialised. The rise in economic activity brought with it environment damage and weak accountably (oil spill in the tourist attraction areas [3]). In 2012, Thai Corporate Social Responsibility Institute (CSRI), run by the Stock Exchange of Thailand (SET), launched the sustainability corporate reporting guidelines [4]. Little is known about environmental disclosures in Thailand and the impact of these guidelines.

This study examines environmental disclosures of Thai listed companies. The research question addressed is "What are the extent, nature, and trends of environmental disclosures of Thai listed companies?". The sub questions supporting this aim are

- Have Thai guidelines for sustainability reporting introduced in 2012 affected the level of environmental disclosures? and
- What are the key determinants affecting the level of environmental disclosures?

LITERATURE REVIEW

Several previous studies have examined the key determinants of environmental disclosures in developed countries [5]-[9]. Meanwhile, few studies have been undertaken in developing countries [10]-[11], and in Thailand [12]-[13]. Some studies investigated key influential factors of Thai listed companies environmental reporting [13]. However, there are no studies that have examined the effect of regulation pressure in the context of Thailand. The environmentally sensitive industries which are high profile companies [5] have been examined in this study. In Thailand, high profile industries include Agro & Food industry and Resources industry [13].

HYPOTHESIS DEVELOPMENT

To investigate the quantity and possible relationship of environmental disclosures with the Thai sustainability guidelines (GRIA), the hypothesis has been tested.

H1: There is a relationship between the amount of environmental disclosures and the Thai sustainability guidelines, released in 2012.

Other key determinants have been derived from the literature and theories as shown in Table 1.

TABLE 1: INDEPENDENCE VARIABLES

Independence Variables	References	Definition
H2: SIZE (Stakeholder theory)	(+) [8], [13] (0) [9], [12]	Companies size (Log of Market capitalisation)
H3: AGE (Stakeholder theory)	(+) [8], [13]	Age of the company operation since inception
H4: RISK (Stakeholder theory)	(+) [13] (-) [8] (0) [9]	Debt ratio (total debt/total equity) or leverage
H5: LIQUIDITY (Stakeholder theory)	(+) [7] (-) [6] (0) [13]	Current ratio (total current asset/total current liability)
H6: PROFIT (Stakeholder, legitimacy theory)	(+) [9], [13] (-) [14], [7] (0) [8]	ROA (net income profit / total assets)
H7: MEDIA (Legitimacy, Media agenda setting Theory)	(+) [15] (-) [14]	Number of news media

(+) positive relationship, (-) negative relationship, (0) no relationship

METHODOLOGY

This study has investigated the environmental disclosures in annual and sustainability reports of companies listed on the Stock Exchange of Thailand (SET) during 2010-2014. This period covers the launch of Thai sustainability reporting guidelines in 2012 including the policy implementation lag time between 9 and 18 months [16]. Therefore this study applies the average lag time of one year. The GRIA independent variable is represented as a dummy variable (0 = no

guidelines adoption 2010-2012, 1 = guidelines adoption 2013-2014).

The sample population is comprised of Thai listed companies on SET. The sample includes two high profile industries, Agro & Food industry (27) and Resources industry (27). The sample is made up of 54 companies, 270 observations, and excluded incomplete data companies for the study period.

Independent variables have been collected from the SET database and Factiva database. The dependent variable, Thai sustainability reporting guidelines is based on Global Reporting Initiative (GRI) version 3.1. Content analysis of 30 checklist items based on GRI 3.1 of environmental disclosures indicators has been undertaken. The environmental disclosure score (EDS) has been applied with un-weighted scoring because each disclosure item is important equally [15].

EViews8 with panel data regression model has been used to analyse the data. The panel data combines cross sectional and time series dimensions together to capture variation across different agents which changes over time. It can capture the difference between years [17]. The panel data regression model is in equation (1).

$$EDS_{it} = \beta_0 + \beta_1 GRIA_{it} + \beta_2 SIZE_{it} + \beta_3 AGE_{it} + \beta_4 RISK_{it} + \beta_5 LIQUIDITY_{it} + \beta_6 PROFIT_{it} + \beta_7 MEDIA_{it} + a_{it} + u_{it} \quad (1)$$

RESEARCH FINDING AND ANALYSIS

I. *The extent, nature, and trend of environmental disclosures of Thai listed companies*

Agricultural industry mostly reports the environmental information in their annual reports with descriptive information whereas resources industry reports more in sustainability reports with descriptive and quantitative data. Furthermore, increasing trends of environmental reporting in both industries have been found.

In relation to the subgroups of GRI 3.1 Environmental performance indicators, both industries focus more on emissions, effluents, and waste data. However, resources industry has more reporting on water and compliance aspects. The underlying reason could be that most of the agriculture companies are processing agriculture products and have not applied water footprint whereas many accidents from resources companies have to pay compensation as a result of compliance requirements.

II. *Panel data analysis*

Model fit

In relation to Multicollinearity using Pearson correlation, no independent variables correlation coefficient have been found to exceed the level of multicollinearity in both industries.

After obtaining estimates from all three panel data models, the Hausman test and Likelihood Ratio test have been applied. The results confirm that random effects model is the most appropriate model to use at confidence

level 95 %. Exogeneity of the independent variables has been proven.

TABLE 2: PANEL DATA RANDOM EFFECT RESULTS

Variable	AGRIULTURE		RESOURCES	
	Coef.	Prob.	Coef.	Prob.
C	-5.094081	0.0606	-12.05912	0.0004
GRIA	2.216787	0.0000*	0.481135	0.4554
SIZE	0.882591	0.0006*	2.027279	0.0000*
AGE	-0.006816	0.8988	0.077940	0.1930
RISK	0.670836	0.1238	-0.539527	0.1042
LIQU	0.011615	0.1082	-0.403132	0.0650
PROF	-0.018216	0.5861	-0.132806	0.0054*
MEDIA	1.051774	0.0005*	-0.047894	0.7553

* Significant at 0.05 level

Agriculture Industry: GRIA, SIZE and MEDIA are significant at the 0.05 level which mean that after the GRI guidelines were launched the disclosures have been increasing. Large companies report more information than small companies. This finding confirms prior literature and consistent with stakeholder theory. The more visible companies provide more environmental information.

Resources Industry: SIZE and PROFIT are significant at the 0.05 level. However, interestingly, the GRIA is not significant. This may be because raw data of resources companies have already reported environmental information before Thai sustainability reporting guidelines were launched in 2012. Furthermore, there is a significant negative relationship of PROFIT which means the less profitable companies will disclosure more information. The MEDIA is not significant which may be because the nature of the resources companies' reports as already mentioned and some companies have disclosure in companies' reports but not in the news.

CONCLUSION

This study has found an increasing trend of environmental disclosures which mostly focus on emission, effluents, and waste data. Agricultural industry mostly reports environmental information in annual reports whereas resources disclosure occur more in the sustainability reports. Moreover, SIZE has been found as a significant factor for both the industries. However, GRI adoption is just significant in the agricultural industry. The companies in high profile industry group still exhibit material differences in relation to periods of adoption and types of environmental data.

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Stakeholder influence on health and safety controls

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Abstract: Using the levers of control model, this paper investigates how primary stakeholders influence the introduction of organizational health and safety strategies while improving organizational management control systems. These pressures to embed interactive mode of controls help management to create a dialogue with the employees, which in turn can change the diagnostic controls, boundary systems and belief systems.

INTRODUCTION

Lapses in health and safety could cause serious economic, social and legal problems for organizations. Having understood the importance of health and safety for corporate sustainable development, organizations adopt various strategies to improve safety at work. The successful adoption of health and safety strategies requires the commitment of management including shareholders. Despite the importance of the influence of various stakeholders in propelling organizations to adopt safety strategies, there is a dearth of studies that identify the contribution/influence of primary stakeholders in establishing safety as a part of organizational Management Control Systems (MCS). This paper investigates how primary stakeholders of organizations influence the MCS of an organization through the introduction of organizational health and safety strategies.

LITERATURE REVIEW

Among the various dimensions of safety-related studies, accident causation and mitigation has received widespread attention with the famous domino theory of Heinrich [1]. Many researchers opine that the vast majority of accidents are caused by unsafe work behaviours or human errors [2] [3]. These early studies and developments provided a platform for the emergence of a more systematic approach to occupational health and safety in the workplace. Subsequent studies have used management tools such as balanced scorecard and quality function deployment to construct safety management frameworks [4].

Another strand of research that has received the attention of many scholars is safety culture. Organizational safety culture is defined as “the set of beliefs, norms, attitudes, roles and social and technical practices which are concerned with minimizing the exposure of individuals, within and beyond an organization, to conditions considered dangerous or injurious” [5]. Even under safety culture, the adoption of the balanced scorecard to translate the organization’s safety policy into a clear set of goals has been suggested [6]. In a broader sense, health and safety strategies that foster a safety culture can be considered an important element of MCS. The next section presents the theoretical model based on MCS.

THEORETICAL MODEL

MCS are essentially a means to successfully implement strategies. They are the formal information-based routines and procedures used to maintain or alter patterns in organizational activities. MCS of an organization are influenced by many stakeholders, especially by the primary stakeholders, who include shareholders, investors, employees, customers, and suppliers [7]. Though MCS are significantly influenced by primary stakeholders, their influence on MCS has not been adequately studied.

The “levers of control” model is a widely used model in MCS [8]. We use this model as the theoretical model in our study to analyse the influence of primary stakeholders on the health and safety strategies. In this model four distinct control levers are identified as belief system, boundary system, diagnostic control system and interactive control system [8]. Belief systems encompass the company’s values, mission and other statements of philosophy. When managers “walk the talk” and exemplify appropriate behaviour, there is a powerful lever of control over employee actions. Boundary systems are based on the power of negative thinking that specifies what employees should not do.

Diagnostic control systems are the traditional monitors of critical performance outcomes such as costs and revenue. Diagnostic systems help managers to track the progress towards strategically important goals. However, in order to face the challenges of today's dynamic environment new formal control systems need to be created to harness creativity, which is not facilitated through diagnostic systems. Interactive controls are the formal information systems that managers use to involve themselves regularly and personally in the decisions of subordinates. Through them, senior managers participate in the decisions of subordinates and focus organizational attention and learning on key strategic issues. It is argued that the most important fact is not identifying the types of controls firms use but rather how managers use them. Even though the "levers of controls" have been widely studied in measuring the accounting and finance related measures and performances [9], there is a dearth of studies relating its application to health and safety strategies which are a part of an organization's MCS.

METHODS

We selected the case study approach in this study as it provides an in-depth understanding of complex social phenomena [10]. Since our main focus was on a social parameter (i.e., health and safety), which is basically company-specific, the relevant data was not available in public sources. Therefore we had to use a variety of data collection methods such as semi-structured interviews, review of archival data and on-site assessments. The use of multiple sources of evidence enabled verification through triangulation, which is a strength of case research [11].

A well-known mining company (hereafter referred as "MN") in Sri Lanka, which is listed in the country's main stock exchange, was selected as the unit of analysis in this study. The main reason for selecting this company was both the importance of the company performance in the mining sector and the accessibility to rich health and safety and MCS information.

THE MINING COMPANY

MN is the world's only vein graphite producer and has been exporting products to countries all over the world for more than a hundred years. Having operated as a private entity for well over hundred years, the company was nationalized in 1970. Under a programme to privatise government owned institutions, in 2000 MN was privatized and its control went to a specialist-mining firm in Germany. In 2008, 80% of the parent German company's shares were acquired by a global mining company incorporated in the Netherlands. During the year 2014, MN recorded a turnover of LKR 607 million (approximately US\$ 4.7 million) with its 188 employees.

In 2008, after the acquisition, the Netherlands-based parent insisted on establishing and maintaining formal and systematic health and safety strategies for MN. This led to radical organizational changes related to health and safety. Among them, the establishment of a separate safety department, awareness and training, and continuous adoption of a new safety reporting policy are important. Therefore, year 2008 was an important milestone in MN's operations relating to health and safety. In this study we identified MN's health and safety-strategies in two periods, i.e., pre-2008 and post-2008, when applying the four levers of control.

FINDINGS & DISCUSSION

In the pre-2008 era, MN didn't have a formal Safety, Health and Environment (SHE) policy. Mainly due to the company's long accident-prone history, the employees believed that it was their destiny to suffer injuries (or even death) in the mine in their belief system. The employees were not aware of and even never wanted to have health and safety measures that could save lives and minimize work injuries. After 2008, subsequent to the introduction of the new SHE policy, MN was forced to follow health and safety measures rigorously. As a result, the employees realized the benefits of the SHE policy and their attitudes changed. Since health and safety have now become a part of their belief system, the employees value and they themselves follow the health and safety measures adopted by the company [5].

In the pre-2008 era, in terms of the boundary system of MN, there were few rules and regulations in place for health and safety. In the absence of these internal policies or rules, MN only complied with the legal requirements enforced by the government. Government legislation necessitated compliance with only basic and minimum health and safety standards. Consequently, the number of accidents reported was high in MN. However, after the change in the parent company, in the post-2008 era, MN had to introduce new internal rules and regulations for health and safety through its SHE policy. As a result of the adoption of the SHE policy, the number of accidents dropped significantly and it resulted in an unexpected improvement in productivity as well [5].

