Doctor of Philosophy Dissertation

UNIVERSITY OF SOUTHERN QUEENSLAND

IDENTIFICATION OF EFFECTIVE MANAGEMENT ACCOUNTING SYSTEM CHARACTERISTICS TO SUPPORT SUSTAINABLE VALUE CHAINS: TOWARDS A CONCEPTUAL MODEL FOR SUSTAINABLE DEVELOPMENT OF FIRMS

A Dissertation Submitted

By

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Dedication

This dissertation is dedicated to my niece and my nephew, Kanokluk Petcharat and Weeraphat Petcharat.

EXECUTIVE SUMMARY

Sustainable growth organizations that create environmental and social efficiency in the development of economic performance would become highly competitive and strengthen their reputation in the eye of stakeholders and marketplaces. In contrast, companies lacking sustainability perspectives would be faced with difficulty in responding to government regulations, supporting stakeholders' and the public's demands, and complying with environmental and social performance disclosures. The study is motivated by the current practice of activity based costing (ABC) which, to date, has not recognized environmental and social costs and/or separated them from overheads to create more accurate cost information for decision-making and sustainability reporting initiatives.

The literature review also demonstrates that there is a need for a conceptual model or theoretical framework for environmental management accounting (EMA) and social management accounting (SMA) to be developed for more accurate cost accounting data on environmental and social impacts. Without further research, companies appear to lack a system that accurately captures costs and provides information to support internal decision making and external disclosure initiatives. There is a need for an accounting framework or conceptual model to measure costs of improvements in society and the environment, while adding value to organizations and making them more sustainable.

This study, therefore, designed a sustainability management accounting system (SMAS) combining environmental management accounting (EMA) and social management accounting (SMA) concepts and practices as a new conceptual model for sustainable growth organizations. A SMAS is also designed to expand on activity based costing (ABC) application using a cost allocation and analysis approach to create more accurate cost information while fully costing for effective decision-making and external reporting initiatives. In establishing an appropriate conceptual model, the study used mixed methods combining quantitative and qualitative research approaches to collect and analyse data to triangulate findings. Three theories—deep ecology, Marx's labour theory of value, and stakeholder theory—were fused to examine ethical and moral obligations in identifying cost accounting data of environment and social impacts to support internal decision-making and address stakeholders' concerns.

The results of this study indicate that companies were looking for ways to improve cost identification and measurement of environment and social impacts. Companies were intending to change to new management accounting practices to separately identify and measure these costs for more effective decision-making. A Sustainability Management Accounting System (SMAS) conceptual model designed by this study would support companies to meet data accuracy needs. Applying ABC application in a design of a SMAS creates more accurate cost information, thus fully costing products to effectively enhance internal management decisions and develop tracking and reporting systems. By adopting such a system, it would support companies in becoming strong, sustainable growth organizations capable of creating economic, environmental and social value both immediately and in the future, whilst complying with government regulations and external reporting initiatives such NGER or GRI.

Further research is suggested in terms of identifying effective management accounting practices for environmental and social cost dimension in service manufacturing companies to meet sustainability objectives. Further research is also suggested in terms of financial management accounting for more precise financial disclosures in addressing the concerns of stakeholders and the public.

CERTIFICATION OF DISSERTATION

I certify that the ideas, analyses, and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

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Signature of Candidate Date

ENDORSEMENT

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Signature of Supervisor/s Date

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Signature of Supervisor/s Date

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Neungruthai Petcharat, Toowoomba, Australia, November 2010.

Candidate's list of research outputs

Book chapter:

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LIST OF ACRONYMS AND ABBREVIATIONS

ABC	Activity based costing
CDP	Carbon disclosure project
CSR	Corporate social responsibility reporting
EA	Environmental accounting
EMA	Environmental management accounting
EPA	Environment Protection Authority
FA	Financial accounting
FEA	Financial environmental accounting
GRI	Global Reporting Imitative
MA	Management accounting
NGA	National Greenhouse Accounts
NGER	National Greenhouse and Energy Reporting
SA	Social accounting
SFA	Social financial accounting
SMA	Social management accounting
SMAS	Sustainability management accounting system
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

CHAPTER 1: INTRODUCTION

1.1. Background

Sustainable growth organizations can be a confluence of business opportunities from compelling operational outcomes and enhancing competitive advantage in 'green' markets. At a boardroom level, sustainability is elevated to a way to create eco-efficiency—along with the development of environmental and social performance (Epstein & Roy 2001). In this regard, market drivers and competitive differentiations are major environmental and social issues that companies need to consider (Laszlo 2008). Companies' responsibilities are relevant to improving ecological and environmental patterns and enhancing the quality of life of employees, and the community and society in which they operate (Gray et al. 2001). In order to add shareholder value, companies need to promote themselves as sustainable organizations, thus minimizing their use of natural resources (material, energy, and water), creating less emission and waste, and developing social well-being as a whole (Berkel 2003). Furthermore, stakeholders are concerned with disclosure reporting on three performance indicators—economic, environmental, and social development in the form of a triple bottom line (Berkel 2003). As a result, company costs (environment and social impacts) are required to be measured and reported as intangible costs (IFAC 2005) in a corporate financial report (Gadenne & Zaman 2002). Such reporting will create compliance with sustainable development legislation and enhance investment decisions to build economic, environmental, and social value adding (Figge & Hahn 2004).

In accordance with stakeholders' concerns, companies are required to capture full costs of products—which includes environment and social impact costs—to support internal decision-making strategies and external disclosure initiatives (Gray 2006; Gray et al. 2001; IFAC 2005). Companies also need to identify costs of environmental factors expended on environmental management, pollution prevention, and waste treatment costs from internal and external organizations (Gadenne & Zaman 2002; Gale 2006a; Sendroiu et al. 2006). These costs are significant in creating cost-saving opportunities, including natural resources efficiency and emission and waste incentives (Gadenne & Zaman 2002; Gale 2006a; Sendroiu et al. 2006). In the meantime, social impact costs are collected from expenditures, funding, cash or time donation that bring benefits to employees, the community and society (Mook, Richmond & Quarter 2003). Social costs are created to support evaluations of social expenditure for improvement in social performance (Gray & Bebbington 2001). In doing so, companies create intellectual operational efficiency, thus meeting the goals of a sustainable organization, as well as addressing concerns of stakeholders and the public.

Nonetheless, environmental and social impact costs have historically been treated as overheads by traditional management accounting practices in financial disclosures (IFAC 2005). Companies are in the early stages of developing their understanding on how to identify environmental data from costs of unit outputs, non-product outputs, emissions and waste treatment, environmental prevention, research and development, and intangible costs (IFAC 2005). Companies also appear less interested in measuring social impact costs due to increasing total costs of products (Hazilla & Kopp 1990). Companies mainly provide corporate environmental performance and social responsibility (CSR) reporting to create a positive reputation and image in the marketplace (Gray 2006), but fail to develop a coherent sustainability policy. As a result, companies are unable to encompass internal management decisions to improve economic, environmental and social performance (Berkel 2003). Previous studies (e.g. Gadenne & Zaman 2002; Gale 2006a; Gray & Bebbington 2001) claim that energy efficiency programs should help in identifying business opportunities, thus creating cost savings and successful return-on-investment. Subsequently, the needs of companies are to accurately identify and measure costs of environment to support internal decision-making, thus creating potential investment in environmental efficiency (IFAC 2005). Apart from that, companies are recognized as early adopters for establishing sustainability frameworks of conceptual models that could help in environmental and social cost identification and measurement (Epstein 2008). Without a holistic system of sustainability accounting, companies are unable to successfully improve their decision-making on sustainable development performance or provide completely accurate cost accounting data to address the demands of stakeholders and the public.

Taplin et al. (2006) argue that a holistic system or framework that embraces sustainability accounting concepts should be introduced to sustainable development firms as a new management mechanism for environmental and social cost identification and measurement. A sustainability accounting concept involves enhancing business decision-making and providing sustainability reporting to add shareholder value in terms of economic, environment, and social performance (Lamberton 2005). Sustainability accounting aims to optimize decision-making frameworks for quantifiable measures of environmental and social impact dimensions. Environmental and social impact costs need to be separately identified from overhead accounts and allocated to each production activity where these costs are consumed (Sendroiu et al. 2006; UNDSD 2001). Subsequently, companies are able to develop internal decision making policies on the management of these costs, as well as supporting and balancing stakeholders' demands (Epstein 2008). Thus, an effective management accounting framework becomes a significant business tool to support economic, social, and environmental aspects of decision-making. This framework assists companies in providing disclosure of performance, while adding value to an organization and ensuring its sustainability (Berkel 2003; Gadenne & Zaman 2002; Hubbard 2009). Additionally, companies not only create better relationships with their stakeholders, but also promote themselves as 'green producers' or environmentally and socially aware organizations (Carbon Trust 2005; EPA Victoria 2007).

