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CARBON ACCOUNTING:
A TOOL TO MITIGATE CLIMATE CHANGE FOR A GREENER WORLD

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ABSTRACT

Climate change is a complex phenomenon and an important change in either the average state of the climate or in its variability persisting for an extending period. Climate change is one of the most potent global environmental concerns created by humans for the humans dealing with problem of food and freshwater scarcity, natural ecosystems risks, health, etc. This paper illustrates a wide conception of carbon accounting, involving a system that uses accounting to document, evaluate and report climate change data, and carbon related capital, legal responsibilities, expenditure and income according to the users decision. This paper also describes how carbon accounting can play a role for the development of carbon management systems and assessment of energy efficacy, carbon productivity and revelation of carbon deduction activities. Carbon accounting is a multi-facet subject and naive inventive strategy is necessary to develop carbon accounting framework, methodology and feasible scheme. The conclusion states that carbon accounting is in its growth stage and endows promising future research opportunities.

Keywords: *Climate Change, Carbon Accounting, Carbon Management, Global Environment.*

Introduction

Climate change is a complex phenomenon and an important change in either the average state of the climate or in its variability (in terms of temperature, atmospheric pressure, precipitation status etc.) persisting for an extending period (typically decades or longer) (Solomon *et al*., 2007).

Climate change is one of the most potent global environmental concerns created by humans for the humans dealing with problem of food and freshwater scarcity, natural ecosystems risks, health, etc. Since the preindustrial era earth's climate system has remarkably changed globally and at regional level. The latest scientific assessment also shows evidence that warming (of 0.1°C per decade) observed over the last 50 years, has resulted due to human activities (Sathaye *et al.*, 2006). The ill effects of human activity and GHG emissions would further destroy the ecosystem environment (IPCC 2013). The negative effect of climate change on economy, social activities and people's health has already been rising and the trend toward a low carbon economy has begun. Efforts for carbon deduction and corporate level emissions reporting has enhanced readily in accordance to institutional necessity and regarding consideration of value creation. A wide variety of industries are expected to be affected by the regulatory and market related changes (Tang and Luo 2014) and research with a carbon accounting focus needs to be implemented. The attention paid to carbon-related issues in the carbon management literature is limited. There is, however, an increasing interest in this area concerning various aspects of climate change related carbon accounting (Milne, and Grubnic 2011, Engels 2009).

This article presents review, objectives, some essential elements and challenges pertaining to carbon accounting. This paper also illustrates detailed methodology which can be applied by firms to achieve carbon reduction targets by improving its climate change strategy and carbon management system. Carbon accounting will be used as a tool for sustainable development of the world in every aspect of environmental issues and constraints for developing a cordial relationship between the human and nature as a whole (Hopwood 2009). A very specific carbon accounting system needs to be developed for carbon management system as carbon control is unavoidable for business sustainability.

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However, most of the authors appear to seek to constructively but critically engage with businesses and other organizations to help them identify a range of social and environmental sustainability risks and opportunities and make changes to the way they operate in a direction intended to result in less unsustainable operations. More specifically, this argument implies researchers should critically engage corporations to take part in carbon deduction programs (Hopwood, 2009, Bebbington and Larrinaga, 2014). That means firms will operate in an entirely new atmosphere which will require new management philosophy, policy and operating system. Then companies do have incentives or under pressure to alter their behaviour to improve their carbon management system and to minimise their exposure to carbon risk and liability.