In the pre-2008 era of MN, in terms of the diagnostic system of MCS, the performance evaluation system focused only on monetary benefits, such as provision of bonuses when employees meet the given targets [4] [8]. MN had employed a monitoring system that focused on mining output. In order to achieve the given targets and to qualify for the monetary benefits (bonuses), the employees worked recklessly, sometimes even risking their own lives in the mine. MN neither evaluated its existing MCS nor held any discussion with mineworkers regarding the performance evaluation system despite the alarming number of accidents experienced. In the post-2008 era, the new parent company of MN recognised the health and safety issues arising from the financially biased performance evaluation system and its consequent cost in terms of accidents and injury. To overcome these issues, the parent company insisted on MN transforming its monitoring system and reviewing its target setting process and performance evaluation system. These changes that MN initiated later resulted in a better safety environment, productivity and economic performance.

In the pre-2008 era, MN hardly exercised an interactive control mechanism. The company employed mainly a diagnostic approach to monitoring and did not solicit subordinates' comments or their suggestions regarding the health and safety controlling system. However, after the change in the parent company, in the

post- 2008 era, the new parents company's emphasis on introducing new MCS relating to health and safety demanded an interactive method of control. MN had to seek the involvement of all subordinates from top to bottom and obtain their suggestions for health and safety improvements. The management of MN started fostering a close relationship with the employees especially with the miners through constant dialogue. The views of the miners are now considered in the daily decision making process. Apart from the new safety policy (SHE), the new training policies and new performance evaluation system are interactive in nature. Consequently, MN's safety indicators, financial performance, productivity and employee satisfaction were on the rise. Further, owing to the new mode of interactive operations, MN was able to change the employees' beliefs about health and safety when working in a mine. The change in their core values is such that now, the health and safety procedures have become a part of the DNA of the MN's employees.

CONCLUSION

The above discussion suggests that the pressures generated from the primary stakeholder (i.e. parent company) create, in turn, pressures on management to adopt health and safety strategies in an organization. These pressures to embed interactive mode of controls help management to create a dialogue with the employees, which in turn can change the diagnostic controls, boundary systems and belief systems. These broad changes in MCS can lead to better health and safety standards, a contented work force and improved economic performance. The findings reveal the importance of safety controls in developing a sound safety climate in an organization. They further reveal the importance of an interactive, diagnostic and boundary system of controls in developing, adopting and sustaining different organizational strategies such as health and safety strategies.

The findings of this study may be limited due to several reasons. The qualitative case study method followed in the study poses the limitations of generalizability of the findings. The results will therefore only be able to

theoretically generalize in a contextual way. Thus, we consider the findings to be particularly relevant for accident-prone industries such as mining. In future studies, these findings can be further explored by way of multiple case studies or surveys covering accident-prone organizations of different sizes and contexts.

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Development of an ontology of sustainability assessment methods for the ICT sector

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This research in progress aims to develop an ontology providing stakeholders of the ICT sector with a comprehensive choice of sustainability assessment methods. Following the identification of primary classification dimensions, a systematic literature review of assessment methods addressing the ICT sector is conducted. Upon examination of the literature, further defining characteristics are to be included in the final ontology.

INTRODUCTION

The increasing global consumption of ICT (information and communication technology) generates a multitude of environmental, economic and social problems, including resource scarcity, toxic emissions and techno stress [1], [2], [3]. These issues challenge both research and industry to develop more sustainable business practices for the ICT sector.

The research project eCoInnovateIT aims to design and implement measures for making the consumption of ICT more sustainable. Following an Open Innovation approach, these measures integrate the perspectives of various stakeholders and focus on the sustainability of ICT products, services or companies. The developed practices may take the form of a variety of initiatives, whose net impact on sustainability requires evaluation by suitable assessment methods.

Sustainability assessment has evolved from earlier forms of impact assessment and constitutes a relatively new field of research [4]. Even so, a number of reviews of sustainability assessment methods have been published [4], [5], [6], [7], [8], [9]. These give general overviews, focus on certain fields of application, present practical guidelines or categorise assessment methods based on a variety of dimensions.

Extant research on sustainability assessment tends to apply high levels of abstraction, allocating the studied methods to defined categories. This approach does not allow a retrospective recognition and understanding of further differentiating factors, making it difficult to select adequate sustainability assessment methods based on specific application-oriented criteria.

In addition, few publications [10] deal with sustainability assessment of ICT in particular. Lacking a consistent and industry-recognised standard for sustainability assessment, the ICT sector has produced a large variety of assessment methods, which differ in measuring criteria, level of detail and subject of investigation and thus deliver highly divergent and incomparable results [11]. As a first step, improving transparency for the ICT sector requires collating the respective assessment methods' measurement criteria and presenting these in a comprehensible way.

The research in progress presented here aims to close

these gaps by developing application-oriented guidance and providing businesses, researchers and other stakeholders of the ICT sector with a comprehensive choice of sustainability assessment methods meeting their specific requirements. The final artefact will be an ontology that allows the identification of suitable methods for specific applications based on defined target criteria. Hence, the underlying research questions of this paper are:

Which methods for assessing sustainability are established in the ICT sector?

Which distinguishing factors are addressed by the respective assessment methods?

How can these methods be categorised to allow the identification of suitable sustainability assessment methods based on target criteria?

This abstract is structured as follows: Section 2 outlines the general research approach. Section 3 develops a typology to serve as the basis for the final ontology, integrating three primary dimensions derived from our research objectives. Section 4 describes the literature review process and initial results produced as part of this research in progress. Section 5 concludes with a brief outlook on future research activities planned as part of this project.

RESEARCH APPROACH

As the explanatory power of any classification depend on the chosen set of dimensions [12], identification of the analysed subject area's defining characteristics is essential and requires a theoretical basis and prior knowledge for guiding the selection process [13]. In order to create a structural basis, we thus begin by developing a typology of sustainability assessment methods for the ICT sector.

Providing an extensive review of taxonomy development, [13] differentiates between taxonomy and typology. While the former is derived empirically, typology construction is based on the prior conceptualisation of multiple exhaustive classes, thus following a deductive strategy. A third approach to classification integrates both conceptual and empirical approaches, either by first forming empirical clusters that are later assigned to proposed concepts (empirical to deductive) or by starting with the conceptualisation of dimensions followed by the review of empirical cases (deductive to empirical) [14]. Each step may then be revisited in several iterations [12].

With the aim of reducing complexity in the field of sustainability assessment and identifying suitable areas for practical application of assessment methods, our research is based on the latter approach (deductive to

empirical), supplemented by additional review cycles (Figure 1).

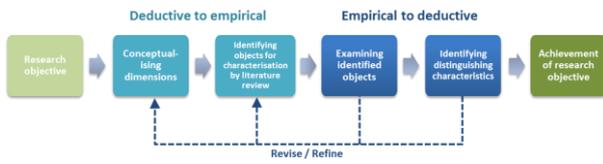


FIGURE 1: RESEARCH APPROACH (ADAPTED FROM [12])

We begin by conceptualising the initial dimensions along which the identified sustainability assessment methods are to be classified, deriving from the research project eCoInnovateIT’s objectives. Following the identification of relevant classification dimensions, a systematic literature review [15], [16] is conducted in order to provide the empirical cases to be classified by the developed typology. Upon examination of the relevant literature, further defining characteristics are identified to be included as dimensions of the final ontology.

TYPOLOGY OF SUSTAINABILITY ASSESSMENT METHODS FOR ICT

Since the idea of sustainable development was first defined by the Brundlandt Report in 1987 [17], discussions on how such a broad concept could be implemented in practice have yet to deliver a conclusive answer. Although not without critique, the triple bottom line, which regards social, environmental and economic targets as equal pillars of sustainable business activities, is a common interpretation in business contexts [18]. Accordingly, we argue that to be considered relevant, sustainability assessment methods must be able to assess performance in at least one of the three target dimensions (economic, environmental, social).

A holistic analysis must also enable the evaluation of sustainability measures before, during and after the implementation of such strategies [7], [9]. The developed ontology must therefore consider a temporal dimension classifying the respective assessment methods into ex ante (before), during and ex post (after).

Since it is our goal to provide businesses, researchers and other stakeholders with a comprehensive yet manageable choice of sustainability assessment methods for ICT, the developed typology must differentiate between ICT goods, services, hybrid products and organisations as the objects of investigation.

In general, sustainability assessment methods considered in our ontology must be specifically developed to assess the impacts of ICT.

Based on the three primary dimensions of *target area*, *timing* and *object of investigation*, we developed the concept matrix in Table 1 for the analysis of sustainability assessment methods for ICT, which will form the basis of our ontology.

TABLE 1: CONCEPT MATRIX AS A BASIS OF OUR ONTOLOGY

Factors: Methods	Target area			Timing			Object of investigation				...
	Eco	Env	Soc	Ante	Dur	Post	Prod	Serv	Hyb	Orga	
Method 1 Paper a Paper b											
Method 2 Paper c Paper d ...											

Following the examination of relevant sustainability assessment methods from the identified literature, further defining dimensions will be integrated in order to allow an application-oriented selection of suitable methods.

LITERATURE ANALYSIS AND INTERIM RESULTS

As established in Information Systems (IS) research, the systematic literature review process is based on a comprehensive keyword search on the bibliographic databases given in Table 2 [15], [16].

Reflecting the research questions underlying this abstract, the following search phrase was applied to title, keywords and abstracts, yielding the 135 relevant records listed in Table 2 [19]:

(Sustainab OR Environment* OR social OR economic) AND (assessment OR performance OR impact OR report) AND (ICT OR “Information Communication Technology”)*.

TABLE 2: OVERVIEW OF LITERATURE SEARCH RESULTS

Database	Valid Hits / Total Hits	Specificity
ScienceDirect	29 / 84	35%
AISeL	19 / 301 abstract 12 / 116 title	6% 10%
Business Source Complete	30 / 68	44%
Web of Science	45 / 128	35%
EconBiz	0 / 7	0%

The search was restricted to academic journals and conference articles published in English since 2000 . We scanned titles for relevance to ensure compliance with our research objectives. Next, abstracts and then full papers will be scanned for relevance to arrive at the final set of records. The search phrase may be extended by additional keywords and a forwards and backwards search be performed to identify further sources [16], [20].

Findings of the subsequent analysis of each relevant publication will be documented in the concept matrix provided in Section 3, which will be extended by further classification dimensions identified from the literature. Due to the iterative approach of our research, the final list of factors considered as part of the planned ontology can only be provided once the literature analysis has been completed.

CONCLUSION

Aiming to develop an ontology of sustainability assessment methods in order to address the ICT sector’s challenges of lacking standardisation and unmanageable variety of methods, a systematic literature search was performed. The three primary classification dimensions *target area*, *timing* and *object of investigation* were

derived from the research project eCoInnovateIT's objectives and integrated into a typology which will serve as the basis for structuring the planned ontology. In the following, the identified set of relevant literature will be analysed in depth, the typology extended by further classification factors and the respective sustainability assessment methods classified in the final typology.

Based on contents of the final typology, an ontology to provide the different stakeholders and allowing the identification of suitable sustainability assessment methods for specific applications will be developed.

A future objective of this research in progress is the development of a prototype in the form of, for example, an online tool. Allowing easy and widespread access, this online tool could enable the identification of specific methods by applying set filters and criteria based on the application in question.

As Open Innovation is one of the main pillars of eCoInnovateIT, development of the ontology will be an iterative process allowing the integration of stakeholder feedback. In order to ensure usefulness and continuous relevance, the ontology will require systematic evaluation and maintenance.

Depending on the results of the literature analysis, a research agenda for advancing sustainability assessment in the ICT sector and addressing possible drawbacks of existing methods could be developed.

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Woschnack, D.

Framing of accountability: For what and to whom are corporations accountable?

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Extended abstract: This empirical study deals with the framing of corporations' accountability in the area of non-financial disclosure. Although the disclosure of non-financial, sustainability-related information of corporations rose from a minor matter to an issue on companies' agenda in the last decades, the field is still in its infancy with different actors struggling for gaining interpretive power. Several initiatives try to establish frameworks to standardize the reporting of non-financial information. However, those initiatives are far from agreeing on nature and scope of the accountability of corporations. By conducting interviews and analyzing documents and websites, using qualitative content analysis, I identify different interpretive frames of accountability among the stakeholders of sustainability accounting and reporting. These identified frames reflect the demands corporations have to fulfil in order to gain social legitimacy. I also take a closer look at the role of corporations in the legitimation process. Therefore, I shed light on the question: For what and to whom are corporations accountable?

INTRODUCTION

Corporations are a central element of modern societies. In 2000 "51 of the largest 100 economies in the world were not countries but multinational corporations" and in 2013 about 2000 of the largest global publicly listed corporations employed more than 85 million people and around half of the world's GDP was generated by them [1,p.105]. Since they shape social structures continuously and "have far-reaching impacts on stakeholder and societal interests" [2,p.964], corporations are increasingly asked to inform next to their financial performances also about their social and ecological impacts transparently. By now, about 73 per cent of the 100 world's largest corporations report on corporate responsibility [3]. Corporations use these reports to meet the demand for more transparency regarding their sustainability performances as well as their social and ecological impacts in order to overcome the current information asymmetry between corporations and their stakeholders [4], [5,p.28].

While the financial disclosure of companies is well established and standardized, its sustainability counterpart is still in its infancy. A large number of sustainability accounting and reporting initiatives (SARIs) try to establish standards and guidelines for the disclosure of corporate non-financial information. The corporations' responsibility to give account for their non-financial performances is an important issue in current societies. However, SARIs are far from agreeing on nature and scope of the accountability of corporations.