Therefore, environmental management accounting (EMA) is introduced as a new form of sustainable development to create accurate environment cost information for management decision strategies and external disclosures (Berkel 2003). Environmental management accounting is a component of environmental accounting and sustainability that helps in identifying, measuring and analysing environment-related costs (IFAC 2005). Previous studies (e.g. Burritt & Saka 2006; Gadenne & Zaman 2002; Gale 2006a) have suggested that EMA should be developed as a framework or conceptual model for more accurate measurement of environment costs. This would facilitate companies to develop tracing and tracking reporting systems, as well as improving physical quantities and management of environmental flows in production processes (Burritt & Saka 2006). It would also allow companies to deal adequately with environmental data, thus avoiding attribution of these costs to overhead accounts, as currently treated by traditional management accounting (UNDSD 2001). This study applied shallow ecology theory to examine the measurement of environmental costs to support decision-making on reduction of carbon emission, and further develop environmental-friendly and ecological systems. Consequently, environmental management accounting concerns environment internal decision-making on costs and management of environmental flows and external reporting initiatives. Companies provide sustainable development reporting by disclosing environmental and social performance to a broad group of stakeholders and public (Berkel 2003). However, environmental management accounting does not cover improvement in social efficiency to address stakeholder and public interests (IFAC 2005). In relation to this, companies need an appropriate management accounting tool for social cost identification and measurement.

In sustainability accounting concepts, social management accounting is introduced to sustainable development firms as a subset of social accounting practices, leading to more accurate cost information of social impacts (Mobley 1970). Currently in Australia, companies are most likely disclose their sustainable development performance to build their reputation and create a positive image, rather than addressing concerns of stakeholders and the public (Deegan 1996). As a result, cost accounting data of social impacts are not only inaccurate, but are less likely to enhance social internal decision-making and support external reporting initiatives. Thus, social accounting should be generated as a framework (Spence 2009) and introduced to Australian companies to help in cost identification and measurement of social impacts. Subsequently, companies would have the capability of capturing social data from expenditures spent on improving the quality of employees' lives, the community and society (Mook, Richmond & Quarter 2003; Quarter & Richmond 2001). Accurate cost information of social impacts is also employed to enhance social internal decision-making (investment decisions) on cost measurement (Gray 2006; Gray et al. 2001) and provide accurate corporate social responsibility (CSR) reporting and disclosure to a broad group of stakeholders and the public (Tinker, Lehman & Neimark 1991). Marx's labour theory of value was considered appropriate for this study to help examine the needs of companies in measuring costs of social impacts (Tinker & Gray 2003). As the need of companies is to provide more accurate cost accounting data of social impacts and environment for decision-making and reporting purposes, existing management accounting should be further developed for cost allocation and analysis such as activity based costing (ABC).

Activity based costing (ABC) application of traditional management accounting becomes the main focus in developing green accounting concepts that help in identifying and allocating environmental costs to single production activity using cost drivers or cost centres (Cãpusneanu 2008). ABC application should be expanded on environmental and social management systems using full cost accounting systems to collect sustainable costs of environment-related costs and social impacts. These costs should be allocated to each production activity where they are consumed in the production process, thus avoiding cost allocation to general overhead accounts (Jasch 2009). ABC application is expanded to cost analysis relying on environmental cost calculation, environmental management systems, and investment management of private costs—social expenditure (Cãpusneanu 2008; IFAC 2005; Sendroiu et al. 2006). The principles of ABC application facilitate companies to create eco-efficiency as a result of cost savings from reducing unit inputs (e.g. material, energy, water, and wastes) and non-product outputs such as emissions, wastes, and/or disposal wastes (Cãpusneanu 2008; CIMA 2006). Thus, by expanding on ABC application, companies could improve their ability to fully cost products—thereby creating more accurate costs of environment and social impacts for better management decisions on cost savings and reporting initiatives (Jasch 2009). Therefore, companies could create better business opportunities and improve economic performance, as well as developing environmental and social efficiency and addressing the concerns of stakeholders and the public.

Accordingly, this study designed a conceptual model for a Sustainability Management Accounting System (SMAS) as an effective management accounting tool to improve management accounting systems of organizations. A SMAS integrates environmental management accounting (EMA) and social management accounting (SMA) concepts to help in the identification of environmental costs and measurement of social impact costs (Burritt, Herzig & Tadeo 2009; Gadenne & Zaman 2002; Gale 2006a; IFAC 2005; Richmond, Mook & Quarter 2003; Sendroiu et al. 2006). A SMAS also applies on the application of the activity based costing (ABC) approach of allocating these costs to individual costs of products (Englund & Gerdin 2008; Taplin, Bent & Aeron-Thomas 2006; The Sigma Project 2003). By adopting a SMAS, companies can provide more accurate cost information for environmental and social impacts, thus improving internal decision making. In addition, companies could employ this cost information to support disclosures of environmental and social performance in the form of a triple bottom line report. Thus, stakeholder theory is employed to examine ethical and moral obligations of companies in providing cost information of environment and social impacts to support external disclosures.

Consequently, the adoption of a SMAS would benefit companies by adding value to their organizations and enhancing their sustainability (Berkel 2003; Gadenne & Zaman 2002). Additionally, a SMAS could support companies in their attempts to create a positive reputation as a 'green organization' in the eyes of their stakeholders and/or to become more competitive in the marketplace (Carbon Trust 2005; EPA Victoria 2007). However, in measuring costs of environment and social impacts, companies are faced with various difficulties, which are captured in the research problem outlined in Section 1.2 below.

1.2. Statement of the research problem

As companies are in the early stages of environmental and social cost identification and measurement, these costs are currently hidden among production processes (IFAC 2005). In addition, traditional management accounting has historically allocated environmental and social costs to general overhead accounts, thus creating difficulty with specific cost identification and measurement of environment and social impacts (Gale 2006a; IFAC 2005). Meanwhile, as product costs increase, there is a reduced focus by firms on social impact costs, despite this aspect being of significant concern to stakeholders (Pramanik, Shil & Das 2007; The Sigma Project 2003; UNDSD 2001). As a result, environmental and social cost information appears to be inaccurate when employing cost information to support management decisions on cost savings and sustainable development performance disclosures. Companies seek to be seen as sustainable growth organizations as a result of creating energy efficiency, minimizing wastes and disposal, reducing packaging materials and product designs, generating water efficiency, and using renewable energy. Also, when it comes to competitive differentiation in 'green' markets, companies are unable to create better business opportunities by adding shareholder value from operational effectiveness and environmental and social efficiency.

Although management accounting systems could assist companies to deal with environmental and social cost identification and measurement, it is not clear from the literature what the appropriate characteristics of a holistic system are. Based on the literature, a theoretical framework has been developed building on the concept of social and environmental management accounting that identifies some—but not all—of the characteristics required in a SMAS. Furthermore, incorporation of these environmental and social costs into a management accounting system is not widely accepted by manufacturing industries and, to date, has not been fully exploited (Gadenne & Zaman 2002; Gale 2006a; Hubbard 2009). There appears to be limited awareness and expertise among companies that sustainability accounting concepts could provide a holistic system to overcome this problem (Gadenne & Zaman 2002; Gray 2006). In addition, separating environmental and social data from overheads is viewed as complicated by management accountants with little knowledge of cost allocation and analysis of environment and social impacts (Epstein & Roy 2001; Gray 2002a).

Furthermore, sustainability reporting is elevated in sustainable development discussion at board room level to disclose economic, environment, and social performance in the form of a triple bottom line (Berkel 2003) and corporate social responsibility (CSR) reporting systems (Gray 2006; Tinker & Gray 2003). Companies are facing increased pressure from stakeholders, investors and the public to volunteer environmental disclosure risks, depending on levels of carbon intensity (Schaltegger & Burritt 2000). In relation to this, regulators such as EPA Victoria[1] are influential in requiring companies to disclose their carbon emissions and energy consumption in line with the Climate Action and Energy Policy (EPA Victoria 2007).

