Journal of Cleaner Production 174 (2018) 1608–1619

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Environmental management accounting and its effects on carbon management and disclosure quality

Wei Qian [a, *], Jacob Hörisch [b], Stefan Schaltegger [b]

[a] Centre for Sustainability Governance (CSG), School of Commerce University of South Australia, Adelaide, Australia
[b] Centre for Sustainability Management (CSM) Leuphana University, Lüneburg, Germany

ARTICLE INFO

Article history:
Received 10 December 2016
Received in revised form
2 November 2017
Accepted 13 November 2017
Available online 13 November 2017

Keywords:
Environmental management accounting
Environmental accounting
Carbon disclosure
Carbon management
Sustainability management

ABSTRACT

Along with the development of environmental management accounting (EMA) in the past decade, a variety of management accounting and control tools have been designed and implemented to improve the measurement and management of corporate environmental performance and information. While the importance of EMA to corporate sustainability has been increasingly acknowledged, extant literature has drawn little attention on assessing and understanding EMA application and its effectiveness on the quality of carbon emission management and disclosure. Using data gathered of 114 large firms in the US, Germany, Australia and Japan, we find that many firms have applied some EMA tools, yet only a few have applied the full range of EMA tools. The empirical analysis reveals that EMA application has a significantly positive impact on both corporate carbon management and disclosure quality. Further analysis specifies that audit and benchmarking tools as well as control tools have significant effects on carbon management and disclosure, while for measurement tools no significant effects could be observed. Based on the results, implications are developed for management education and practitioners, which can help managers to make better informed choices for the application of EMA tools.

1. Introduction

The annual Earth Overshoot Day marks the day on which human induced pollution exceeds the carrying capacity the earth provides for a given year. Constantly, this day is reached far before the end of the year and the overshoot increases each year (Posthuma et al., 2014; Worland, 2015). Carbon and other greenhouse gas emissions are one of the main drivers of this overshoot and large corporations are the main emitters of greenhouse gases, both historically, but also at present (CDP, 2013; Heede et al., 2014).

To measure environmental impacts including carbon emissions, environmental management accounting (EMA) has received growing attention for the past decades (e.g., Christ and Burritt, 2013; Ferreira et al., 2010; Gibson and Martin, 2004; Passetti et al., 2014; Schaltegger and Burritt, 2000) and a variety of EMA tools such as material flow cost accounting (Christ and Burritt, 2015; Strobel and Redmann, 2002), eco-control (Henri and Journeault, 2010) and the sustainability balanced scorecard (Hansen and Schaltegger, 2016), have been designed and increasingly implemented to reduce the environmental impacts of companies. While the focus of previous environmental and social accounting and reporting research is predominantly on environmental disclosure (Parker, 2005; Schaltegger et al., 2013), EMA has been increasingly used and investigated as a company-internal approach to support the quality of environmental management in corporate practice (Adams, 2002; Burritt et al., 2002). It has been acknowledged that EMA can play a significant role in spurring operational as well as organisational change towards reducing corporate environmental impacts (Bennett et al., 2003; Ferreira et al., 2010; Masanet-Llodra, 2006).

More recently, the usefulness of EMA has been explored and discussed in the context of corporate carbon management and accounting (Ascui, 2014; Burritt et al., 2011; Schaltegger and Csutora, 2012; Stechemesser and Günther, 2012). Governments around the world have attempted to drive corporate responses to climate change through the introduction of emission trading schemes and/or taxes, abatement and disclosure regulation that aim to reduce carbon emissions. Under the current European Emissions Trading Scheme (ETS), carbon pricing or other related carbon reduction mechanisms, it has become increasingly important for corporations to account for carbon emissions (Bell, 2017;

* Corresponding author.
E-mail addresses: Wei.Qian@unisa.edu.au (W. Qian), hoerisch@leuphana.de (J. Hörisch), stefan.schaltegger@leuphana.de (S. Schaltegger).

https://doi.org/10.1016/j.jclepro.2017.11.092
0959-6526/

Bowen and Wittneben, 2011; Engels, 2009; King, 2014; Qian and Schaltegger, 2017). The expectation that a first step towards reducing corporate carbon emissions is to improve transparency and disclosure of such emissions, has led to the establishment of initiatives such as the Carbon Disclosure Project (CDP). The CDP collects and publishes (voluntary) disclosure of the greenhouse gas emissions of the world's largest corporations.

While business managers may have learnt about the importance of EMA and applied this knowledge for carbon management or reporting, practical questions remain under-researched, e.g. which groups of EMA tools are useful to reduce carbon emissions effectively, and more specifically, whether the application of different EMA tools has an effect on corporate carbon management and disclosure. Despite insightful suggestions provided, previous EMA research is primarily either conceptual/descriptive, or focused on technical issues in EMA application through single or several case studies (e.g. in Ascui's 2014 review of carbon accounting development in social and environmental accounting literature, most of the 65 carbon accounting papers are conceptual with technical orientation on method development or representing case study experimentation). Different from reporting and other technical or more general sustainability management tools, such as life-cycle assessment and eco-efficiency analysis, that have been extensively studied in previous literature (Hellweg and Canals, 2014; Scipioni et al., 2010), EMA, as a package of useful accounting tools, has not been investigated in the context of carbon disclosure and management. Research has so far paid little attention to assessing the effectiveness of EMA application on the management and disclosure of corporate carbon emissions.