Due to the variety of initiatives, different frames and ideas of accountability seem to exist among the stakeholders of sustainability accounting and reporting. By identifying these frames, I give insights into the demands corporations have to fulfil in order to gain social

legitimacy and, hence, I answer the question, for what and to whom are corporations accountable. Furthermore, I take a closer look at the role of corporations in the legitimation process. Are corporations only passive actors meeting imparted social demands? Or do corporations actively influence these demands by selecting, interpreting, and applying specific disclosure standards and guidelines?

To pursue these questions, I take a closer look at the framing processes in the field of non-financial disclosure. By using a computer-assisted qualitative content analysis, I identify the interpretive frames of different actors in the field like corporations, SARIs, financial market actors, selected NGOs and stakeholders from politics, science and audit firms.

THE FIELD OF CORPORATE DISCLOSURE

From the 1970s onwards, a transnational movement took place for a standardization of financial accounting and reporting practices. It resulted in well-established instruments to measure, publish, and compare the "economic activity" [6, p.301] of corporations on a global scale. The globally accepted and applied International Accounting Standards (IAS) and International Financial Reporting Standards (IFRS) enable transnational comparisons about the financial performances of different kinds of corporations [7], [8].

Compared to the field of financial disclosure, its non-financial counterpart is still in its infancy although the first institutionalized attempts to encourage organizations to share non-financial information date back to the idea of social accounting in the 1960s and 1970s [9,p.237], [10]. By now, several initiatives increasingly seek to establish their frameworks as opportunity for corporations to directly inform their stakeholders with standardized and comparable non-financial information [11], [12].

Corporations can publish this information via three different instruments: sustainability reporting, sustainability accounting, or integrated reporting. Sustainability reports are standalone reports; they are characterized by quantitative and qualitative, descriptive information. Sustainability accounting is a means to communicate the sustainability information to stakeholders in an aggregated, almost numerical form by publishing sustainability key performance indicators (KPIs) in the corporate balance [13]. Furthermore, companies can integrate quantitative as well as qualitative sustainability information into their annual report resulting in an integrated report [14], [15].

Different initiatives try to establish their own frameworks as a standard of sustainability disclosure, e.g., the Global Reporting Initiative (GRI) as sustainability reporting initiative, the Sustainability Accounting Standards Board (SASB) as sustainability

accounting initiative, and the International Integrated Reporting Council (IIRC) as integrated reporting initiative. These SARIs reflect social demands for corporations' accountability in different ways by selecting and emphasizing certain aspects of sustainability. Therefore, the field of sustainability disclosure is still emerging and a variety of actors struggle for the prerogative of interpretation of corporate accountability [16], [17].

THEORETICAL APPROACH: CORPORATE LEGITIMACY

According to the new institutionalism in sociology, gaining legitimacy from their institutional environment is indispensable for organizations [18], [19]. To gain legitimacy, corporations have to be oriented towards the socially accepted "rules, laws, norms, values, and cognitive frameworks", as well as towards the social demands [20,p.54]. Nowadays, corporations are increasingly asked to be and act sustainable. Corporations try to fulfil this demand and gain social legitimacy by informing transparently about their social and ecological impacts using the instruments of sustainability reporting, sustainability accounting, or integrated reporting [9,p.237], [21]-[23].

EMPIRICAL RESEARCH

In order to explore the demands of the corporate environment and to answer the question for what and to whom corporations are accountable, I identify interpretive frames of accountability among stakeholders. Interpretative frames are "schemata of interpretation" that help individuals "to locate, perceive, identify, and label" [24,p.21] actions and actors as well as conditions in their social life [25,p.614]. As Benford and Snow (2000) in the field of social movements, I identify the *diagnostic*, *prognostic*, and *motivational framing* of a variety of actors, e.g., different SARIs like GRI, SASB, and IIRC, representatives of DAX-listed corporations, sustainability rating agencies, NGOs, and associations like Finance Watch, the Carbon Disclosure Project and the German professional association for sustainable investments (Forum Nachhaltige Geldanlagen, FNG). Also stakeholders from politics, science and audit firms will be integrated in my empirical research.

By using a computer-assisted qualitative content analysis [26], I analyze documents, websites and self-conducted interviews with a self-developed system of categories in order to identify interpretive frames about the accountability of corporations. The document and websites analysis is in process; the interviews are enquired and will be conducted soon.

CONCLUSION

In the last decades, corporations were more and more asked to be and act not only profitable but sustainable. To gain social legitimacy from their institutional environment, corporations meet these demands by informing next to their financial performances about their non-financial performances transparently. However, the field of sustainability disclosure is characterized by its immaturity; different actors are far from agreeing on

nature and scope of the corporate accountability. By identifying occurring interpretive frames among the stakeholders, I shed light on the question for what and to whom are corporations accountable in the field of sustainability. This helps to understand the field of non-financial disclosure, especially its role in legitimation processes. I also explore if and how corporations actively affect the social demands and the legitimation processes.

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Two Decades of Corporate Environmental and Sustainability Accounting in Japan

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Summary: Environmental and sustainability accounting (ESA) researches in Japan can be classified into the following three aspects; external reporting, internal management and accounting for meso area management. External reporting researches is from the perspective of both inside and outside of financial accounting framework. Environmental reporting and accounting guidelines issued by the Japanese Ministry of the Environment promote ESA researches outside of the framework. Environmental management accounting research in Japan includes both theoretical studies and case studies on material flow cost accounting. Further, the Japanese ESA studies for the meso area, such as natural resources, the value chain and industrial clusters. With the increasing interest in social and environmental issues in Japan, it is expected that there will be an increase in studies on ESA models.

Keywords: *environmental financial accounting, environmental and sustainability reporting, environmental management accounting, meso accounting*

INTRODUCTION

Japanese researches on environmental and sustainability accounting (ESA) started in the 1970s (*e.g.* Kurosawa 1972; Aizaki 1974, 1983; Sakamoto 1974; Yamagami 1974; Aoki 1976, Kawano 1979). Such ESA studies cover many accountancy areas, including disclosure, management accounting, auditing, macro accounting, and meso accounting. Later, specific ESA types were examined, such as corporate social accounting, social audit, *sozialbilanz*, value-added accounting. However, ESA was not generally introduced into corporate management practices in Japan and few Japanese corporations disclosed their corporate social or environmental information.

From the 1990s, as social interest in environmental issues increased, ESA researches developed, and in-depth theoretical, empirical, and case studies emerged. The ESA research fields consisted of disclosures, management accounting, and meso accounting.

In the field of environmental disclosures, environmental financial accounting (EFA) investigations were based on the financial accounting standards and the environmental laws. The primary environmental issues included asset retirement obligation, greenhouse gas emission allowances, soil contamination, and nuclear power plants. The environmental accounting (EA) guidelines released by the Japanese Ministry of the Environment (MOE) in 1999 promoted the introduction of EA in corporations, and the voluntary disclosures of ESA information by corporations. Reflecting this situation, studies emerged on disclosure framework (theoretical), advanced

corporations (case studies), and disclosed environmental information (empirical). Recently, as integrated reporting (IR) has emerged in Japan, the relationship between IR and environmental reporting (ER) or sustainability reporting (SR), and the link between financial data and non-financial data have been discussed.

In the field of environmental management accounting (EMA), various EMA models were initially examined. These included an EA project by the United States Environment Protection Agency (USEPA), environmental quality costing, lifecycle costing (LCC), environmental costing, material flow cost accounting (MFCA), and product line analysis. The Japanese Ministry of Economy, Trade and Industry (METI) started an EMA project in 2000. This project developed different EMA models, including an environmental budget matrix, environmentally conscious investment, MFCA, environmentally conscious target costing, LCC, and environmentally conscious performance evaluation. These EMA models have been implemented in Japanese corporations, particularly MFCA, and many case studies have been investigated. Recently, EMA on the value chain has been developed from the view point of sustainability; such as sustainability accounting, value chain EMA, and sustainability balanced scorecard (sustainability BSC).

Meso ESA studies have been approached from both micro and macro accounting perspectives. After the MOE released its EA guidelines, a number of EA studies were developed for local authorities and water utilities. The local authority studies measured the environmental conservation activities, and the effectiveness of the environmental policies and waste accounting. The studies later investigated the environmental water management and accounting for the water supply systems based on the MOE guidelines. Additionally, forest preservation and the efficient uses of biomass resources (wood, foods) are critical environmental issues in Japan. Correspondingly, forest accounting, biomass EA, and EA for industrial clusters were developed. These EA models measure the material flows and stocks on the value chain from the view point of sustainability.

The following sections further consider each Japanese ESA research field.

ENVIRONMENTAL DISCLOSURES RESEARCH

1. Research processes

Broadly, environmental disclosure research is split into; (1) EA within the conventional financial accounting frameworks, and (2) EA outside the conventional financial accounting frameworks. The former studies follow two stages; (1a) research on the treatment of environmental costs and liabilities and (1b) research

undertaken after Japanese society gained a better understanding of the importance of the environmental risks and of corporate governance.

The EA research outside the conventional financial accounting frameworks followed four development stages; (2a) the necessity of environmental information disclosures, (2b) the standardization of EA or ER, (2c) ER case studies and (2d) SR and/or IR (see Fig. 1). The issuances of the ER and the EA guidelines by the MOE (see Table 1) acted as a positive driver for the development of both research and practice, particularly voluntary ER research.

TABLE 2: JAPANESE MINISTRY OF THE ENVIRONMENT GUIDELINES ON SUSTAINABILITY REPORTING, 1999-2016

	GRI	Environmental Reporting Guidelines	Environmental Accounting Guidelines
1999	Exposure draft		Interim report
2000	First edition	2000 version	2000 version
2002	2 nd edition		2002 version
2005			2005 version
2006	3 rd edition, Japanese translation of 3 rd edition		
2007		2007 version	
2011	3.1 edition, Japanese translation of 3.1 edition		
2012		2012 version	
2013	G4, Japanese translation of G4		
Current			On the process of revision.

Recently, the (1n) and (2d) research trends shown in Figure 1 have amalgamated to generate IR research. Further, financial accounting researchers are increasingly interested in IR. Figure 1 illustrates recent trends in research on environmental information disclosures.

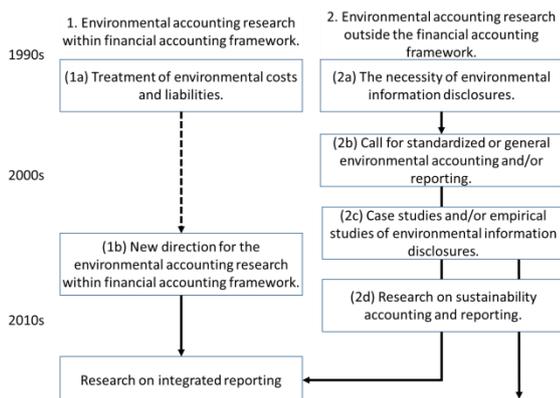


FIGURE 10: DEVELOPMENT OF THE RESEARCH ON ENVIRONMENTAL INFORMATION DISCLOSURES

2. Development of research on environmental financial accounting

The (1a) research trend illustrated in Figure 1, is known as EFA. The Canadian Institute of Chartered Accountants (CICA) and the United Nations Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting (UNCTAD-ISAR) have driven this research area, and have affected EA and EFA researches in Japan. CICA (1993) was translated into Japanese in 1995, and

Hiramatsu (1994) and Taniguchi (1995) examined the treatment of the environmental costs and liabilities based on CICA (1993). Concurrently, case studies of environmental information disclosures in Japanese companies' annual reports were developed (e.g. Matsuo 1999). Such studies were probably motivated by the increase in the environmental costs and liabilities arising from the introduction of stringent environmental regulations such as the Superfund Act in the United States and from environmental regulations in Japan.

Subsequently, EFA research developed in line with the research on voluntary environmental information disclosures. During the early 2000s, many incidents emerged that were related to the financial risks caused by social and environmental issues, such as: frequent accounting frauds, the tightening of financial reporting and governance regulations, enactments of stringent environmental related regulations, accounting standards originating with environmental issues such as asset retirement obligations, and the introduction of new greenhouse gas emission allowances. Clearly, such incidents emphasized the importance of EFA to company managers and investors. Consequently, an accounting regulation for an annual report (known as the *security report*) was amended to require companies to include additional risks and governance information in the report. In line with these trends, the Japan Accounting Association (JAA) established a study group on the *international movements of environmental financial accounting and its basic concepts* (Kawano et al. 2009). This group surveyed the international trends for EFA studies, clarified the EMA domain, and identified the issues and prospects of each EFA issue, such as the asset retirement obligation, soil contamination and emission trading (Fig. 1(1b)).

3. Development of research on voluntary environmental information disclosures

Research on voluntary environmental information disclosure (Fig. 1 (2)) considers the environmental (accounting) information in ER or SR that are issued voluntarily. In the early stage of this research area, theoretical studies stressed the necessity of disclosing environmental information (Fig. 1 (2a)). Representative studies are on green accountability. Kokubu (1999) used social theories to construct a theoretical base for the disclosure of environmental information by companies. Mukoyama (1993) focused on accountability and legitimacy for the theories of environmental information disclosures. Studies on green accountability or on social theories were influenced by the research outcomes from the Centre for Social and Environmental Accounting Research in Scotland. Further, the JAA established a study group (known as 'Expansion of the Concepts of Accountability') that clarified the concepts of green accountability as a basis of social and environmental information disclosures (JAA 1996).