Apart from that, the Australian Government currently requires—since last fiscal year (2008-2009)—compulsory reporting for all polluters with GHG emissions over 25,000 tonnes of CO_2 per year. In relation to this, the Australian Government formulated the Carbon Pollution Reduction Scheme Policy, to be enforced as an emission trading system (ETS), to reduce waste, solids and carbon emissions, and anticipated to be operational by 2011 (Department of Climate Change 2008b). Although this policy has been dropped at the early in 2010, the current debate is about carbon pricing which will require companies to disclose energy consumption and emissions abatement (Bartolomeo et al. 2000; Bose 2006) to comply with NGER[2] and GRI[3] requirements (Department of Climate Change 2008a; KPMG 2007).

Thus, this study's design of a SMAS helps provide companies with a holistic system that could meet most of their internal decision-making needs and external reporting requirements.

[1]Environment Protection Authority (EPA) Victoria is a regulator of non-governmental organizations that provides sustainable development principles to work with Australian companies for improvement in environmental performance, along with economic and social efficiency (EPA 2010).

[2]The National Greenhouse and Energy Reporting NGER is a requirement of national reporting in terms of energy consumption and emissions abatement of organizations which also introduces emission trading scheme policy to all types of emitters (Department of Climate Change 2008a).

[3]The Global Reporting Initiative (GRI) is 'a multi-stakeholder non-profit organization that develops and publishes guidelines for reporting on economic, environmental, and social performance as sustainability performance' (KPMG 2007, p.2).

1.3. Scope of the study

An initial aim of this study is to identify an effective management accounting practice for environmental and social impact costs of best practice companies to support the design of a sustainability management accounting system (SMAS) conceptual model. For the purpose of the study, the scope of management accounting systems primarily involves environmental and social cost identification and measurement. Creating accurate cost information to support internal decision-making on cost savings and reporting purposes frame the boundary of this study. This study adopts sustainability accounting concepts using environmental management accounting (EMA) and social management accounting (SMA) to integrate with an activity based costing (ABC) application in a SMAS conceptual model. However, this study does not attempt to disclose financial accounting practices. In addition, the study is limited to Australian non-service manufacturing companies.

1.4. Definition of key terms

To minimize some confusion in the use of cost measurement concepts used within the theoretical framework of a sustainability management accounting system (SMAS), this section provides key definitions. The key definitions are related to cost measurement of environmental and social impacts that will be incorporated as characteristics of the sustainability accounting system to be designed. Concepts of EMA and SMA are also adopted to define characteristics that should be incorporated into the theoretical framework.

1.4.1 System characteristics

System characteristics identified relate to accounting approaches or systems that help in the identification and measurement of environmental and social impact costs relying on sustainability accounting concepts/practices. The system provides companies with a way to capture physical (material, water, energy, wastes, and emissions) and monetary (financial reporting and earning) units. The system characteristics referred to in this study incorporate environmental management accounting and social management accounting concepts. The system is better able to capture environmental and social performance indicators based on the requirements of GRI and NGER.

According to IFAC (2005), environmental management accounting (EMA) is an appropriate accounting approach for environmental cost measurement, and the system could appropriately capture costs while helping to manage the use and flow of natural resources within the production process. Berkel (2003) claimed that environmental management accounting concepts provide companies with a way to disclose their environmental performance. Further, previous studies (e.g.Gadenne & Zaman 2002; Savage, Ligon & Lomsek 2001; Sendroiu et al. 2006) considered environmental management accounting as an accounting tool to identify, analyse, and measure environmental costs. As a result, the system characteristics have the capacity to capture environment costs to enhance internal management decisions by creating more accurate cost information for incorporation into disclosures in both financial and non-financial forms.

On the issue of social cost measurement, the system characteristics capture overhead expenditures to enhance society, employee well-being and environmental protection, which are usually then allocated to or by default included in overheads. In doing so, the system characteristics necessarily could redefine social management accounting (SMA*)* concepts to support social disclosures (Gray 2001, 2002a, 2006). Moreover, system characteristics could capture social impact costs to maximize profits when products are produced and sold in larger numbers (Pittman & Wilhelm 2007). Subsequently, social disclosures appear inaccurate when reported to management and/or to company stakeholders and the public. Therefore, to deal with this issue, a system which incorporates appropriate characteristics can present companies with a way to create more accurate financial and non-financial information to not only improve business decision-making, but to add stakeholder value.

Significantly, the system characteristics of a SMAS are defined by this study as covering full cost accounting that could be fully allocated to appropriate production activities (Antheaume 2007). As full cost accounting aims to collect costs from external and internal organizations (Antheaume 2007; Bebbington et al. 2001), the system characteristics are designed to capture full costs of products, including environmental and social impacts. The systems also allocate cost information to a single production activity using the activity based costing approach. Cãpusneanu (2008) employed activity based costing (ABC) to deal with environmental costs as 'green accounting' for environmental cost analysis and allocation. Such measures would result in companies improving their business decision-making, as well as assisting in the preparation of economic, social, and environmental performance disclosures (Englund & Gerdin 2008; The Sigma Project 2003). Consequently, this study defines system characteristics using environmental and social management accounting concepts to measure costs of physical and monetary units in production activity and external organizations in terms of environmental and social performance indicators based on GRI and NGER requirements. These characteristics have been drawn for the most recent literature on environment and social reporting, as well as sustainability management accounting best practice.

1.4.2 Management accounting best practice

Management accounting is a traditional accounting approach that refers to cost identification, measurement and analysis within production and service processes (Heeren 1998) while preparing cost information for financial reporting (IFAC 2005). According to CIMA (2005), management accounting aims to create more accurate cost accounting information to enhance management decisions and increase shareholder value. Management accounting also refers to accounting processes and techniques that assist companies to effectively and efficiently manage use of resources (Langfield-Smith, Thorne & Hilton 2009) while fully costing resources consumed by production activity (Young 2003). These practical approaches include cost management strategy in production processes such as labour hours, use of materials, and/or overhead expenditures. These costs need to be assigned to appropriate production activities using cost drivers to inform business decisions for planning, budgeting, and managing use and flows of materials, energy, and water (IFAC 2005). Management accounting, therefore, introduces an activity based costing (ABC) approach to help management in cost allocation and analysis—resulting in improved internal decision-making (Eldenburg & Wolcott 2005). Subsequently, management accounting is an effective accounting technique that facilitates management accountants and financial professionals to capture the full cost of products, to define differential cost accounting, and to take managerial accounting problems into account (Young 2003). The initial aim of management accounting is to appropriately capture full costs while allocating to a single production activity (Bragg, S. M. 2005). According to Bragg (2005), the main expectations of best practice in cost implementation are based on the costing system of activity based costing (ABC) approach. Costs allocated to each production activity to fully cost products should be correctly identified from the task of production processes of its product (Bragg, S. M. 2005). Management accounting best practice needs to rely on an activity based costing (ABC) system when capturing product costs and allocating to individual products to create accurate cost information. Accurate cost information will result in improved business decisions and support of financial reports. Companies also create greater shareholder value when disclosing operational performance in economic, social, and environment areas to stakeholders and the public.

Recently, stakeholders have exhibited increased concerns regarding environmental and social performance; therefore, companies need effective accounting approaches to deal with environmental and social costs. Even though management accounting is widely used to measure cost of inputs (materials and labour), environmental and social costs have historically been treated as overhead expenditures (Hill, McAulay & Wilkinson 2006). This approach results in these costs being hidden among production and service processes at a time when companies would benefit from more accurate cost information for business decision-making (IFAC 2005; UNDSD 2001). To deal with this matter, management accounting could be developed as a holistic accounting system that captures and reports full costs while identifying these costs in appropriate categories such as environment and social impacts. This system can be developed using management accounting best practice to help control production costs while measuring improvement in productivity (Johnson, T. H. & Kaplan 1987). Management accounting systems also help in providing accurate cost information to support internal management decisions on products and pricing systems (Johnson, T. H. & Kaplan 1987). Thus, a management accounting system can be an effective accounting approach that helps in cost identification and allocation of environmental and social impacts to ensure sustainability.

This study has defined management accounting best practice as existing accounting systems providing companies with a way to accurately identify, measure and capture environmental and social impact costs, as well as separating these costs from overhead expenditures. Management accounting best practices are recognized as cost identification and measurement tools to provide full costing for enhanced management decision making and financial disclosures. Best practice companies were also identified as those companies successfully reducing environmental costs and contaminants. Additionally, management accounting best practice defined by this study means to provide triple bottom line disclosure, as well as corporate social responsibility (CSR) reporting to add value to sustainable organizations. Following section provides best practice companies in their environmental and social development performance.