This paper largely deals with the working of carbon accounting at firm level. Many studies consider the varsity of climate change, carbon market and carbon regulations on corporate accounting practices (Bebbington and Larrinage-Gonzalez, 2008, CIMA 2010, Harmann, et al 2013, IETA 2007, Cook 2009). For example, authors have addressed the problems such as the market impact of carbon emissions (Matsumura, et al 2014, Chapple et al 2013), carbon undertaking and auditing (Simnett et al 2009, Olson 2010, McKinnon 2010), carbon cost accounting and carbon management accounting (Broome 1992, Ratnatunga 2007, 2008; Ratnatunga and Balachandran 2009; Ratnatunga et al 2011), carbon disclosure, (Reid et al 2009), etc. It is generally accepted that accountants and accounting academics face a big challenge dealing with GHG accounting (Young 2010). Ratnatunga (2007; 2008) and Ratnatunga and Balachandran (2009) describe how carbon-related information could affect and control in various organizational areas (new product development, supply, marketing and so forth) and they also point out the strategic cost management and accounting practices that may be affected by carbon accounting. Carbon costing comprises of naive cost allotment methods (like activity-based management and life-cycle costing) that enhance the recognition and tasks of carbon-associated costs and budgets to such things like products, services, customers and institutional processes (Ratnatunga and Balachandran, 2009).

In addition, the Chartered Institute for Management Accountants (CIMA) and Accounting for Sustainability (CIMA, 2010) conducted an international survey among sustainability professionals to investigate the role of climate change in shaping the management accounting profession. The survey highlights the potential beneficial effects of integrating carbon management in carbon accounting systems. The survey provides the various reasons for, and obstacles against, the integration or even merging of environmental accounting and traditional accounting. The study documents that management accountants could have a role in areas such as carbon footprint calculation, tracking climate change performance measures/KPIs, preparing the business case for climate change initiatives and carbon accounting/budgeting. The CIMA (2010) study also documents that management accounting has potential to support environmental management with its traditional portfolio of tools (cost-benefit analysis, investment appraisal, Balanced Scorecard).

Overall, while such a research stream provides a promising area for theory testing, this type of empirical research necessarily must rely on reliable and valid information about GHG disclosures. From several commentaries (Bebbington and Larrinaga-Gonzalez, 2008; Young, 2010), this seems not to be the case. Hartmann et al (2013) argue that there is a need to establish some solid foundations, starting from a more thorough understanding of internal mechanisms of carbon accounting and it seems appropriate to examine how carbon accounting is deployed internally and how it relates to externally oriented accounting systems. Currently, there is no theory, let alone empirical evidence, to explain the extent to which environmental management goals and traditional firm goals are both supported via one integrated management accounting system.

Increased GHG emissions revelation crucial for many companies; however, there is lack of knowledge about the companies gradation towards carbon management and accounting systems (Ratnatunga and Balachandran, 2009). Further there is very little evidence of the technical process in this regard. However, the practitioner surveys suggest a huge (important) effect of carbon accounting in accounting practices, and it provides a pertinent and timely approach for academic research.

Carbon Accounting and Carbon Management Systems

Carbon accounting is a network that uses accounting methodology and approach to assemble, document, and inspect climate change associated data, and account and report for carbon related assets, accountabilities, costs and income which is must for internal managers and external stakeholders for the process of decision-making.

Objectives of Carbon Accounting

The major objectives of carbon accounting are to assist managers to formalise climate change strategy, identify and control climate change risks and opportunities, improve carbon management system and to attain carbon deduction targets (Tang and Luo 2014). All aspects of traditional accounting knowledge and techniques can be utilised to make contribution: financial accounting (e.g. accounting for carbon estate and accountability, carbon disclosure etc. Luo and Tang 2013), management accounting (e.g. carbon reduction cost control, carbon project budget, evaluation of carbon investment, etc, Tang & Luo 2014), and auditing (e.g. GHG statement assurance, Datt, et al, 2015, Tang 2015). However, there are inevitable problems in conventional accounting methods because carbon accounting also encompasses non-monetary revelation of companies climate impact (Luo et al 2012) and carbon evaluation involving comparison with a standard.