Subsequently, research on the disclosures of EA information developed further in Japan. As the seriousness of the environmental issues became widely

recognized among Japanese people, there was a corresponding interest in environmental management systems (EMS). For example, many Japanese companies acquired an ISO 14001 certification (ISO, 2016). Additionally, the number of companies with ER or SR increased during the late 1990s (MOE 1998-2014). Further, Japanese companies were disclosing EA information in their ER or SR. Therefore, the practices of disclosing EA information developed in pace with the diffusion of the issuance of ER or SR (MOE 1998-2014). The number of ER or SR issuances and the disclosure of EA information had increased with every publication or amendment of the guidelines issued by the MOE (see Table 1).

Following the above research trend came research on the standardization and/or the classification of EA information (Fig. 1 (2b)). The MOE used an informative policy to motivate companies to disclose their environmental information. This policy was aimed at promoting voluntary environmental conservation activities by corporations. Further, the MOE established specialist committees to prepare ER and EA guidelines (Table 1). Prominent Japanese researchers in this field such as Prof. Kawao and Prof. Kokubu were members of the committees.

The JAA's special committee, known as the 'Development and Construction of Environmental Accounting' classified the research areas of environmental accounting (JAA, 2000).

Practitioners such as certified public accountants or business persons also actively engaged in EA case studies. (Fig. 1 (2c)). At this time, the corporate practices of ER or SR and EA became popular, followed by empirical studies on environmental information and content analysis of ER or SR (e.g. Kozuma & Umezawa 1995; Kokubu & Nashioka 2002; Kokubu et al. 2002a, 2002b; Ishikawa & Mukoyama 2002; Park 2004). As shown in Table 1, the MOE published and amended its ER and EA guidelines several times. The issuance of these guidelines promoted ER or SR and EA practices and improved the transparency of companies' environmental related practices. However, there were critiques about the usefulness of EA information based on the EA guidelines for internal and external stakeholders' decisions (e.g. Kokubu 2005). Therefore, the major EA research emphasis shifted to EMA around 2010. One way to overcome the decision usefulness problem is by using the Japan Environmental Policy Priorities Index (JEPIX). This tool uniformly evaluates the corporate environmental activities in a quantitative unit. JEPIX is a measurement and disclosure systems of uniform environmental efficiency indicators (Miyazaki 2006). JEPIX was developed by Japanese researchers; therefore, many Japanese companies used this tool to evaluate and disclose their environmental activities (JEPIX, 2016).

One remarkable event in the early 2000s in the field of environmental information disclosure was the publication of the SR guidelines by the Global Reporting Initiative (GRI), an international independent standards organization. The GRI guidelines have been amended

several times and its latest version is known as G4 (see Table 1). In line with the GRI guidelines, the content of research on environmental information disclosures has been expanded, to include not only environmental information, but also social and governance information. Kokubu (2005), Yagi (2011) and Mukoyama (2012) are representative studies in this area. Further, the Business Ethics and Compliance Research Center in Japan's Reitaku University issued its corporate social responsibility accounting guidelines to promote the standardization of the contents of sustainability reports. The Japanese Institute of Certified Public Accountants (JICPA) also presented ESA and reporting research. The JICPA research themes were related to environmental matters until the early 2000s; although, broad sustainability issues or corporate social responsibility issues were considered in their research reports (JICPA, 2016) (see Fig.1 (2d)).

Recently, the (1) and (2) research streams that are illustrated in Figure 1 have joined, forming a new stream of IR studies after the issuance of the IR discussion paper (IIRC, 2011). Japanese IR studies are in the fields of financial accounting, managerial accounting and ESA. The IR studies by the financial accounting researchers generally relate to non-financial information disclosures in an annual report and to financial risk disclosures (e.g. Koga 2011; Konishi 2011, 2012; Furusho 2012; Ochi 2015). For example, Konishi (2012) points out the importance of the key performance indicators and the key risk indicators realize the organically combined financial information and the non-financial information based on the current trends of the expansion of the contents of non-financial information in an annual report. The IR studies based on ESA research, generally stresses the importance of social and environmental information (Mukoyama 2012) and the strategic disclosures of sustainability information (Yagi 2015). Further, as the objective of IR is to explain how to create value for the entity, IR needs to include business management information. Therefore, managerial accounting researchers propose the usefulness of BSC to prepare IR for the entity (Ito 2014; Uchiyama 2014).

ENVIRONMENTAL MANAGEMENT ACCOUNTING (EMA) RESEARCH

As explained in the section II, Japan has developed the external reporting aspect of ESA since the late 1990s. However, EMA research developed not only from the emergence of the EFA or EA, and the implementation of EMS introduced in various companies (Ogawa 2013), but also by the following domestic and international trends.

(1) The environmental accounting project for environmental management implemented by the USEPA in the early- to mid- 1990s.

(2) Large European-based projects such as 1) the Eco-Management Accounting as a Tool of Environmental Management (ECOMAC) projects that were also implemented in the early- to mid- 1990s; 2) the EMA

research project of the European Environmental Management Accounting Network; and 3) the environment costing handbook published by Germany's Federal Ministry of the Environment and the Research on MFCA by the Environmental Management Institute of Augsburg in Germany.

(3) The EMA project of the United Nations Sustainability Development Department, which includes MFCA.

(4) The 'Eco-business development and promotion research (environmental accounting)' project that METI implemented from 1999 to 2001, which took into account the domestic and international research outlined in (1)-(3) above. METI published an environmental management accounting workbook as a final output of the project in 2002.

As indicated in Table 2, the METI workbook considers six types of EMA techniques based on the application category of management. The workbook also proposes how to use th techniques.

TABLE 3 EMA TOOLS BASED ON THE APPLICATION CATEGORY OF MANAGEMENT: METI WORKBOOK

Application Object	Management Area	Type of EMA Techniques	
Company and Site	Capital Investment	Environmentally Conscious Investment	Environmental Budget Matrix
	Process of production and Physical Distribution	Material Flow Cost Accounting	
Product	Product plan and design	Environmentally Conscious Target Costing	Environmentally Conscious Performance Evaluation
		Life Cycle Costing	

In Table 2, the EMA for the company and the site is environmentally conscious investment and MFCA. Environmentally conscious investment is an investment decision technique that takes into account the environmental costs and effects on conventional capital investment. The MFCA technique divides the material flow and cost on the process of materials and raw materials procurement, production, physical distribution into products and waste (loss). This means a thorough management of losses.

Next, the EMA for the product is environmentally conscious target costing and LCC. These techniques are intended to complement consideration of the environment in the planning and design stage of a product from a cost perspective. Environmentally conscious target costing is used for cost reduction and profit management in the planning and design stages of environment-friendly products. It achieves the consensus of the relevant company departments, such as technology, production, sales, purchasing, and accounting. The LCC technique promotes the efficient management of product acquisitions. The manufacturer uses LCC to measure, manage, and report all of the costs incurred in the entire lifecycle process of a product, from the research and development of a product to its disposal and recycling.

Finally, the environmental budget matrix and environmentally conscious performance evaluation are used to manage environmental conservation activities and to analyse cost and effect related to the activities. These

are also available for understanding the effect of the environmentally conscious product design, and of capital investment. The environmental budget matrix applies PAF (prevention-appraisal-failure) approach of quality costing. This technique explains the causal relationship between prevention costs, appraisal costs, and failure costs (internal failure costs and external failure costs) by using a worksheet to allow for the overheads in a matrix form. It also logically plans environmental management goals and objectives, and examines the associated budgeted costs. The environmentally conscious performance evaluation is a technique that evaluates the economic and environmental aspects in a business segment of the performance evaluation system that has been introduced into a company. For example, Japan's Ricoh Company, Ltd. introduced a strategic target management system based on the BSC, and conducted a performance evaluation.

Environmentally conscious investment, environmentally conscious target costing, environmental budget matrix, and environmentally conscious performance evaluation are all techniques that account for the environmental factors based on the existing management accounting techniques. However, the MFCA and LCC techniques are not obtained by adding the environment factors to the existing cost accounting system. These techniques are positioned as a comprehensive technique that has its own database (Kokubu 2007).

A number of these techniques are not used in practice. However, MFCA is becoming the mainstream technique for EMA research and practice. MFCA can implement resource conservation and cost reduction through waste reduction, and thereby improve resource productivity. ISO14051 (published in 2011) arose from the research and practice in Japan, including MFCA research and investigations that were carried out in Europe and the United States. Additionally, there are investigations on the integration of MFCA and an environment budget matrix (Ito 2009), on improvement activities and budget management (Nakajima and Kimura 2012), on supply chain management (Kokubu 2007; Kokubu et al. 2015), on applicability to carbon management (Omori et al. 2015), and on the integration of life cycle assessment and carbon footprint (Kokubu et al. 2015).

Japanese EMA research includes six main techniques based on the application category of corporate management, the MFCA feasibility studies, and a new model based on MFCA. However, Japanese companies must aim for the simultaneous realization of environmental protection and profits by the use of EMA techniques, through the partial optimization or the total optimization of environmental management. Research is also needed on the effectiveness of the EMA technique for the decision making of the information users in the company. As described in section IV, it is important to consider the feasibility or the scalability of the EMA techniques used by the regional and the national economic entities.

Recently, Japanese companies have conducted corporate social responsibility management or sustainability

management based on creating shared value concepts and ISO26000. Therefore, it is necessary to develop a new management accounting model to support such management, while applying the EMA technique. Recent research on the management accounting model includes a sustainability BSC model analysis (Oka 2010), and the applicability of the sustainability BSC to support sustainability supply chain management (Kanetoh 2015). The above discussion shows that EMS studies are needed to conduct the development and practical applicability of the EMA technique for a company. Further research is needed to expand the applicability of the technique for a new economic entities such as regional and national and sustainability management in the future.

MESO ENVIRONMENTAL ACCOUNTING

As mentioned in section I, EA research on regions are popular in Japan. The term *meso* means middle or intermediate; hence, meso accounting encompass the middle field of micro and macro accounting. Koguchi (1986) was the first to proposed meso accounting for water resource management in Japan. Meso EA is also approached by both micro and macro accounting, and is developing in the area of EA for natural resources accounting for local authorities and water utilities, such as forest and water resources, and industrial clusters.

1. Environmental accounting for local authorities and water utilities

As the disclosure of EA information based on the MOE guidelines increased, some Japanese local authorities also disclosed EA information in their ER. Local authority EA can be classified into three aspects; disclosing the costs and benefits of environmental conservation activities for the entity; disclosing the environmental costs incurred in the entities' programs and projects and the benefits accrued in its jurisdictions; and a combination of the first two classes (Kawano 2001).

There is a greater interest in EA in the waterworks bureau of a local authority than in its other administrative offices. Many Japanese waterworks bureaus disclose EA information in line with the MOE guidelines. These bureaus produce and preserve water as a natural resource: the environmental benefits exceed the environmental costs, acting as a positive driver for the bureaus to disclose the information (Kokubu 2006).

A Japanese citizen group proposed using waste accounting to promote the general understanding of the costs of the treatment and recycling of general wastes (Bin Saishori Network 2005; Yagi 2006). After waste accounting trials at some municipalities, the MOE established the Accounting Standards for General Wastes (MOE, 2007) in 2007. Subsequently, many municipalities introduced the standards, and disclosed detailed waste treatment and recycling costs information in line with the standards.

Meso EA is also approached from a macro accounting perspective, including through the system of environmental-economic accounting (SEEA). SEEA refers to "a system for organizing statistical data for the

derivation of coherent indicators and descriptive statistics to monitor the interactions between the economy and the environment and the state of the environment to better inform decision-making" (UNSD 2016). The Cabinet Office of Japanese Government, which is in charge of compiling macro accounting information, estimated the SEEA for the overall Japanese economy in 2009, and further estimated the SEEA for water circulation in Japan in 2012. Additionally, three Japanese prefectures estimated the SEEA for each jurisdiction under the initiative of the Economic and Social Research Institute of the Cabinet Office (ESRI, Cabinet Office, 2016).

2. Environmental accounting for forest resources

Approximately 70 percent of Japan's landmass is covered in forests; however, the total forestry output has been in decline since 1970s. Sustainable forestry accounting is a recently developed management tool designed to overcome this situation. The objective of the tool is to achieve the sustainable cultivation and management of forests by the forestry firms. Forests are not only a resource for wood products, but also are CO₂ sink. Hence, forestry accounting includes EMA development to grasp forestry costs and the corresponding environmental conservation benefits or the forests absorption credits (Maruyama, 2010).

Some stock oriented EMA studies seek to evaluate environmental assets such as company-owned forests. For example, a stock-oriented EMA was developed for a company that operates an environmental conservation oriented theme park. This EMA model measures the stocks of and the changes in, biodiversity, continental assets, marine area assets, man-made environmental assets, environmental liabilities, and environmental capital (Yagi and Saio 2005).

Japan introduced a national strategy called the 'Biomass Nippon General Strategy' in 2006, and further enacted a basic law for biomass promotion in 2009. These initiatives generated an increased social interest in biomass resources generated from forests, such as woods, timber from forest thinning, and thinning residues. Such resources are a carbon neutral energy source and a positive driver for local economic growth. Biomass EA is an EMA tool that measures the overall economic, environmental and social aspects of biomass businesses. This tool measures the stocks and flows of the woody pellets, ethanol, and electricity that are generated from forests stocks, the wood products output from forests, and the woody wastes, which are all included in the biomass value chain.