1.4.3 Best practice companies

Best practice companies encompasses firms that providing better techniques, methods and process to create greater operational outcomes than others in similar circumstance. Best practice companies create eco-efficiency while leading the way with significant environment-friendly and social well-being (Epstein 2008). Best practice companies identified in this study refer to those firms having higher competency in dealing with environmental and social performance, as well as creating eco-efficiency in the eyes of stakeholders and the public (Hancock 2004).

An example of this is IBM, which has been recognized for its international best practice in using lower volumes of energy and creating less emission. IBM has adopted a variety of management strategies that would potentially reduce energy consumption and GHG intensity of its energy usage (World Resources Institute 2004). In relation to this, Shell has been identified as a leading edge company for environmental impact costs in terms of the measurement of energy consumption to reduce GHG emissions (Gadenne & Zaman 2002). Shell has also designed operational control systems to report energy consumption and GHG emission abatement (World Resources Institute 2004). Another best practice company is Toyota. Toyota is well-known for its environmental management performance, as well as their focus on reduction in energy consumptions and GHG emission abatement. This company is regarded as being environment-friendly by producing cars that create less emission in the air while achieving ISQ 14001 requirements in 2009 (Toyota 2009).

Best practice companies such as IBM are also concerned with improvement in the quality of society, employees, and the local community where they operate. This company provides technology and social development programs to support working performance while offering learning programs, courses and degree with 250 universities in developing countries to support future careers (IBM 2008a). In relation to this, Shell provides local supply chain and community programs to help local suppliers set up their business, as bringing financial benefit to the community by hiring local employees. Training courses and coaching are also provided to support working performance, as well as providing health and safety programs to reduce injury rates (Shell 2009). Toyota also provides local community development programs including sport, environment and local community services which, in turn, create stronger relationships with local communities. This results in Toyota being recognized as a best practice company in supporting local community and social development (Toyota 2009).

Consequently, this study has defined best practice companies as leaders in corporate sustainability and having a superior ability to deal with environmental and social issues, along with economic performance. Companies need to meet the criteria of international benchmarking companies such as IBM, Shell, and Toyota, as well as achieving GRI and NGER requirements in measuring environmental and social performance indicators. Best practice companies build high reputations in terms of environment-friendly and socially aware organizations. Best practice companies are significantly concerned with improvement in negative impacts on society and local communities where they operate. Companies employ better management accounting techniques/systems to manage use and flow of resources (e.g. material, energy, water, waste, and disposal) in production processes while creating lower levels of wastes and emissions. Social impact costs can be accurately captured from social expenditures provided to support societal well-being. Management accounting of best practice companies are employed to design an improved SMAS conceptual model; thus, the following section provides a definition of a sustainability management accounting system

1.4.4 Sustainability management accounting system (SMAS)

A sustainability management accounting system (SMAS) refers to sustainability and management accounting concepts and practices dealing with environmental and social issues, as well as traditional cost management. Sustainability has been accepted as an integration of three performance issues—economic, social, and ecological systems (environment)—that are required in order for companies to sustain development (Dixon & Fallon 1989). The main areas of development are related to human, social, economic and environment (Goodland 2002)—which companies need to disclose in the form of a triple bottom line report (Berkel 2003). Milne (1996) mentioned that the main purpose of 'sustainability' is to wisely manage use and flows of unit inputs (e.g. materials, energy, and/or water) used in production processes. Organisations need to apply appropriate management accounting practices to create cost accounting data to guide business decision-making regarding these inputs (Milne 1996). Thus, sustainability and management accounting practices become a significant combination to maintain the balance between business performance and environmental concern, as well as taking social responsibility into account.

Bennett and James (1998) emphasized that a sustainability management accounting system mainly focuses on measuring and analysing financial and non-financial data to internally and externally disclose the performance of a business in the form of triple bottom line (economic, social, and environmental) to add value to sustainable organizations. In extending this definition further, a sustainability management accounting system aims at identifying costs of environment and social impacts to create more accurate cost accounting data for reporting purposes. Companies adopt accounting data of these costs to support business decision-making processes (Henri & Journeault 2009) in relation to capital budgeting and cost analysis for future productions (The Sigma Project 2003; UNDSD 2001). In addition, a sustainability management accounting system supports the long-term development of organizations in relation to triple bottom line performance (economic, social and the environment) (Donaldson & Preston 1995; Drengson & Inoue 1995; Shaw 2009). This includes sustainable development processes which company stakeholders expect to be disclosed to support their decision-making before investing in particular organizations.

Schaltegger's (2004, p. 3) definition of sustainability management accounting (SMA) relating to sustainability accounting and reporting is as follows:

> '….a subset of accounting and reporting that deals with activities, methods and systems to record, analyse and report, firstly, environmentally and socially induced financial impacts and, secondly, ecological and social impacts of a defined economic system (e.g. a company, production site, nation, etc.). Thirdly, and maybe most important, sustainability accounting and reporting deals with the measurement, analysis and communication of interactions and links between social, environmental and economic issues constituting the three dimensions of sustainability'.

These measures help in providing financial disclosures for the development of sustainable organizations and to add value to economic, social and environmental performance (Bebbington 1997). In addition, social and environmental management accounting could also encourage companies to be more concerned with the development of society and the environment while reducing natural resources employed to support production processes (Bebbington 1997). Social and environmental management accounting (SEA) is a new accounting approach that needs to be explored in future studies (Bebbington 1997) as it has the potential to help companies maintain their sustainability (Berkel 2003; Gadenne & Zaman 2002; Hubbard 2009).

For this study, a sustainability management accounting system (SMAS) has been defined as an effective conceptual model of an accounting system for sustainable organizations in relation to environmental and social cost identification and measurement. The initial aim of a SMAS conceptual model is to improve cost identification, measurement, and allocation of environmental and social impacts while fully costing products for better management decisions. A SMAS is also recognized as a sustainable development tool that provides companies with a way of providing environmental and social disclosures such as triple bottom line reporting and/or corporate social responsibility (CSR) reporting. Companies are then able to support demands of stakeholders and the public for fuller disclosures while creating value and sustainable organizations.

1.4.5 Sustainable organization

A sustainable organization refers to one that is concerned with the long-term development of economic, social and environmental performance. A sustainable organization aims at sustaining society by firstly ceasing environmentally harmful practices, then considering social aspects and, finally, achieving sustainability from the present through to the future (Bradbury & Clair 1999). With sustainability becoming a new key driver of innovation, sustainable companies are required to disclosing triple bottom line reporting—which ultimately results in adding value for stakeholders and gaining a competitive advantage in the marketplace (Nidumolu, Prahalad & Rangaswami 2009). Subsequently, sustainable companies are required to incorporate environmental and social performance in their financial reports to support stakeholders' concerns (Hasnas 1998). In doing so, companies implement sustainable development practices, as well as meet sustainability targets (Lamberton 2000). Thus, creating a sustainable organization is a valuable business strategy to create a competitive advantage in the marketplace (Robert 2008).

In Egypt, Wahaab (2003) claimed that development and the environment should be integrated to reach sustainable development needs in order to support improved decision making on environmental aspects. This results in sustainable organizations gaining a competitive advantage (Rouse & Daellenbach 1999) by successfully creating a positive reputation as a 'green' producer, and the perception of a socially responsible firm with their stakeholders (Matthews & Shulman 2005). In this regard, a sustainable organization aims at managing cost efficiency of environmental and social impacts while creating cost information to enhance management decisions in relation to these costs (Bebbington, Brown & Frame 2007). Thus, companies need to be more aware of natural resources management and maintaining the balance between nature and humanity (Bebbington & Gray 2001).

According to Osborn (1998), a sustainable organization is a new form of business strategy, management control and information system designed to wisely organize the use of resources within production activities to improve the sustainability of organizations. In addition, as natural patterns and ecological systems have been claimed as the main archetype on Earth, all polluters and/or resources extractors need to be aware of the requirement to reduce the impact on the bottom-line and activate environmentally practices to ensure sustainability (Ryland 2000). To be a sustainable organization, companies need to create value in economic performance when measuring use of resources to produce large volumes of products and/or services (Taplin, Bent & Aeron-Thomas 2006). Consequently, a sustainable organization is a 'green' organization by being concerned with the development of sustainability in relation to ecological and/or environmental systems (Jennings & Zandbergen 1995). A sustainable company is significantly involved in the development of three elements: economic, environmental, and social performance—thus ensuring its sustainability is achieved (Bebbington 2007b).