Against this background, this study focuses on the use of EMA as opposed to more general sustainability management tools, based on over two decades' evolvement of EMA tools. We empirically investigate the application of EMA in corporate practice and its influence on carbon management and disclosure quality. The investigation uses data collected for a larger project – the Corporate Sustainability Barometer (CSB) (Schaltegger et al., 2014) and analyses EMA application in 114 large companies across four developed nations, namely the U.S., Germany, Australia and Japan. The data collected in the CSB survey is examined against the carbon performance management and disclosure information provided by the Carbon Disclosure Project (CDP) database.

The contributions of this study are twofold. First, this paper extends the existing research by filling the gap in the literature where empirical investigations of the role of EMA in combatting climate change at the corporate level and the application of EMA and its effectiveness on improving carbon management are still lacking. It thus makes a rare attempt to analyse the link between different EMA tools and carbon management and disclosure. Second, from a practitioner's perspective, the findings of this empirical examination will provide implications for business managers to understand the usefulness of different EMA tools for corporate carbon management. Clearly, there has been an increasing number of EMA tools available to business managers (e.g. Burritt et al., 2002; Burritt et al., 2011), but implementing a full coverage or the 'whole set' of EMA tools appears unrealistic in terms of time and resource availability. As such, it is expected that the results of this study will help managers make better choices of EMA tools and consequently map out better carbon management activities.

The remainder of the paper is structured as follows. Section 2 provides a review of the development of EMA and its multidimensional tools elaborated in prior literature. Following the review, Section 3 outlines possible links between the use of EMA tools and carbon performance and information disclosure. The research method used for this study is discussed in Section 4 and the findings of the study are presented in Section 5. Section 6 discusses the results as well as its research limitations and future research opportunities.

2. Review of EMA development and application

2.1. Development of EMA

Conventional accounting focuses predominantly on profitability and ignores other major business impacts such as climate change, the use of non-renewable resources or other environmental issues as well as societal issues in supply chains. The unconsidered negative environmental and social impacts have motivated researchers to criticize conventional accounting and made environmental management accounting (and more broadly social, environmental and sustainability accounting) rise to prominence in recent years (e.g. Schaltegger et al., 2013). Differentiating itself from conventional accounting, EMA highlights the importance of tracing, managing and reporting 'full', 'total' or 'true' costs and impacts of business activities that conventional accounting often overlooks (Bebbington et al., 2001; Bracci and Maran, 2013; Epstein, 1996; Ferreira, 2004; Herbohn, 2005; Jasch, 2009; USEPA, 1998). In essence, EMA helps organizations to capture both economic and ecological footprints and to examine the entire operation of their corporations including the supply chains as an activity with both economic and ecological impacts (Bartolomeo et al., 2000; Bennett et al., 2002; UNDSD, 2001). To achieve this ultimate goal, business has to employ an environmental management system, including EMA, to record, analyse and report environmentally induced financial and ecological impacts of a defined economic system (e.g., a firm, plant, region, nation) (Burritt et al., 2002; Jasch, 2009; Schaltegger and Burritt, 2000). EMA has been increasingly seen as one of the master keys to unlock the perceived long standing tension between economic development and environmental degradation and to achieve "win-win" business cases (e.g. De Beer and Friend, 2006; Ferreira et al., 2010; Jasch, 2009; von Weizsäcker et al., 2009).

EMA is a broad-based term that encompasses various kinds of accounting and performance control tools (Bouten and Hoozée, 2013; USEPA, 1998). Rikhardsson et al. (2005) consider EMA a form of managerial technology encompassing various tools and techniques of targeted information collection, analysis and communication. This relatively new set of management accounting tools includes a variety of tools such as environmental cost accounting, material flow cost accounting (e.g. Christ and Burritt, 2015; Günther et al., 2015; Strobel and Redmann, 2002), benchmarking, auditing (e.g. Earnhart and Leonard, 2016), eco-control or balanced scorecards (e.g. Hansen and Schaltegger, 2016; Henri and Journeault, 2010), all aiming at helping companies seek improvement of their environmental, social and economic performances (Burritt et al., 2009).

2.2. Categories of EMA tools

Previous literature has explored this flexible and broad-based concept and suggested a number of characteristics and functions EMA can fulfil. These functions are summarized below in the three categories of (1) measurement, (2) auditing & benchmarking, and (3) control tools.

2.2.1. Measurement tools

The first and foremost characteristic of EMA is its emphasis on measuring *monetary and physical flows* in a life-cycle of a product or system. Previous studies indicate that conventional accounting uses predominantly monetary measures and places less weight on