Biomass EA generates information encompassing the entire biomass value chain; hence, its users can understand the objectives of and the indicators for, the forests biomass stocks and flows (Table 2). Biomass EA facilitates decision makers when considering the biomass business that is appropriate to the regional environmental and the social environment, based on local forest reserves. Further, biomass environmental information can contribute to a consensus among regional stakeholders,

such as local authorities, companies, employees and residents (Yagi et al. 2015).

TABLE 4 EXAMPLES OF OBJECTIVE AND INDICATORS IN BIOMASS ENVIRONMENTAL ACCOUNTING

Objects	Terms	Policy goals	Environmental indicators	Economic indicators	Social indicators
Forest resources (Biomass stocks)	Long	Conservation of eco systems	Biodiversity	Multiple value of forest	Creation of regional brand
	Mid.	Volume of forest stocks	Cumulative dosage of standing tree	Asset value of forest	Living with nature
	Short	Establishing forest management systems	Rate of thinning	Sales of thinned woods	Activation of rural area
Forest flows (Biomass flows)	Mid.	Activation of forest flows	Reduction rate of GHG	Profitability of business	Stable local society
	Short	Effective use of forest biomass	Usage rate of forest biomass	Sales of electricity	Employment creation

3. Environmental accounting for water resources

Japanese research on accounting for water resource management started with Kamiya's study in 1958. This study considered a land improvement district as an accounting entity, and stressed the importance of managing farm irrigation facilities included in the district. Subsequently, water resource accounting has examined the imbalance of raw water management costs between old and new developers of water resources, and the capital maintenance of dams (Kawano 1983; Harada 1983; Koguchi 1983). These studies set a river system as a management boundary, and emphasized the necessity of water resource accounting in water utilities.

With the increased public awareness of the importance of water resources since the 2000s in Japan, came a renewed interest in resource accounting. Japan enacted a the Basic Law on the Water Cycle in 2014 as a basis for the general administration of water, to enhance accountability and the integrated management of its water resources. Concretely, Japanese Cabinet Office tested macro-based water accounting in 2010 (ESRI 2010). This study tries to clarify the role of water circulation in the Japanese economy. Further, micro-based accounting research has emerged that stresses the importance of constructing a water accounting system to improve the accountability to the water information users and of using the water information for the integrated water resource management (Omori, 2015).

4. Environmental accounting for industrial clusters

Japanese EMA studies for industrial clusters started around 2010, with an examination of food industry clusters in each region. This study looks at promoting local economy development in the food industry clusters. EMA studies on industrial clusters apply a BSC to manage the economic aspects of the entire cluster, and to analyse the relationship between each organization within the cluster (Takahashi, 2010). The BSC acts as a shared information system to realize the maximum benefits of the cluster. Further research examines the industrial

cluster BSC includes sustainability aspects has been started (Kanetoh, 2015).

CONCLUSIONS AND OUTLOOK

Since 2000, ESA research in Japan has been developed in each identified area, such as information disclosures, managerial accounting and meso accounting. Japanese companies have introduced strategies for CSV, sustainability, integrated thinking, environmental business, and the management of global warming in their corporate management. Further, the standardization of environmental and sustainability information disclosures has made steady progress, through the issuance of ER and EA guidelines, IR frameworks and the Corporate Governance Code. Japan has been criticized for lagging behind in socially responsible investment; however, information users have been actively using sustainability information, since the Principles for Responsible Investment of the United Nations were signed by the Government Pension Investment Fund. Additionally, there is a growing number of responses for the Carbon Disclosure Project by Japanese companies, and Japan's Principles for Financial Actions for the 21st Century has been endorsed by 223 institutions (as of June 30, 2016) (MOE, 2016).

In response, there are four ways that ESA can develop in Japan. First is the development of the ESA model corresponding to the long-term sustainability strategy of the company. Second is the development of the ESA model corresponding to the widened stakeholder information needs and the value chain. Third is to elucidate the effectiveness of disclosed ESA information by conducting empirical studies, and fourth is the evaluations of natural capitals, such as regional biodiversity, forests, and water.

Finally, the realization of the importance of sustainability aspects is increasing in corporate management. Therefore, it is expected that ESA studies in Japan will be promoted as a prerequisite tool to realize the sustainable business of companies.

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Economic Sustainability in Urban Renewal Projects

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INTRODUCTION

As the birth, developing and spreading places of culture and civilization, cities also themselves, grow, develop, transform and sometimes get smaller throughout the history. Economic, environmental and social quality of life declines occurring over time in urban areas, requires planned interventions to the built environment. Also to meet new demands and expectations coming to the agenda, as a result of improved policies to ensure economic growth and social welfare, urban renewal projects are implemented [1]-[2]. Urban renewal includes activities such as upgrading the physical quality of buildings and their environments, preservation of cultural heritage, provision of social development for those living in the area and loading economic functions suitable to the conditions of the area [3]. So it covers quite a large area like housing, business, health, education, transport and other economic, social and environmental issues. From this point of view, urban renewal will be an important tool to get a sustainable city, which is defined by Geenhuisan and Nijkamp as the city where socio-economic interests and environmental and energy concerns are harmonized in order to ensure continuity in change [4]. To achieve this urban renewal should be conducted in a manner that is compatible with economic, environmental and social dimensions of sustainability.

Definitions of sustainability like, managing the economic system in a way so that we could maintain our lives with the dividends of our resources without extinguishing hope for continuance or improvement of the future standard of life with today's decisions [5]. and growing of real per capita gross national product over time and the growth is not to be threatened by biophysical (pollution, resources depletion) and social influences [6] are the definitions which brings economic dimension of sustainability in the foreground. Economic sustainability includes developing a variety of strategies which enables use of existing resources in the most advantageous way, at the same time, it is related also with creation of financial resources to implement environmental and social sustainability and provision of the continuation of this in a sustainable way [7]. In this respect, an urban renewal project which is economically unsustainable, can not be environmentally and socially sustainable. To be economically sustainable in the long-term, urban renewal should attract additional investment to the region, increase employment by creating new business areas, revitalize the region's economy, increase the rent and sale values of properties by increasing the charm of the region, improve the economic situations of the inhabitants and reduce spending's by saving from the use of any resources.

MAIN IDEA

In this study, it is considered the economic sustainability dimension of urban renewal. By a comprehensive literature review, the relationship between built environment design elements and economic sustainability is demonstrated. For example, Lee argues that establishment of public buildings and local commercial activity areas such as shops, banks, cafes enhance economic sustainability by increasing employment and making the region attractive for potential residents [8]. Shultz and King found that the positive effect of open spaces on the property values [9]. Mixed use contribute to economic sustainability with its results like reducing the need for cars, increasing vitality, promoting daytime and evening activities [10]. Investors can pay higher prices for buildings with flexible design [11]. An effective transportation system is an essential element for quality of life, for successful economy and for pleased society [12]. Li and Brown (1980) have found housing prices is increased with the decline of intensity and visual appearance affects real estate prices [13]. With increase in permeability of street and building layout, the total number of commercially effective points also increases [14]. Protection and rehabilitation of existing buildings has a positive impact on the economy in terms of time and cost saving [15]. Recycling and reuse of materials provides economic advantages compared to new production [16]. Real estate prices and rental values of renovated buildings increase because of their physical condition improvements and developments implemented with urban renewal [15]. Reducing energy consumption with new or renovated buildings, nature will be protected and expenses will be saved [16]. In this way it is possible to contribute to both economic and environmental sustainability. It is known that, protection of historical buildings and local identity in an urban renewal region, stimulates the tourism, so the economy.

RESEARCH

In the first phase of this study, 50 built environment design elements that may arise in an urban renewal project were identified, and then this number was reduced to 32 with the pilot study. Contribution of these 32 elements to economic sustainability of an urban renewal project was evaluated by a 5 point likert type survey carried out with participation of 323 experts, who are mainly city planners, architects and engineers living in Istanbul and Ankara and taking part in urban renewal projects. The results were analyzed with SPSS software and the design elements were grouped by factor analysis under six different factors. By the way 4 design elements were eliminated during factor analysis, since they contributed more than one factor. The factors were Transportation and Accessibility (consisting of 6 design

elements), Built Environment Quality (consisting of 6 design elements), Conservation of Natural Resources (consisting of 5 design elements), Promotion of Social Life (consisting of 3 design elements), Trade and Economy (consisting of 5 design elements) and Connection with the Past (consisting of 2 design elements). The weight of the factors over economic sustainability of urban renewal projects, was identified by Analytical Hierarchy Process, with participation of 60 people consisting of academics and urban renewal practitioners. The weights were found as Transport and Accessibility 14 %, Built Environment Quality 20%, Conservation of Natural Resources 21%, Promotion of Social Life 18%, Trade and Economy 17% and Connection with the Past 9%.

CONCLUSION

As a result of this study, to ensure economic sustainability in an urban renewal project, which design elements under what factors should be included was found. By finding the weights of each factor with AHP analysis, a model which could evaluate economic sustainability of an urban renewal project was created. The results are considered to be a guide to urban renewal stakeholders in Turkey and in all over the world, in the way of ensuring economic sustainability of urban renewal projects.

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Value Added Statements in Latin America, a rising trend

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The last ten years have witnessed the increase of Value Added Statement (VAS) reporting in several countries in Latin America. Not only different models have been tested, but also a growing amount of companies have begun to report their VAS. Furthermore, only a few companies discontinued their VAS reporting to this moment. Thus, this paper intends to explore this relatively unknown phenomenon, its recent history and its possible consequences both for companies and society.

VAS reports are accounting reports that show how economic value created by a company is shared among its stakeholders. While several VAS models exist, all of them share this common focus: instead of focusing only on the bottom line as a conventional Profit and Loss Statement does, VAS aim to explain value distribution to a wider range of stakeholders. The following graph shows this idea one of those VAS models proposes the following framework [1]:

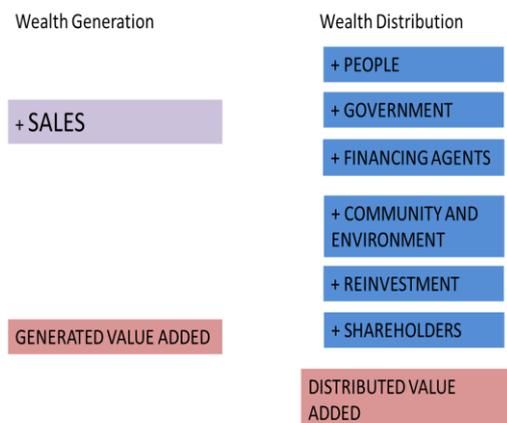


FIGURE 1: GENERAL STRUCTURE OF A VALUE ADDED STATEMENT

There is a rich history of VAS in Europe. Burchell et al. [2] famously present the “value added event” in the UK, a rapid raise of interest in VAS that eventually waned. Buchell et al. suggest that a “constellation” of diverse social factors allowed this sudden (while ephemeral) interest to happen. The disarticulation of this “constellation” (mostly due to a change in government at that time) led to a gradual disappearance of the VAS in the UK. Similar situations were documented in Spain [3], France and Germany [4]. VAS were also proposed in the US [5], Asia [6], and South Africa [7].

In spite of being relatively new to South America, VAS enjoyed in the last years a sudden surge of interest in the region. While at first glance this may seem a déjà-vu of the “value added event” in the UK in the seventies, this paper contends that the “constellation” of factors in Latin America is indeed at motion today and that consequently

VAS can be expected to be a growing trend in that region.

Probably the single most important development happened in Brazil, where interest grew for a local VAS model that had been used since the late nineties [8]. As many companies were beginning to voluntarily publish their VAS reports, researchers could profit from those new sources of data to further explore income distribution in Brazil. For instance, Pinto and de Souza Ribeiro [9] studied a set of manufacturing firms in Santa Catarina State, while de Souza Ribeiro & dos Santos [10] analyzed electricity distribution firms in Brazil. The sustained interest in this VAS model eventually led to its becoming mandatory for all quoted firms in 2008 [11].

Outside of Brazil, VAS reports in Latin America have been made on a voluntary basis, usually following other VAS models. Two of these models are illustrated in this paper. First, the Fourth Financial Statement (FFS) created by Luis Perera, former partner of a Big Four firm in Santiago de Chile [12]. This model has been used by large firms in Colombia, Chile, Uruguay and Mexico. For instance, the two largest companies in Uruguay, ANTEL (the State-owned telephone firm) and ANCAP (the State-owned oil company) have been using this FFS model. In Colombia, the utility firm of Medellin city (EPM) uses the FFS, as well as Grupo Bolivar, a large financial and insurance group. In Mexico, Industrias Penoles, one of the largest silver mine companies in the world is among the oldest reporters of the FFS (now ten years of continuous reporting).

The situation in Argentina is a particular one, as the Argentinian accounting profession has proposed a local VAS model in 2012 [13]. While this model is not mandatory, the accounting profession suggests its use as the main social reporting tool for companies, no matter their size or their being quoted or not.

All these three aforementioned models share strong similarities: focus on value distribution and valuation principles similar to those of conventional accounting. While differences still exist, all three models converge to a more complete explanation for value distribution in the region. It has to be emphasized that these models (as all VAS models) draw their data from conventional financial reports. Thus, they present information that already exists in financial reporting (most notably the Profit and Loss Statement), only that they make the value distribution explicit.