This study defines a sustainable organization as one that is managing reductions in use of natural resources, preserving ecological systems and natural patterns, as well as taking social responsibility into account. A sustainable organization, as identified by this study, aims at developing economic, social, and environmental performance while disclosing in triple bottom line and corporate social responsibility (CSR) reports to stakeholders and the public. Furthermore, this study has recognized a sustainable organization as a ‘green’ producer and socially responsible organization in the marketplace, and one that maintains the balance between removing and replacing natural resources to reduce long-term negative impacts on nature and society.

1.5. Study motivation and expected contributions

Prior motivation for undertaking this study was driven by growing concerns for the sustainability of our planet. This is fuelled by the concerns voiced by stakeholders and the public in relation to social and environmental performances of organizations (Berkel 2003; Gadenne & Zaman 2002), which have resulted in firms needing to be accountable for their actions and activities. However, in accomplishing these goals, stakeholders are also seeking a solution that is both efficient and effective. Therefore, this is the primary motivator of this study and its contribution to the practice of accounting.

Previous studies (e.g. Beer & Friend 2005; Gale 2006a; IFAC 2005; Qian & Burritt 2007) have identified the need for environmental management accounting to better manage physical and monetary units, and this provides further motivation for this study to contribute to the literature. Companies also need to adopt triple bottom line reporting to support internal decision making and for disclosures to stakeholders and the public (Lamberton 2005), as well as for energy consumption and emissions abatement reporting (Bartolomeo et al. 2000; Bose 2006). Other studies (e.g. Cullen & Whelan 2006; Richmond, Mook & Quarter 2003) also suggest that social accounting should be employed to measure concerns of social issues to create shareholder value while providing corporate social responsibility reporting. Thus, this study seeks to contribute to both practice and the literature.

Contribution to the literature

This study is expected to make contributions to the literature in relation to introducing sustainability accounting concepts and practices for sustainable organizations while expanding on activity based costing for cost allocation and analysis of environment and social impacts. Firstly**,** it would appear, based on the current literature review, that no studies have developed a holistic model that combines environmental management accounting (EMA) and social management accounting (SMA), as defined in this study. Environmental management accounting concepts and practices should be introduced to Australian non-service manufacturing companies (Gadenne & Zaman 2002) to identify and capture environmental costs from internal and external organizations (Gale 2006a). Meanwhile, social management accounting concepts need to be employed for social cost measurement to support working performance of employees and for the development of society as a whole. Thus, an integration of EMA and SMA designed by this study could make a contribution to previous studies (Gadenne & Zaman 2002; Gale 2006a; Gray 2006; Gray et al. 2001) aimed at motivating companies to be involved in sustainability accounting concepts and procedures (Berkel 2003; Lamberton 2005; Taplin, Bent & Aeron-Thomas 2006). Such integration is considered a useful contribution for environmental and social cost identification and measurement when the need of companies is to create accurate cost accounting data for management decisions and disclosures.

Secondly, these costs could be allocated to appropriate costs of products while fully costing for management decisions and supporting external disclosures—thus extending ABC application is seen as a significant contribution to the literature (Gadenne & Zaman 2002; Nachtmann & Al-Rifai 2004; Sendroiu et al. 2006). Using an extended ABC application, environmental management accounting could be used to identify costs of environment and manage use and flows of resources, energy and water before assigning to single products (Beer & Friend 2005; Gale 2006a; IFAC 2005; Qian & Burritt 2007). In addition, social management accounting could provide companies with methods to measure social costs to improve the quality of society, employees, and the environment (Gray 2006; Mook, Richmond & Quarter 2003; Pittman & Wilhelm 2007; The Sigma Project 2003). Such strategies would help provide more accurate environmental and social cost accounting information to improve internal decision making (Burritt, Herzig & Tadeo 2009; Gale 2006a; Gray 2006), while concurrently developing three specific areas of performance—economic, environmental and social (Berkel 2003; Gadenne & Zaman 2002; Hubbard 2009; Lamberton 2005).

Thus, an ABC application is considered appropriate to expand on ABC application to help capture environmental and social impact costs while assigning to appropriate production activities. This leads to a significant contribution to practice by this study, which intends to develop a conceptual model of sustainability management accounting system (SMAS) for sustainable organizations.

Contribution to practice

This study demonstrates that the conceptual model of a SMAS could bring essential benefits of improved system characteristics of sustainability accounting to non-service manufacturing companies in Australia. Firstly, by having a developed SMAS companies could potentially identify and allocate environmental costs more accurately, as well as manage reductions in associated costs and contaminants (Beer & Friend 2005; Borga et al. 2009; Burnett & Hansen 2008; Gale 2006a). A SMAS could also help measure social impacts costs from overhead expenditures provided to support working performance, healthcare and safety of employees, as well as social responsibility as a whole (Gray 2006; Mook, Richmond & Quarter 2003). This study expects that a SMAS could create more accurate cost accounting data of environment and social impacts, thus fully costing from production processes and external organizations.

Secondly, a SMAS could facilitate the collection of full costs of products, including environment and social impact costs, to allocate to the appropriate production activity (Bebbington et al. 2001; Englund & Gerdin 2008; The Sigma Project 2003). A SMAS could support companies to employ cost accounting data to enhance management decisions on reductions in these costs and contaminants while reducing negative impacts on society, employees, and environmental patterns. By adopting a SMAS, companies meet the requirements of a sustainable organization, thus balancing operational performance and ecological systems—as well as social responsibility. Apart from that, cost accounting data could be utilized to incorporate into financial reporting in the form of a triple bottom line, and disclosing three areas of performance—economic, social, and environmental.

Finally, companies would potentially add value to their triple bottom line (Berkel 2003; Milne 1996) by using environmental and social costs information to provide disclosures to external stakeholders (Borga et al. 2009; Taplin, Bent & Aeron-Thomas 2006). This would lead to companies establishing and benefitting from a better relationship with stakeholders, while building positive reputations as green producers in the marketplace (Carbon Trust 2005; EPA Victoria 2007). Finally, adopting a SMAS could also provide organizations with the ability to comply with reporting energy consumption and emissions abatement to the National Greenhouse and Energy Reporting (NGER) and meeting the requirements of the Global Reporting Initiative (GRI).

As a consequence, a SMAS could provide effective management accounting practices and procedures for sustainable organizations in relation to environmental and social cost identification and measurement. Companies could employ more accurate cost accounting data to develop internal management decisions, as well as providing triple bottom line reporting to support stakeholders' interests. By applying a SMAS, companies could add value to economic, social, and environmental performance, thus becoming socially and environmentally aware organizations in the eyes of stakeholders and in the marketplace.

1.6. Research approach and methodology

To achieve the research objectives, the following four phases were constructed for this study:

- Development of research model and objectives;
- Survey system characteristics of sustainability management accounting;
- Interviews to ascertain current benchmarking management accounting practices among cases; and
- Improvement in a conceptual model of sustainability management accounting system (SMAS).

Firstly, the study developed a research model relating to the identification of an effective management accounting system characteristics for measurement of environmental and social impact costs. Three prior theories were fused to help examine the needs of companies in accurately measuring costs of environment and social impacts. As these costs are complex, companies have tended to ignore the requirement to accurately measure these costs for their internal decision making or disclosures (Gale 2006a; Hazilla & Kopp 1990; IFAC 2005). However, previous studies (e.g. Burritt, Herzig & Tadeo 2009; Gadenne & Zaman 2002; Gale 2006a; Sendroiu et al. 2006) suggested that environmental costs need to be accurately identified in order to support internal decision making, as well as developing the environmental performance of an organization. Meanwhile, social costs should be included to improve quality of life of employees, society and the environment—and, at the same time, develop social and economic performance in the long-term (Geibler et al. 2006; Schaltegger & Wagner 2006). Thus, three theories were applied to examine the ethical and moral obligations in providing cost information (Donaldson & Preston 1995; Drengson & Inoue 1995; Shaw 2009; Yee et al. 2008), along with the measurement of environmental and social impact costs in the theoretical framework of a sustainability management accounting system (SMAS).

In a theoretical framework of a SMAS, the related terminologies were reviewed from the relevant literature to design a SMAS conceptual model. This included an environmental management accounting (EMA) concept that is utilized to separately identify costs of environment in production processes (Gale 2006a; IFAC 2005). A social management accounting (SMA) concept was used to help measure costs of social benefits that companies could provide to improve quality of employees, society, and, to some extent, the environment. In addition, activity based costing (ABC) application was applied in relation to cost allocation and cost drivers. This helped support a SMAS to appropriately assign environmental and social impact costs to an appropriate production activity, as well as a single product cost.