It is our contention that there is a consilience between the scope of carbon management mechanism and scope of carbon accounting. Some specific carbon management system must be adopted by firms if they plan for carbon mitigation target. We argue that the implementation of the carbon management systems largely depends on the function of carbon accounting, but there has been very little discussion of its implementation in a systematic way. This is largely because carbon management systems have been studied very less and firms do not adopt standard CMS. So our discussion is based on a theoretic model of CMS which represent the practice of the largest companies in the world that participated in CDP (Tang and Luo 2014). The first study was conducted by Tang and Luo (2014) that identified what constitutes an efficient CMS and empirically evaluated its effect and CMS is defined by them as, "It is a method to device a company's carbon scheme or policy to intensify the effectiveness of data-use, mitigate emissions and threat and circumvent agreement costs or to secure a combative advantage". Their carbon management system theoretical model contains 10 basic elements within 4 perspectives, (i.e. Carbon Governance, Emission Tracking and Reporting, Operation, Engagement and disclosure). The details of the methodology of carbon accounting for CMS are illustrated in the table1 given below.

Table 1: A Summary of the Roles of Carbon Accounting for Carbon Management Systems (Tang and Luo (2014))

Sr. No.	Major CMS components	Aim	The role of carbon accounting
1.	Board function	To develop an overall climate change strategy and policy	Carbon accounting provides adequate information for formalization of carbon policy to address climate change issues.
2.	Carbon Risk and opportunity assessment	To identify and assess carbon risk and opportunity	Carbon accounting is needed to draft the method to evaluate climate threat and scope, specifically regarding financial inferences for firm working and profitability.
3.	Evaluation of staff participation and carbon functioning	To persuade staff and increase insight of climate change issues	Carbon accounting should be used to draft distinct measures essential to motivate them to take part in carbon deduction and energy conservation projects.
4.	Emission target	To devise a mitigation goal that is stable with the carbon policy	Carbon accounting should deliver adequate data for managers to configure assessable and quantifiable emission reduction goals.
5.	Carbon actions and policy execution	To enforce the carbon policy by prioritising reduction actions and allocating resources to achieve targets	Carbon accounting should evaluate low carbon projects, energy efficiency project, clean energy initiatives. Carbon project needs specific funding, specific objectives so feasible study is needed.
6.	Supply chain emission control	To reduce supply chain emissions	Carbon accounting is needed to develop specific measures to control supply chain emissions.
7.	GHG emissions recording, accounting and internal reporting	To keep track of carbon inventory and emission footprint	Carbon accounting has specific and distinct protocol and standards and norms to account for emission. Carbon accounting should prepare this report for the decision making of managers who is responsible to achieve carbon target.
8.	External carbon assurance	To increase the reliability of carbon data	External and internal GHG emission assurance and verification is also needed to check carbon recording and energy consumption.
9.	External disclosure	To increase the transparency of mitigation activities and outcomes, To strengthen the link with stakeholders	Carbon accounting should specify the contents, format and frequency of carbon disclosure to external stakeholders groups who care about emissions.

Conclusion

Climate policy is an extremely broad issue, thus the need to substantially reduce GHG emissions not only mobilises governments and private sectors, but also requires that millions of organizations and individuals change their production procedure, consumption patterns and life style, which implies changing an economic system to meet a threat that lies at present and in the future. The issue is both wider and deeper than other national and international issues, touching all areas of human life and fundamental human beliefs and values (Hoffman, 2011). To achieve this goal will require the efforts of the entire society, and accountants and auditors are expected to position themselves as managers of carbon control and implementation of climate change strategy (Lovell & MacKenzie 2011). For that purpose, there are many challenges. Carbon accounting should critically engage with business for sustainability. We can conclude that carbon accounting has the potential to help even for profit-seeking entities reduce carbon emissions as firms cannot make a profit if it continues to manufacture carbon intensity products. The carbon foot printing and carbon credits accounting should also made mandatory for all the business factories and also they can be motivated for a competition in having supremacy with less carbon foot printing and maximum carbon credits achieved. The traditional accounting methods/approaches are inadequate, so more innovative methodology should be considered in a carbon accounting system.

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