This further explication intends to make these reports

legible to a wider audience, not just specialists. This intention is far from new, for instance Meek & Gray [14] in 1988 were proposing the use of VAS by worker's unions, particularly in the context of salary negotiations. For instance, ANTEL and ANCAP (the two Uruguayan firms) contribute to more than 10% of that country GDP. The way that these two firms share their value should be of interest to policy makers, journalists and the general public.

Moreover, the growing and (to this moment) sustained interest in VAS in Latin America may be linked to the large income inequality in the region – one of the highest in the world. In this context, it is possible that companies feel pressured to explain how they contribute to alleviate this pressing situation. This may be particularly important in the case of companies that are large (as Grupo Bolivar in Colombia), State-owned (as ANTEL and ANCAP in Uruguay) or that use non-renewable resources (as Industrias Penoles in Mexico).

Besides, this emphasis on VAS reporting may suggest the high priority of value distribution in CSR in Latin America. While the Global Reporting model (GRI) includes a table on value distribution as part of its wide framework, VAS reports suggest a priority for the question on how economic value is shared. This does not mean a conflict between both models, but only a matter of diverse social preferences. Indeed, some Latin American companies combine both perspectives by presenting GRI-compliant sustainability reports that include a VAS table in the EC1 performance indicator.

Despite the novelty of this trend, researchers can now begin to conduct longitudinal studies on these reports. For instance, Zicari and Perera [15] explored nine years of reporting at Industria Penoles in Mexico, showing that the company has a consistent value distribution policy over time. As the price of metals frequently fluctuates, value created by this company tends to be volatile. However, this firm managed to sustain a protective policy for employees, while shareholders tended to receive the

full impact of those fluctuations. A similar study in Uruguay shows that ANTEL (the telephone firm) maintained a large and growing part of its value devoted to investing – much in line with their developmental mission as a State owned firm.

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Sustainability Performance and Corporate Governance: a meta-analysis

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SUSTAINABILITY PERFORMANCE AND CORPORATE GOVERNANCE: A META-ANALYSIS

The purpose of this paper is to investigate the association between Sustainability Performance and Corporate Governance applying a meta-analysis to a sample of 68 empirical studies, identifying the underlying effects that moderate the relationship between the variables.

We analyze if the different results are attributable to the subgroups identified in our sample according to, the Corporate Governance system (Anglo-Saxon, Communitarian, Asian,...), the sustainability performance measure (social and environmental or financial) and Corporate Governance measurement. Finding that the relationship between Sustainability Performance and Boards oriented towards CSR is positive, moreover the results are more significant in the continental legal context, and in the social and environmental measures context.

INTRODUCTION

The sensitization of society on a more ethical way of doing business, understood as “doing better at doing good” [1] has had a significant impact on business involvement in areas related to Sustainability Performance (SP) and Good Corporate Governance (GCG)¹⁸. This ethical awareness has resulted in a significant variation in corporate governance tools and social performance improvement strategies and has led to an increasing number and diversity of stakeholders to which corporations must be accountable for apart from shareholders.

In such a changing context, bearing in mind that Sustainability as a social common objective and Corporate Social Responsibility as a strategy to reach it, the social and environmental performance is increasingly important when determining the value of companies and corporate governance is considered the principal mechanism in establishing the strategic direction and responsibility of firms.

Sustainability Performance (SP) in the context of this study is a multidimensional construct, encompassing a variety of social, environmental and financial issues and is defined as an organization’s performance in all dimensions, including Social Performance (Soc P), Environmental Performance (EP) and Economical or Financial Performance (FP) and for all drivers of

corporate sustainability (extensive range of stakeholders) [2].

There are a multitude of Corporate Governance indicators but we will use as a variable a multidimensional construct that will make reference to the characteristics of the Board of Directors, such as the independence of members and its gender diversity.

We have observed that there are a multitude of empirical studies that have linked the characteristics of Corporate Governance and the different types of business performance (financial, social and environmental) with counterpoised and inconclusive results.

Of the meta-analytic studies that have studied the relationship between the analyzed variables, none has analyzed the relationship between social and environmental performance and any variable of corporate governance.

The purpose of this paper is twofold: First, to investigate the link between Sustainability Performance and some Corporate Governance features (board independence, , board gender composition,) applying a meta-analysis to a sample of 68 empirical studies. This will allow us, based on the results of empirical studies completed to date, to obtain additional evidence that will indicate the level of association between the diverse Corporate Governance features and the different performance types (financial, social and environmental). Second, to identify the underlying effects that moderate the relationship between the variables, to this end we analyze if the different results are attributable to the subgroups identified in our sample according to: the Corporate Governance system (Anglo-Saxon, Communitarian, Asian), the sustainability performance measure (social and environmental or financial), and Corporate Governance measure (independence and diversity of the board).

In this context, the potential contribution of our study is to present the degree of association of performance variables (financial, social and environmental) with the CSR orientation of the Board. Where the evidence obtained to date is inconclusive, we find that the relationship between Sustainability Performance and Boards oriented towards CSR is positive, showing that the effect on the social and environmental performance is more pronounced than on the financial performance. We also found that the different legal systems determine the relationship between performance and CG tools.

The analysis of two constructs (measurement of Sustainability Performance and Corporate Governance)

¹⁸ Searching for the term “Corporate Social Responsibility” on Google Scholar (we just focus on quantity, not so much on quality) returns 367.000 results

“Sustainability Performance” 18.800 results.

“Good Corporate Governance” 38.200 results.

“Board Diversity” 5.960results

Date of search 23/05/2016

as moderator of variables allows us to independently study the relationship of each of its components. On the one hand, financial performance or social and environmental performance and on the other hand, for the Corporate Governance measure construct, the independence and diversity of the board,. The uncertainty that could arise from the use of two variables that have not been measured thus far could be decreased.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Our hypothesis and methodological approach must rely on meta-analytic studies that have previously studied the relationship between components that make up SP and CG, the most important being as follows:

Meta-analytic studies focused on financial performance or business value and Corporate Governance variables of different characteristics of the firm: corporate governance and firm performance [3], board composition and size with financial performance [4],[5], board leadership structure and performance [6], ownership structure and firm performance [7] and ownership concentration and firm performance [8].

The association between Corporate Social Responsibility and Financial Performance has been discussed in depth in four meta-analytic studies: [9-12]. The link between Corporate Environmental Performance (CEP) and Corporate Financial Performance (CFP) was also meta-analysed [13].

Finally, disclosure and Corporate Governance were meta-analysed in three different articles [14-16].

A. Financial, Social and Environmental Performance

Dunn and Sainy [17] state that *"the essence of Corporate Social Performance is the recognition or awareness that there are multiple stakeholders against which a business has responsibility towards in the longer term"* and it involves broadening the focus of financial targets covering also social and environmental ones, facing the need to assess and measure both financial and social and environmental performance.

Therefore the economic component of sustainability does not focus solely on the economic situation of the company itself but also includes the effect of the company's activity in the environmental, economic and social situation of stakeholders or interested parties and in the local, national and international economic frameworks [18]. Moreover, Schaltegger and Synnestvedt [19] emphasize the need for environmentally sustainable businesses to also be economically sustainable, otherwise their survival is at risk.

The performance concept we studied in our meta-analysis is analogous to the concept "Triple Bottom Line" that Elkington [20] defines as *"the concept of TBL basically expresses the fact that businesses and other organizations create or destroy value in multiple dimensions considering economic, social and environmental as principal dimensions"*.

There are numerous studies that have tried to empirically contrast the economic impact of CSR through the study

of causality and correlation with financial performance [9-11],[21-23]. Aras and Crowther [24] mention that both the internal management of the company from a financial perspective, and the external management of the environmental impact of the company, coincide when targeting the objective of creating value in the long term.

These studies have shown that the causality between financial and environmental and social performance is positive and bidirectional, so that the role of accounting and the supply of social and environmental information would be coincidental with the role that accounting and financial information would have, justifying the inclusion of financial performance management and management of social and environmental performance as interrelated components of sustainability performance management [2].

So to try to measure sustainability performance, we selected empirical studies that have taken into account different performance variables (financial, social or environmental) and some variables of corporate governance (board composition and diversity, board size, duality and institutional participation).

B. Good Corporate Governance

Corporate Governance is defined as "the system by which companies are managed and controlled" and it is considered that the ultimate responsibility for the design and implementation of the structure of corporate governance lies with the board of directors to the extent to which it is the organ that makes a link between shareholders, managers and the different stakeholders or interested parties of the company [25].

Board members should be responsible for setting the company's mission and the strategies to achieve this mission [26], the board being the main body responsible for designing, implementing and improving the contributions that the company will make to sustainability, understood as the objective and common good of society.

The composition of the board, the typology of its directors and its gender and nationality diversity has been considered as mechanisms of good corporate governance [27-28].

For decades the importance of the presence of independent directors on the boards has been recognized as a way to improve their effectiveness [5],[29-30] and it is in the context of agency theory [31] where it is first considered that independent directors, as they are not related to the management of the company, provide additional financial performance benefits as they further protect the interests of shareholders [5],[27],[32].

As for social and environmental performance, it is the stakeholder theory [33] which considers that the presence of independent directors improve the social and environmental performance of the company, as they represent the social and environmental interests of the various stakeholders of the company.

The heterogeneity of the board, understood as its diverse composition in terms of its independence, gender and nationality of directors and its impact on economic and social and environmental performance, has been extensively studied in recent decades with mixed results. Amongst others, Rao et al. [34], find a positive relationship between CSR disclosure and independence and gender diversity. Meanwhile, Minguez-Vera and Lopez-Martinez [35], detected a positive relationship between board gender composition and financial performance in Spanish SMEs. Cuadrado Ballesteros et al [36], found that board diversity, measured by the presence of female and foreign members, has a positive effect on the socially responsible behavior of companies. Adams and Ferreira [37], instead found a negative relationship between gender diversity and financial performance, Kaczmarek et al. [38], also observed a negative relationship between financial performance (Tobin's Q) and the independence of the board for a sample of companies in the UK.

C. Variables moderating the relationship between sustainability performance and good corporate governance.

We believe that our sample reflects a great variability in the meta-analytic results as they come from very different legal, economic and cultural contexts, where the commitment to sustainability and the requirements and corporate governance practices are very different. In order to try to narrow this variability, we have studied a number of moderating variables:

- Measurement of the variables; and
- Legal and governance systems as moderating variables.

MEASUREMENT OF VARIABLES AS MODERATING EFFECT

In this moderating variable we want to analyze, on the one hand if the way of measuring good corporate governance (independence, diversity) affects its performance according to the evidence of non-coincidental results from Haniffa and Cook [32]; Martinez - Ferrero et al.[36]; Rodríguez-Ariza et al.[39]; Sundarasan et al.[40]; Zhang [41], or with the same positive results obtained by Barako and Brown [42]; Choi et al. [43]; Garcia - Sanchez et al. [44]; H. Khan [45]; Kiliç et al. [46].

On the other hand, regarding the measurement of the other variable, namely sustainability performance, Zahra and Pearce [29, pg. 327] suggest that the use of different ways of measuring performance (accounting, based on the market and they note the lack of measuring social performance as at that date), may affect the relationship of performance with the different characteristics of the board. This moderating behaviour of alternative measures has been maintained and has since been studied often.

Thus, how to measure performance has been considered as a moderating variable in meta-analytic studies, both by those who have studied Financial Performance [3-7], [13],[47-48]and by those who have analysed Social and Environmental Performance [9-11],[13].

To evaluate the effect of the moderating measurement variable of sustainability performance, we divided the sample into two different subgroups, in the first we include studies (28) that have used financial performance as a measurement variable, in line with other meta-analytic studies that have measured financial performance [3-7],[13],[47-48]. In the second subgroup we include studies (40) that have measured the social aspect of sustainability performance.

In our meta-analytic work, as a result of the characteristics of the studies analyzed and with the aim of having a significant number in each group, we have grouped the studies based on three variables measuring social and environmental performance: Orlitzky et al., [9], pg 408; Margolis et al.[11], pg 9; Allouche and Laroche [10], pg 17.

- a) Disclosure of social and environmental performance (CSR Disclosure)
- b) Indices and ratings on environmental and social performance (CSR Index)
- c) Direct and objective measurement of social and environmental performance (CSR Performance)

Legal and governance systems as moderating variables

Finally, the third moderating variable studied is the different corporate governance systems that have evolved worldwide. Many authors have considered that these different legal systems have had a significant effect on the different types of sustainability: Aguilera et al. [49]; Ballesteros et al. [36]; García- Sánchez et al. [44]; Miras-Rodriguez et al. [50].

Different meta-analytic studies have also used different legal systems and corporate governance models as moderating variables. Sanchez-Ballesta and García-Meca [7] divided the studies under the Saxon Anglo, Continental systems and studies with companies from different legal systems to analyze the relationship between ownership structure and financial performance. The same authors in 2010 when analyzing the relationship between board independence and ownership concentration with voluntary disclosure divide the sample in Anglo-Saxon, Continental and Asian. Siddiqui [3], instead divides the sample into common law systems or Anglo-Saxon and civil law systems.

Based on previous studies, we divided the sample into three different subgroups: Anglo-Saxon, Continental and Asian. Some studies include companies with different legal systems which we have excluded from the analysis of this moderating variable.