In the second phase, as a primary exploratory study, companies' responses to the Carbon Disclosure Project (CDP) questionnaire were considered appropriate for investigation as secondary data in this study. Secondary data for the quantitative study was conducted from January to March, 2010. Sixty-two companies' responses were selected from non-service sectors using purposive sampling methods based on the purpose of the study. Interviews were conducted from May to June 2010. These sectors were from (1) mining and metal product; (2) food, beverage and tobacco; (3) textile, clothing, footwear and leather; (4) petroleum, coal, chemical and associated products; (5) machinery and equipment; (6) electricity, gas and hot water supply; (7) construction; (8) retail trade (with the exception of motor vehicles and motorcycles; repair of personal and household goods); (9) air transport; and (10) telecommunication. Responses were sought from sixty-two targeted companies (53 Australian and 9 New Zealand companies) to determine the requirements of environmental and social management accounting practices (IFAC 2005; UNDSD 2001), identified as system characteristics currently used or planning to be used by these companies.

The third phase, the benchmarking model, was developed from a Lean Six Sigma Improvement Cycle process, and was applied to measure management accounting best practices among fifteen companies, as a case study. Companies to be studied were selected from 53 Australian companies in non-service sectors using purposive sampling methods. Three companies from each sector were studied. The companies were examined in terms of their management accounting practices or systems used in the measurement of environmental and social impact costs, evaluation of waste and emission abatement, and environmental and social cost allocation. Management accounting best practices among the fifteen companies were identified in terms of data accuracy, enhancement of internal decision-making, and sustainable value added. This included the accuracy of cost information that companies utilize to support environmental and social internal decision making and/or external disclosures. In this phase, the survey results were employed to support management accounting best practice for environmental and social cost identification and measurement in a benchmarking model. Further, best practice companies capturing environmental and social impact costs were used to support the design of a conceptual model of a sustainability management accounting system (SMAS).

In its fourth phase**,** this study designed a conceptual model of a sustainability management accounting system (SMAS) integrating environmental management accounting (EMA) and social management accounting (SMA) practices, while expanding on an activity based costing application. A SMAS was designed to improve cost identification and measurement of environment in order to more accurately create cost information to enhance internal decision-making on cost savings and emission abatement. A SMAS helps manage the use and flows of resources, energy, and water (including measurement of reduction of emissions and waste, where possible) by relying on environmental management accounting approach. A SMAS also improves cost measurement of social impacts using social management accounting practice to accurately create cost information of social impacts. By expanding on ABC application in a SMAS, environmental and social impact costs would be separately captured from overhead accounts before assigning to single production activity where these costs are consumed. Thus, a SMAS could provide companies with a way to fully cost products for management decisions and supporting external reporting initiatives.

1.7. Dissertation outline

Chapter 1 provides the background to the statement of the research problems that led to the scope of the study. It also describes study motivations and contributions, as well as providing a brief overview of the research approach and methodology (including an outline of each of the chapters).

Chapter 2 introduces three related theories that are fused to help examine environmental and social impact costs. The chapter also reviews the relevant literature, and definitions of terminologies are provided to support the designed conceptual model of a sustainability management accounting system (SMAS). Gaps in the literature—which this research seeks to fill—are also identified.

Chapter 3 justifies gaps in the literature to address research questions and propositions as part of the research design. This chapter also describes a theoretical framework of a sustainability management accounting system (SMAS) which is built from the process of the study. Three preliminary theoretical perspectives were applied to the theoretical framework to support the measurement of environmental and social costs for the design of a sustainability management accounting system (SMAS).

Chapter 4 identifies the research methodology which provides an approach to the data collection and analysis. This chapter describes the selection of survey targets and companies to be studied, as well as describing data collection procedures. Additionally, it includes a discussion of the pilot case studies and analysis procedures. The development of a survey instrument and the sampling strategies are described and, finally, the data analysis section provides an overview of quantitative and qualitative data analysis approach.

Chapter 5 provides quantitative results of analysis, as well as describing analysis procedures of descriptive and cluster analysis methods. It also provides a discussion of the results in answer to the sub-research questions.

Chapter 6 describes qualitative results in a benchmarking model beginning with identifying backgrounds of company case studies and detailing their management accounting practices. The chapter also describes data collection and analysis procedures. The results of benchmarking analysis are discussed based on propositions.

Chapter 7 discusses major findings of quantitative and qualitative data analysis in detail, based on sub-research questions and propositions. Literature review and three fused theories provided in previous chapters are discussed—along with the results of benchmarking analysis. The major findings are employed to support the design of a SMAS conceptual model.

Chapter 8 concludes the study with a reiteration of the research question and propositions and contributions of the study to the literature and company practice. The limitations of this study are discussed, along with suggestions for future research. An outline of the dissertation, including the focus of the eight chapters of the study, is provided in Figure 1.1.

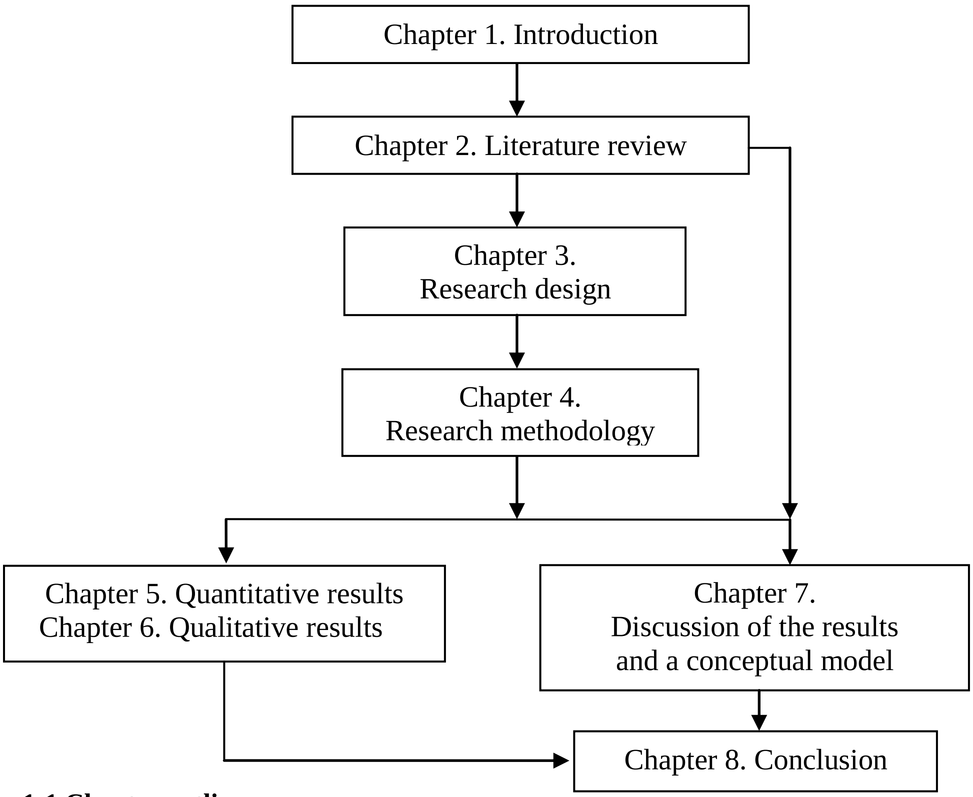

Figure 1-1 Chapter outline

1.7. Chapter summary

As environmental and social performance becomes of increasing concern to stakeholders, companies are required to measure costs of environmental and social impact for discloser in the form of the triple bottom line. Companies need to have effective management accounting systems to help measure costs of environmental and social impact costs, while capturing full costs of products. Such systems assist companies to employ cost information to improve internal decision making, as well as supporting disclosures for stakeholders.

Nevertheless, environmental costs are difficult to identify and measure as they are hidden among production and service processes. Companies, therefore, assign these costs to overheads, resulting in inaccurate cost information. Meanwhile, social costs appear to be ignored as they are claimed as private costs provided to develop the quality of employees' lives, society, and communities where companies operate. Furthermore, based on the literature, the development of a theoretical framework, built on the concept of environmental and social management accounting and identified by system characteristics required, is not yet complete. This is because incorporation of environmental and social costs into a measure of management accounting system is not widely accepted by non-service manufacturing industries and seems, up to now, not to be fully exploited.