The diverse and opposite evidence observed in published studies to date does not allow us to determine the sign of the relationship between the variables analysed, considering the following working hypothesis:

D. Hypothesis development

Basic hypothesis on the relationship Corporate Governance - Sustainability Performance

H0. There is an association between Good Corporate Governance and sustainability performance.

Moderator effects

The results of the meta-analysis presented by subgroup allows additional evidence on the strength of relationships between variables [51].

Sustainability Performance measurement

A. Financial performance

H1.1 There is an association between Good Corporate Governance and Financial performance.

B. Social and environmental performance

H1.2 There is an association between Good Corporate Governance and Social and environmental performance.

Corporate Governance measurement

Board independence

H2.1 There is an association between board independence and sustainability performance.

Diversity of the board

H2.2 There is an association between Diversity of the board and sustainability performance.

Corporate Governance system

H 3 The Corporate Governance system moderates the relationship between Good corporate Governance and sustainability performance and his different forms of measurement

META-ANALYZED STUDIES

We use different search techniques to identify relevant studies [52]:

1. Searching in electronic databases: Proquest, EBSCO, Emerald, scientific articles with different combinations of keywords "Sustainability, environmental, social, social corporate, responsibility, financial, performance" with "Board, composition, independence, diversity";
2. Consultation of accounting and financial magazines that publish articles of empirical research of the analysed variables (Journal of Business Ethics, Corporate Governance: An International Review, Journal of Financial Economics, International Journal of Economics and Financial Issues);

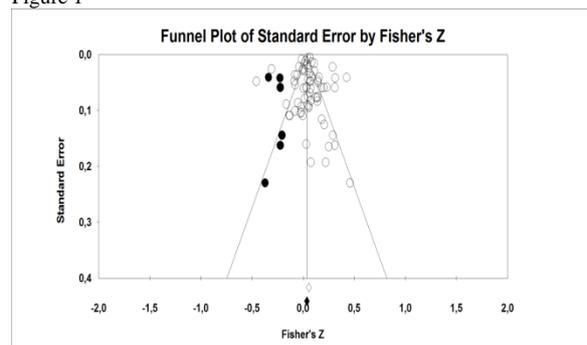
3. Review of different articles that gather empirical studies and meta-analytic studies that have previously studied some variables of our study;
4. Study of the most recent articles' citations; and
5. Study of the articles that have mentioned the most significant methodological studies [53-54].

One of the most important biases in meta-analytic studies is called publication bias [55], where it is considered that the studies with less significant results between the variables studied are more difficult to publish than the studies that show significant results, both as a result of the reluctance of publishers [56], as for the non-delivery/presentation of such results by the researchers [57].

In order to study publication bias, we included the analysis of tolerance index of null results by Rosenthal (Fail-safe N). This index estimates the number of studies that have not been published that would be necessary for the effect size, or average correlation coefficient obtained in our case (0.055), to become zero or null. In our meta-analysis it has been estimated that the value of the statistic is 3.342, which means that the number of unpublished studies required is very large and can rule out publication bias.

To complement the study of publication bias we used the Funnel Plot graph (Figure 1) for the detection of publication bias, which is represented by plot asymmetry. The graph shows that the distribution of the 68 studies is fairly homogeneous and it has been estimated that six additional studies would be needed (with negative results, which would decrease the average effect size, which would remain positive).

Figure 1



This graphical tool has a load of subjective interpretation that needs to be supplemented by more rigorous statistics [58]. as that proposed by Egger et al. [59], which in our case establishes that there is no indication of asymmetry and no publication bias ($t(66) = -0.30734$ $p = 0.37978$).

In cases where studies publish several effect sizes, for example Sahin et al. [60], published the correlation coefficients between the percentage of independent directors and three different performance measures of sustainability (CSR Disclosure index, ROA and Tobin's Q), we follow Hunter and Schmidt [53] and calculate the average coefficient in order to calculate the overall average coefficient [6], considering a single coefficient

per study to meet the condition of independence between the effect sizes for the analysis of the moderating effects.

Table 2

Sample selection process	
Initial Sample	142
Criteria used to exclude studies	
Not enough statistical data	(50)
Exclude GCG variables studied	(22)
Other SP variables not studied	(2)
= Final Sample	68

METHOD.

In meta-analytic practice there are two statistical models, the fixed effects model and the random effects model [54],[58],[60-61]. The first one assumes that all studies are studying the same effect size (correlation coefficient in our case) and the observed variability is exclusively the result of sampling error. We apply the random effects model assuming that there are variables that moderate the relationship between the variables and that the studies included in the sample are not homogeneous and there are different subgroups in which the value of population effect size differ.

Effect sizes

In a meta-analysis the effect size measures the magnitude of the relationship between two variables [51], in our study the average correlation coefficient represents an approach to the degree of connection between our performance variable and different Corporate Governance tools.

Following the Hedges and Olkin technique we perform the meta-analysis of the effect sizes of the individual studies fulfilling the following steps:

For the analysis we employed SPSS macros provided by Davis Wilson and Comprehensive Meta-Analysis software.

First we calculate the average correlation coefficient of the overall relationship between sustainability performance variables and Corporate Governance as a weighted average of empirical correlations.

In this method correlation coefficients are first converted to standard normal metric (Fisher's z ; Z_r),

$$z_{r_i} = \frac{1}{2} \log_e \left(\frac{1+r_i}{1-r_i} \right)$$

In which r_i is the correlation coefficients of the study i .

Transformed effects are used to calculate a weighted average (3) and a confidence interval (4) and the results should be converted back to correlation coefficients (r) before being reported (2) (Field and Gillet, 2010)

$$r_i = \frac{e^{2z_{r_i}} - 1}{e^{2z_{r_i}} + 1}$$

$$\bar{z}_r = \frac{\sum_{i=1}^K w_i z_{r_i}}{\sum_{i=1}^K w_i}$$

In which k is the number of studies in the meta-analysis and w_i is the weight of each study.

In our case, we derive that relationship between performance and Corporate Governance is positive, weak but positive in the 68 studies and for a sample of 130.807 firms.

$$\bar{r} = 0,055$$

In the next step we use the mean correlation coefficient (before transforming (\bar{z}_r)) and standard deviation ($SE(\bar{z}_r)$) to calculate the confidence interval of 95%.

$$[(\bar{z}_r) - 1.96SE(\bar{z}_r) ; (\bar{z}_r) + 1.96\sqrt{\bar{z}_r}] \quad (4)$$

In our case the non-inclusion of zero in the confidence interval [0.003, 0.079] indicates that the result is significant, therefore we can discard the hypothesis that the relationship between performance and Corporate Governance is zero throughout the sample.

Finally to analyze the homogeneity of empirical correlations we used two different complementary statistics:

A. Cochran's Q

$$Q = \sum_{i=1}^k w_i (z_{r_i} - \bar{z}_r)^2 = 810,834 \quad p=0,000 \quad (5)$$

Under the hypothesis of homogeneity Q statistic follows Pearson's χ^2 distribution with $K-1$ degrees of freedom, if the calculated value exceeds the tabulated one for the specified level of significance the homogeneity hypothesis is rejected.

This contrast only reports about the existence of heterogeneity, but without quantifying it, to measure the degree of heterogeneity can be used the following statistic.

B. Higgins, and Thompson [63], I^2 statistic, which measures the degree of heterogeneity.

$$I^2 = \frac{Q - (K-1)}{Q} = 91,74\%$$

This statistical reports on the % of the total variability generated by the moderating variables variability.

In our case both statistics show that our results are not homogeneous, therefore the observed (0.055) positive relationship has a great variability and moderating variables must be analysed to justify and reduce variability.

Moderator variables

Appendix 2 shows the subgroups we considered to analyze discrete moderating variables, fulfilling the criterion of independence and considering each study in one of the subgroups in which we divided the sample in the analysis of each moderator variable.

RESULTS

META-ANALYSIS OF OVERALL RELATIONSHIP

First we performed a meta-analysis to determine the overall average correlation coefficient between Performance and Good corporate governance practices in the 68 studies.

Table 3 presents the results obtained by applying the method of Hedges et.al. to the total sample and subgroups identified to assess the moderating variables.

The mean correlation coefficient between sustainability performance (SP) and the Good Corporate Governance

tools (GCG) for 68 studies and 130.807 firms sample size is positive 0.055 (Table 4, row 1), with a confidence interval of 95% [-0.03, 0.079], the non-inclusion in the range of zero implies that the relationship between the variables is significant.

On the results of the different statistics used to test the homogeneity of the sample, it appears the great heterogeneity of the studies included in the sample, $Q = 810,834$, $p < 0.001$ and $I^2 = 91.74\%$, and the sampling error alone justifies 8.26% of the observed variability in the sample, estimating that the remainder is the variability generated by the moderating variables ($I^2 = 91.27\%$)

The observed heterogeneity confirm existence of possible moderating variables we studied making a meta-analysis of independent subgroups identified for each moderator variable.

META-ANALYSIS OF MODERATORS

First we study the legal system as moderating variable in the overall relationship, the results indicate that the relationship between sustainability performance (SP) and the tools (GCG) is positive for studies in companies of continental legal context, with an average correlation coefficient of 0.071 (table 4, row 4) and a confidence interval of 95% [0.031, 0.111], the results are not significant for Anglo-Saxon ($r = 0.033$, row 2) and Asian ($r = 0.073$, row 3) legal system.

The heterogeneity observed decreases significantly in all subgroups, which together with the significance of the average correlation coefficient indicates that the legal system or corporate governance moderates the relationship between sustainability performance (SP) and the Good Corporate Governance tools (GCG).

The second variable moderator we analyze is the measurement of sustainability performance, in this case we split the sample in studies that have used as a measurement variable the Financial Performance (FP) or the Corporate social and environmental performance (CSP), the mean correlation coefficient with Good Corporate Governance tools is positive ($r = 0.003$)(Table 4, rows 5) with the FP measurement but not significant, and positive and significant for de Corporate Social Performance 0.061 (table 4, row 9) and a confidence interval of 95% [0.018, 0.104].

The heterogeneity observed decreases in both subgroups, in the subgroup that uses FP as a unit of measure the result of the statistical Q shows that the results for the 28 studies are hetererogeneous and no significant, so we split the sample by legal systems, (table 4, row 6,7,8) obtaining variability decreases but continued without obtaining significant results.

Quite the opposite, the subgroup that uses CSP as a unit of measure the result of the statistical Q shows that the results for the 40 studies are homogeneous and significant (table 4, row 9), therefore it would not be necessary to deepen the analysis and search more moderating variables.

The third moderating variable we studied is how the Good Corporate Governance is measured by the studies, differentiating the measurement by the % of independent directors and board diversity (gender and nationality).

Both measuring ways are positive and significant, having greater relevance the diversity ($r = 0.112$; 95% CI [0.068, 0.156])(Table 4, rows 17) than independence ($r = 0.067$; 95% CI [0.029, 0.105])(Table 4, rows 13) in relation to the sustainability performance, heterogeneity decreases but still do not get consistent results, the moderating variables must still explain 60% of the variability.

Table 3

		K	N	TE(\bar{r})	SE \bar{r}	z	sig.	-95% CI	+95% CI	Q-test	sig.	I ²
1	Overall relationship (SP- GCG)	68	130.807	0,055	0,0127551	4,388	0,000***	0,03	0,079	810,834	0,000***	91,74%
2	Anglo-Saxon	25	69.334	0,033	0,01785714	1,859	0,063	-0,002	0,067	40,471	0,019**	40,70%
3	Asian	19	7.601	0,073	0,05561224	1,307	0,191	-0,036	0,18	13,728	0,747	-31,12%
4	Continental	13	47.567	0,071	0,02040816	3,469	0,001***	0,031	0,111	16,495	0,17	27,25%
5	Financial Perform.-Good Corporate	28	100.764	0,003	0,01377551	0,241	0,81	-0,024	0,031	75,381	0,000***	64,18%
6	Anglo-Saxon	9	49.487	0,017	0,01377551	1,218	0,223	-0,01	0,043	8,204	0,414	2,49%
7	Asian	7	2.871	-0,05	0,07091837	0,688	0,492	-0,189	0,092	6,438	0,376	6,80%
8	Continental	7	46.316	0,033	0,02857143	1,163	0,245	-0,023	0,088	8,867	0,181	32,33%
9	Corporate Social Perform.- Good Corp.	40	30.786	0,061	0,02193878	2,787	0,005***	0,018	0,104	31,89	0,783	-22,30%
10	Anglo-Saxon	16	13.847	0,092	0,04234694	2,168	0,03**	0,009	0,174	12,97	0,605	-15,65%
11	Asian	12	2.871	0,171	0,05459184	3,135	0,002***	0,064	0,273	15,161	0,175	27,45%
12	Continental	5	790	0,15	0,04183673	3,558	0,000***	0,068	0,231	4,502	0,342	11,15%
13	Sustainability Performance(SP) -	40	64.583	0,067	0,01938776	3,463	0,001***	0,029	0,105	91,565	0,000***	57,41%
14	Anglo-Saxon	15	56.005	0,017	0,02295918	0,741	0,459	-0,028	0,063	37,016	0,001***	62,18%
15	Asian	12	5.442	0,125	0,0622449	2,002	0,045**	0,003	0,244	23,445	0,006***	53,08%
16	Continental	9	2.248	0,137	0,04489796	3,053	0,002***	0,049	0,223	6,473	0,594	-23,59%
17	SP-Diversity	28	66.967	0,112	0,02244898	4,925	0,000***	0,068	0,156	68,935	0,000***	60,83%
18	Anglo-Saxon	10	7.329	0,154	0,04336735	3,537	0,000***	0,069	0,236	12,826	0,171	29,83%
19	Asian	7	2.159	0,091	0,13979592	0,647	0,517	-0,183	0,352	3,685	0,719	-62,82%
20	Continental	4	46.062	0,04	0,03061224	1,31	0,19	-0,02	0,1	6,63	0,085*	54,75%
21	Financial Performance - Independence	18	52.637	0,003	0,01530612	0,214	0,831	-0,027	0,034	30,563	0,023**	44,38%
22	Financial Performance - Diversity	10	48.127	0,016	0,04540816	0,343	0,732	-0,073	0,104	21,348	0,011**	57,84%
23	Corporate Social Perform - Independence	22	16.918	0,148	0,04132653	3,576	0,000***	0,067	0,226	37,965	0,013*	44,69%
24	Corporate Social Perform - Diversity	18	13.868	0,184	0,03418367	5,298	0,000***	0,117	0,25	19,349	0,309	12,14%

K: Number of effect sizes
 N: total sample size
 TE: Mean effect size
 SE \bar{r} : Standard error of ES
 CI: Confidence interval
 Q-test: Homogeneity test
 I²: Ratio of study variance due to heterogeneity
 ***significant at 1% level; ** significant at 5% level; * significant at 10% level

The independence is positive and significant for European continental legal system (homogenous result), and diversity for Anglo-Saxon system (not homogeneous).

Finally neither diversity ($r = 0.016$; 95% CI [-0.073, 0.104], Table 4, rows 22) nor independence ($r = 0.003$; 95% CI [-0.027, 0.034], Table 4, rows 21) have a significant impact on Financial performance in the studied sample and for all legal systems

However the Corporate Social Performance is positively and significantly associated with board independence ($r = 0.148$; 95% CI [0.067, 0.226], Table 3, rows 23) as well as with board diversity ($r = 0.184$; 95% CI [0.117, 0.250], Table 4, rows 23)

DISCUSSION AND CONCLUSION

In this study we have integrated the results of empirical studies have previously examined the relationship between good corporate governance practices and sustainability performance.

The relationship between the main variables measured by the average correlation coefficient is positive and significant as we have explained previously.

The heterogeneity of the results has led us to analyze the effect of moderator variables, obtaining significant and positive sign evidence among different subgroups of the global relationship between sustainability performance and good corporate governance practices.

The hypothesis H0, of existence of relationship between sustainability performance and good corporate governance practices is significant and positive in continental legal context, showing that this relationship is weak but positive and we find support for the hypothesis H3 which predicted the moderating role of legal system, in consistency with previous meta-analytic work of Siddiqui [3].

It is noteworthy to indicate that the moderator variable sustainability performance measurement has a greater effect on the social and environmental performance than on financial performance.

So we don't find support for Hypothesis H1.1. which predicted that exist an association between Good Corporate Governance and financial performance adding to the evidence of Fernández et. al [64], Kaczmarek et. al [38], Kilic [46] and our findings are also in line with the previous meta-analytic study of Rhoades et.al. [6].

Furthermore, we find support for Hypothesis H1.2. proving that the relation between Good Corporate Governance and Social and environmental performance is positive and significant as it has been shown in numerous studies Ducassy [65], Lorenzo et. al [66] and Sahin et. Al. [60] for the continental context, Kiliç et. Al [46], Choi et al. [43], Huang [67] and Sharif & Rashid [68] for the Asian context and Dunn y Sainty [17] and Jo and Harjoto [69] for the Anglo-Saxon. We have not found any work that has previously meta-analyzed the relationship between Social and environmental performance and Good Corporate Governance.

As limitations of the work we must consider that the meta-analysis only studied the association between variables in our case the correlation coefficient between performance and Corporate Governance, it does not

enable us to control for endogeneity or reverse causality if the individual studies does not control it previously [16].

Another limitation is the small number of studies which have in some of the subgroups analyzed, it would be useful additional empirical evidence to confirm the results obtained in this study.

Several issues for future research exist. Consideration of other moderating variables related to characteristics of ownership or the shareholding concentration and the participation of institutional investors in the process of decision making could improve the results of this study and justify part of the observed heterogeneity. We also consider that the realization of a meta-regression would bring great evidence that could not be obtained in this study

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APPENDIX.

APPENDIX 1. Articles included in the meta-Analyses.

	Autors	N sample size	years analyzed	Performance measure	Corporate measure	Governance	Corporate Governance system	Country
1	Acero y Alcalde (2012)	171	2004-2008	CSRDisclos.	Independence		Communitarian	Spain
2	Adams y Ferreira (2009) P	8253	1996-2003	ROA Tobin's Q	Independence	Diversity	Anglo-Saxon	US
3	Ameer et. al (2010)	277	2002-2007	Tobin's Q	Independence	Diversity	Asian	Malaysia
4	Arora y Dharwadkar (2011)	1522	2001-2005	CSRIndex.	Independence		Anglo-Saxon	US
5	Barakat et. Al (2015)	101	2011	CSRDisclos.	Independence		Asian	Palestine/Jorda
6	Barako & Brown (2008)	40	anterior a 2008	CSRDisclos.	Independence		Africa	Kenya
7	Barroso Castro et. al (2009)	862	1993-2000	ROA	Independence		Communitarian	Spain
8	Bear et. al.(2010)	51	2009	CSRIndex.	Independence	Diversity	Anglo-Saxon	US
9	Berrone y Gomez-Mejia(2009)	2088	1997-2003	CSRPerf.	Independence		Anglo-Saxon	US
10	Bøhren & Strøm (2007) P	1515	1998-2002	Tobin's Q		Diversity	Communitarian	Noruega
11	Campbell, K.; Minguez-Vera,	408	1995-200	Tobin's Q	Independence		Communitarian	España
12	Cho et. Al (2015)	606	2005-2010	CSRIndex. ROS		Diversity	Asian	Corea
13	Choi et al. (2013)	2042	2002-2008	CSRIndex.	Independence		Asian	Korea
14	Cuadrado et. al.(2015) P	4176	2003-2009	CSRIndex.	Independence	Diversity	Anglosajon	Canada, EUA,
15	Cuadrado et. al.(2015) P	1204	2003-2009	CSRIndex.	Independence	Diversity	Communitarian	9 countries
16	De Andrés et. al (2005)	450	1996	Market to Book	Independence		Global	9 countries
17	Ducassy (2015)	41	2011	CSRIndex. ROA	Independence		Communitarian	France
18	Dunn y Sainty(2009)	174	2002,4,5,6	CSRIndex. ROE	Independence		Anglo-Saxon	Canada
19	Fernández et. Al. (1998)	67	1993	Tobin's Q	Independence		Communitarian	Spain
20	García - Sánchez et. Al. (2015)	5380	2003-2009	CSRDisclos.	Independence	Diversity	Global	
21	Ghazali & Weetman(2006) P	87	2001	CSRDisclos.	Independence		Asian	Malaysia
22	Haniffa y Cook (2005)	278	1996 y 2002	CSRDisclos. ROE	Independence	Diversity	Asian	Malaysia
23	Hoje y Harjoto (2011)	13389	1993-2004	ROA Tobin's Q	Independence		Anglo-Saxon	USA
24	Hu et. Al. (2010)	304	2003-2005	Tobin's Q	Independence		Asian	China
25	Huang (2010)	297	2006-2007	CSRDisclos.	Independence	Diversity	Asian	Taiwan
26	Jackling & Johl (2009)	180	2005-2006	ROA Tobin's Q	Independence		Asian	India
27	Jizi et. Al. (2014) P	291	2009-2011	CSRDisclos.	Independence		Anglo-Saxon	US
28	Johnson y Greening(1999)	1260	1993	CSRIndex. ROA	Independence		Anglo-Saxon	US
29	Kaczmarek et. Al (2012)	3106	1999-2008	Tobin's Q	Independence		Anglo-Saxon	UK
30	Kathayini et. Al. (2012)	96	2008	CSRDisclos.	Independence	Diversity	Anglo-Saxon	Australia
31	Khan et.al (2013)	580	2005-2009	CSRDisclos.	Independence	Diversity	Asian	Bangladeshi
32	Khan H. (2010)	30	2007-2008	CSRDisclos. ROE	Independence	Diversity	Asian	Bangladeshi
33	Kiel & Nicholson (2003)	348	1996-1998	ROA (ln)	Independence		Anglo-Saxon	Australia
34	Kilic (2015)	130	2008-2012	ROA	Independence	Diversity	Asian	Turkey
35	Kilic et. Al (2015)	125	2008-2012	CSRDisclos	Independence	Diversity	Asian	Turkey
36	Kock et. al. (2012)	657	1998 y 2000	CSRPerf.	Independence	Diversity	Anglo-Saxon	US
37	Kouki & Guizani (2015)	294	2004-2010	ROA	Independence		Africa	Tunez
38	Lim et. Al (2007)	181	2001	CSRDisclos.	Independence		Anglo-Saxon	Australia
39	Mahadeo et. Al.(2011)	42	2007	ROA	Independence	Diversity	Africa	Islas Mauricio
40	Mahoney & Roberts (2007)	525	1996-1999	ROE		Diversity	Anglo-Saxon	Canada
41	Mallin et. Al.(2013)	221	2005-2007	CSRDisclos.	Independence	Diversity	Anglo-Saxon	US
42	Martínez-Ferrero et. Al(2015)	877	2004-2010	CSRIndex.	Independence	Diversity	Global	9 countries
43	Michelon y Parbonetti (2012)	114	2003	CSRDisclos. ROE	Independence		Global	EUA Europe
44	Miller and Triana(2009)	432	2003	ROA		Diversity	Anglo-Saxon	US
45	Minguez-Vera & Lopez-Martinez (43213	antes del 2010	ROA		Diversity	Communitarian	Spain
46	Ntim y Soobaroyen (2013)	600	2002-2009	CSRDisclos.	Independence		south-africa	South-Africa
47	Ouyang (2007) T	23209	2001-2004	ROA Tobin's Q	Independence		Anglo-Saxon	USA
48	Post et. al. (2011)	78	2007	CSRDisclos.	Independence	Diversity	Anglo-Saxon	USA
49	Prado et. al (2009)	288	2004-2006	CSRDisclos.	Independence	Diversity	Communitarian	Spain
50	Prado-Lorenzo y Garcia-Sanchez	283	2007	CSRDisclos.	Independence	Diversity	Global	28 countries
51	Rao et. Al. (2012)	96	2008	CSRDisclos.	Independence	Diversity	Anglo-Saxon	Australia
52	Rodríguez-Ariza et. al (2014)	3521	2004-2009	CSRDisclos.	Independence	Diversity	Global	Europe
53	Rodríguez Fernandez et. Al(2013)	121	2009	ROA ROE	Independence		Communitarian	Spain
54	Sahin et. Al. (2011)	165	2007	CSRDisclos.	Independence		Asian	Turkey
55	Said et. Al (2009)	150	2006	CSRDisclos. ROE	Independence	Diversity	Diversity	Malaysia
56	Sanan (2016)	148	2008-2013	ROA Tobin's Q		Diversity	Diversity	India
57	Schiehl(2002) T	138	1997-1998	Market to book	Independence		Anglo-Saxon	Canada
58	Sharif & Rashid (2014)	22	2005-2010	CSRDisclos.	Independence	Diversity	Asian	Pakistan
59	Sheikh et. Al (2013)	770	2004-2008	Market to book	Independence		Asian	Pakistan
60	Siregar y Bachtiar (2010) P	87	2003	CSRDisclos.		Diversity	Asia	Indonesia
61	Sundarasan et.al (2016)	450	2011-2012	CSRDisclos.	Independence	Diversity	Asian	Malaysia
62	Uadiale (2010)	30	2007	ROE	Independence			Nigeria
63	Ujunwa (2012)	1274	1991-2008	ROA		Diversity	Africa	Nigeria
64	Valenti et. Al (2011)	87	2005	Market return		Diversity	Anglo-Saxon	US
65	Vo & Nguyen (2014)	752	2008-2012	ROA Tobin's Q	Independence		Asian	Vietnam
66	Walls y Hoffman (2013)	1881	2002-2008	CSRIndex.	Independence		Anglo-Saxon	US
67	Wellalage & Locke (2013)	440	2006-2010	Tobin's Q		Diversity	Asian	Sri Lanka
68	Zhang (2012)	475	2007-2008	CSRIndex. ROA	Independence	Diversity	Anglo-Saxon	US

APPENDIX 2 MODERATOR VARIABLES

	<i>Corporate Governance measurement</i>			<i>Corporate Governance system</i>		
	Total /HC	Independence	Diversity	Anglo-Saxon	Asian	Communitarian
	(n)	(n)	(n)	(n)	(n)	(n)
Performance /Corporate Governance Tools	68	40	28	25	19	13
Performance / Independence		40		15	12	9
Performance / Diversity			28	10	7	4
<i>Performance measurement</i>						
Financial performance/ Corporate Governance Tools	28	18	10	9	7	7
Financial performance / Independence		18		7	5	3
Financial performance / Diversity			10	2	2	4
Social and Environmental performance/ Corporate Governance Tools	40	22	18	16	12	5
Social and Environmental performance / Independence		22		8	7	5
Social and Environmental performance / Diversity						

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