As a contribution to the literature, this study intends to design a conceptual model of a sustainability management accounting system (SMAS) as an effective management accounting system for Australian non-service manufacturing industries. An integration of environmental and social management accounting in a SMAS provides companies with a way to accurately measure and identify costs of environmental and social impacts. In addition, an expansion of the ABC application in a design of a SMAS helps companies to allocate these costs to appropriate products. By utilising a SMAS, companies can accurately measure costs of environmental and social impact costs while capturing full costs of products. Overall, this will provide a significant contribution to practice by demonstrating how companies can employ cost information to support internal decision making and disclosures.

The designed theoretical framework of a SMAS is fused in three prior theories (deep ecology theory, Marx's labour theory of value, and stakeholder theory) to help explain the needs of companies in measuring environmental and social impact costs. Mixed methods (quantitative and qualitative) are employed to collect and analyse data by surveying system characteristics to identify an effective management accounting best practice within a case study and subsequently improve the designed conceptual model of a SMAS to add value to a sustainable organization. The following chapter, Chapter 2, provides comprehensive details of the literature review.

CHAPTER 2: LITERATURE REVIEW

The impetus for the development of economic, social, and environmental performance is driven by stakeholders and their desire to see organisations disclose, in the form of a triple bottom line report, environmental and social impact costs. Previous studies (Berkel 2003; Carbon Trust 2005; Gadenne & Zaman 2002; Hubbard 2009) have suggested that organizations need to accurately measure these costs—not only to support stakeholders' interests, but also to enhance business decision-making. However, measurement of environmental costs is not simple when hidden in overheads by traditional management accounting approaches (IFAC 2005; UNDSD 2001). In addition, capturing social impact costs may result in creating negative impacts on financial performance of companies (Hazilla & Kopp 1990; Mook, Richmond & Quarter 2003). Companies need cost information to report performance issues concerning the environment and society in order to become environmentally and socially aware organizations, as well as being regarded as 'green producers' (Matthews & Shulman 2005). Thus, this chapter provides a review of the literature regarding the needs of companies to create accurate accounting information in relation to environmental and social impact costs. Three prior theories—deep ecology theory, Marx's labour theory of value, and stakeholder theory—were fused to examine the ethical and moral obligations on companies (Donaldson & Preston 1995; Drengson & Inoue 1995; Shaw 2009; Yee et al. 2008) regarding cost identification and measurement.

2.1 Theoretical perspectives

This study applies deep ecology theory (Devall & Sessions 1985) to help identify environmental costs; while Marx's labour theory of value (Marx 1976, 1978, 1981) is utilized to explain cost measurement of social impacts. Stakeholder theory is then employed to explain the ethical and moral obligations of companies to provide accurate cost information for disclosures, as well as for internal decision-making (Freeman 1984; Freeman & Reed 1983). Such approaches aim to enhance the perceptions (both of stakeholders and within the marketplace) of environmentally and socially aware organizations that disclose their performance in the form of a triple bottom line report. Furthermore, to identify environmental costs, deep ecology theory is adopted for the study and this aspect is further discussed in the following section.

2.1.1 Deep ecology theory

Naess (1973), a Norwegian philosopher, developed deep ecology theory to examine environmental movement, known as 'deep, long-range ecology movement and shallow ecology movement' (Drengson 1995,p. 107). The shallow ecology movement is employed to fight against environmental pollution and resource depletion affected by severe ecology crises (Drengson & Inoue 1995). Shallow ecology significantly examines improvements in social health and well-being by reducing air pollutants and/or avoiding resource extractions (Drengson & Inoue 1995). Shallow ecology movement also indicates that quality of life of humans, society, and the environment need to be improved, along with preservation of the world's natural resources, habitats, and wildlife (Devall & Sessions 1985). It helps examine the need of companies to change production processes or product designs in order to reduce their use of limited natural resources (e.g. materials, energy, and water) (Devall & Sessions 1985; Jacob 1994). As a consequence, shallow ecology has been embraced by concerned environmental movements in relation to quality of life for humans and all living things (Devall & Sessions 1985; Drengson & Inoue 1995).

Shallow ecology also explains the need for companies to maintain the balance between communities and natural systems (i.e. man-made activities) and then focuses on finding solutions to solve the problems (Devall & Sessions 1985). Manufacturers, for example, who have significantly removed large quantities of resources to support their business operations need to be aware of preserving resources, as well as reforming business strategies and improving their environmental performance (Devall & Sessions 1985). In doing so, companies are required take environmental pollution and natural resource depletion into account. Further, deep ecology theory continually questions why natural patterns and environmental systems are essential for human life and other existences (Taylor 2001).

In contrast, the deep ecology movement seeks to question the ethical and moral obligations of industrial activities in response to humans, society, and the environment (Drengson & Inoue 1995). The theory indicates that ethical and moral obligations, norms and/or rules are needed by companies when providing luxuries for use in the lives of humans. These obligations include reducing negative impacts on employees, who can be seen to be 'slaves' by companies (Lauer 2002). The deep ecology movement also comprehensively questions how superior ecological patterns could be maintained in order to preserve environmental patterns and natural systems (Devall & Sessions 1985).

Deep ecology theory helps explain the movement of society relating to the changes in human activities and life styles, including the use of new technology to support production/service processes which can create negative impacts on environmental and ecological systems (Buechler 1993; Devall 1988; Seager 1993; Seed et al. 1988)—particularly within the manufacturing industry. Naess (1973), therefore, outlined the principle of deep ecology theory which includes pollution reduction and/or resources preservation for sustaining ecological systems to create environmental images (Devall 2001). Naess and Sessions spent fifteen years researching the issue before presenting the basic (platform) principles of deep ecology theory (Table 2-1) to support the differing views of philosophers and religious groups (Devall & Sessions 1985), as shown below.

> '***The platform principles of the Deep Ecology Movement***
> **1.** The well-being and flourishing of human and nonhuman Life on Earth have value in themselves (synonyms: intrinsic value, inherent value). These values are independent of the use value of the nonhuman world for human purposes.
> **2.** Richness and diversity of life forms contribute to the realization of these values and are also values in themselves.
> **3.** Humans have no right to reduce this richness and diversity except to satisfy ***vital*** needs.
> **4.** The flourishing of human life and cultures are compatible with a substantial decrease of the human population. The flourishing of nonhuman life requires such a decrease.
> **5.** Present human interference with the nonhuman world is excessive, and the situation is rapidly worsening.

> **6.** Policies must therefore be changed. These policies affect basic economic, technological, and ideological structures. The resulting state of affairs will be deeply different from the present.
> **7.** The ideological change is mainly that of appreciating ***life quality*** (dwelling in situations of inherent value) rather than adhering to an increasingly higher standard of living. There will be a profound awareness of the difference between big and great.
> **8.** Those who subscribe to the foregoing points have an obligation directly or indirectly to try to implement the necessary changes' (Devall & Sessions 1985, p.70).

These platform principles have been used by various scholars to support their studies while developing social self aspects, such as traditional aspects between women and men (Drengson 1995). Naess claimed that the platform principles were created to broadly support the 'ecofeminist, social ecology, social justice, bioregional, and peace movement' which avoids anti-humans (Drengson 1995, p.5). Fritjof Capra (1982), for example, who wrote *The Turning Point*, attempted to 'think green' in order to create a new paradigm that involves an ecological framework. Capra employed 'Toa or Yin and Yang' from Chinese philosophy to examine the relationship between value systems and cultural differences within society. This study examined deep ecology movement as a scientific discipline and found that the relationship within society significantly influenced different cultures when changes occurred (Elkins 1990). However, environmentalists of the US green movement argued that his ecological framework failed to explain the balance between nature and hunger in Ethiopia, or to disclose the danger of uncontrolled Latin culture in the US (Elkins 1990). This appears to show that deep ecology is not appropriately concerned with social aspects. Rather, the theory should be employed to examine the movement of environmental performance to support social wealth, which a number of studies into deep ecology have attempted to do.

For instance, Colby (1990) applied deep ecology theory to examine the relationship between the development of economic and resources management to protect environmental and natural patterns. Colby found that although it is not easy to capture environmental costs, the measurement of these costs assists companies in creating greater benefits from development of economic, social, and environmental performance—mainly by reducing negative impacts on the environment and society (Colby 1990). In addition, Bragg (1996) was involved in a research project on deep ecology which examined social movement and environmental psychology. Bragg strongly concurred with previous studies (Bonnes & Secchiaroli 1995; Mack 1992; Reser 1995) that environmental psychology can significantly support social welfare, as well as the natural environment.

The deep ecology movement helped identify ethical and moral actions of manufacturing industries, airlines, and other producers to measure reductions in environmental pollution and resource extractions (Jacob 1994). Khisty (2006) applied Buddhist philosophy (ethical and moral virtue), along with deep ecology, to examine preservation of natural resources and environmental systems necessary to support all existence on earth. Khisty found that where natural resources have been removed by human activity, protection of the environment and natural patterns needs to be considered because of their serious effects on society as a whole. However, socialists who value human qualities and the preservation of all existence claim that the behaviour of industry cannot be changed, but industry can introduce fundamental changes such as basic values and/or business practices (Drengson 1995). Thus, employing deep ecology theory to examine measurement of environmental costs assists companies in their ability to measure reductions of emissions and wastes. The theory also aims to develop companies' behaviours in such a way that they become more aware of the importance of being perceived as green organizations and thus improve their own financial/economic performance and market acceptance.

Consequently, in considering the design of a Sustainability Management Accounting System (SMAS), shallow ecology movement was utilized to examine the needs of companies in measuring environmental costs, as well as managing use and flow of resources, energy, and water. This enables the accurate provision of cost information for business decision-making. This study employed shallow ecology to identify the need of companies to change their production processes or product designs in order to create accountability in the use of limited natural resources (e.g. materials, energy, and/or water) (Devall & Sessions 1985; Jacob 1994). A SMAS employs shallow ecology to explain the need of companies to maintain the balance between communities and natural systems (i.e. man-made activities) and then focuses on finding solutions to solve the problems (Devall & Sessions 1985). Manufacturers, for example, who have significantly removed large quantities of resources to support their business operations need to be aware of preserving resources, as well as reforming business strategies and improving their environmental performance (Devall & Sessions 1985). In doing so, companies are required to take environmental pollution and natural resource depletion into account by measuring reductions in emissions and wastes.

Companies should have their own essential strategies to protect environmental and natural systems to meet the operational goals of management (Khisty 2006). A number of previous studies (e.g. Cãpusneanu 2008; Gadenne & Zaman 2002; Gale 2006a; Qian & Burritt 2007; Sendroiu et al. 2006) also suggested that companies need to measure environmental costs, and manage use and flows of resources to reduce costs and contaminants. Such strategies will not only maintain balances of natural and environmental systems as well as all life on earth, but also help in improving three areas of performance—economic, social, and environmental. At this point, an appropriate management accounting system could help identity and measure basic improvements in values and practices needed by organizations to avoid harmful environmental and societal impacts (Drengson 1995). Companies are increasingly becoming aware of the need to preserve the earth's natural resources and environmental systems to create value for all living things. This awareness may assist companies to become environmentally aware organizations by employing accurate cost information to improve internal decision-making. However, deep ecology has not examined the identification of social issues extensively (Jacob 1994). Thus, this study examined Marx's labour theory of value to help explain measurement of social impact costs. Next, this study examined Marx's labour theory of value to explain measurement of social impact costs.

2.1.2 Marx's labour theory of value

Karl Marx, a German philosopher, developed a concept of surplus-value(s) to explain companies' interest in measuring costs of production processes when producing large quantities of products to support high consumer demand (Little 1986). To realise the surplus-value(s) contained in products (under capitalism), products must be sold in the market at prices reflecting labour inputs (labour costs) of average (in terms of efficiency) producers (Marx 1976, 1978, 1981). Thus, both workers and capitalist business owners are concerned with efficient production, training and skilling of the workforce in selling products demanded by consumers (Marx 1976, 1978, 1981). Therefore, for Marx, companies are only sustainable where they produce at efficient levels, at least at the average for the industry, and where products produced can find a ready market—otherwise, the surplus-value(s) produced in the factory by workers cannot be realised, and some or all of the original capital invested in production may be wasted (Marx 1981; Yee et al. 2008).

According to Marx, capitalists needed to realize that they have an ethical responsibility to not only maximize profits, but also to develop society and/or social structures and to significantly improve the quality of labourers and/or workers (Corlett 1998; Wolff 1999). Corlett also claimed that the Marxist approach is related to business ethics in terms of creating greater relationships between companies and society, while making higher profits from operations. This theory indicates that value is created in production processes by workers when products are sold in large numbers in the marketplace and companies increase their profits. Thus, workers should also be given greater encouragement to improve the quality of their lives (Marx 1874 cited in Keen 2001).

Meanwhile, Lu (2009) investigated Marx's theory of capital to help improve the socialist market economy of China in order to meet global capital standards. Lu claims that Marxist theory significantly helps in reducing high levels of corruption between government departments and companies, thus avoiding violence and illegal use of slave labour, supporting the nation's labourers, and avoiding financial crises. In addition, Ziyi (2006) examined the relationship between modernity and modern production systems of Marx's thoughts. This was to discover modern construction within Chinese society. According to the ideas of Marx, modernity is significantly developed according to capitalist logic, and it is connected to historical evolution. It arose from social conflicts, and it has a global perspective. Qualities of products were based on modern production processes that belonged to the movement of capital and the need to continuously create profit (see Ziyi 2006).

Marx's labour theory of value aims to examine business ethics in companies' attempts to produce higher quantities of products to maximize profits (Marx 1874). Companies need to consider their ethical and moral responsibilities to ensure that expectations of employees and society are supported (Tinker & Gray 2003). According to Marx, surplus-value(s) in the production process is related to improvement in the quality of society and/or employees when products are produced and sold to support the demands of consumers (Marx 1981; Yee et al. 2008). As a result, the relationship between companies and society could be enhanced while simultaneously becoming more competitive in the marketplace (Jasch & Stasiškienė 2005). Consequently, surplus value(s) in production processes could ensue when companies focus their attention on improving the living standards of their employees.

According to Tinker and Gray (2003), sustainability in Marxism is close to ecological sustainability where the value of labour (emancipation of slaves) is connected with production. Value in Marxism aims to create benefits and/or advantages such as surplus value(s) for both capitalists and workers in terms of quantity of products and quality of living standards. However, the surplus value(s) can be no longer given when one party has no commitment to the other (Tinker & Gray 2003). Thus, Marx's labour theory of value appears to be appropriate for measurement of social impact costs in a SMAS while creating surplus value or maximizing profits by selling large quantities of products in the marketplace (Tinker & Gray 2003). The theory is used to explain the need of companies to measure costs of social impacts while improving standards of employees and/or society (Tinker & Gray 2003). The responsibilities of companies are to measure costs of social impacts relating to working conditions, training/career development, and/or health-care and safety. Although these costs could raise the total costs of products (Hazilla & Kopp 1990; Mook, Richmond & Quarter 2003), an appropriate management accoutring system could provide companies with a way to identify which of these costs are essential for developing social performance.

Furthermore, by utilising an appropriate system, companies could also use the cost information to support internal decision-making, while providing disclosure in the form of corporate social responsibility (CSR) reporting. Shaw (2009) mentions that CSR reporting could be considered as a business ethics issue and as part of embracing improvements in the quality of society generally, as espoused by Karl Marx. In doing so, companies could create better relationships with stakeholders, as well as having greater opportunities in the marketplace (Borga et al. 2009; Geibler et al. 2006; Schwarzkopf 2006). Marx's labour theory of value would help explain measurement of social impact costs while creating surplus value or maximizing profits when selling large quantities of products in markets (Jasch & Stasiškienė 2005).

Thus, in a designed SMAS conceptual model, Marx's labour theory of value is considered appropriate to help examine the need of companies to improve quality of life of employees, community, and social well-being as a whole. The theory also helps explain the need of companies to measure social expenditures in order to create more accurate cost information for enhancement of social internal decision-making on cost measurement. Social impacts should be more accurately created to enhance internal management decisions on cost measurement and financial investment in creating social efficiency. Companies need to provide social expenditures including cash donation, donation in kind of employees' times, and/or materials to bring benefits to local community where companies operate.

This study also employs Marx's labour theory of value to examine the ethical and moral obligation of companies to collect cost information of social impacts to support external reporting initiatives in addressing stakeholders' and public' interests (Tinker & Gray 2003). The theory explained the need of companies to create more accurately cost information of social impacts to precisely incorporate cost information into external reporting initiatives such as corporate social responsibility (CSR) reporting and/or GRI requirements. Social cost data needs to be precise and reliable when disclosing to build a positive reputation as a socially aware organization in marketplaces and to create better relationships with stakeholders and the public. Thus, in the design of a management accounting system, it is necessary to consider deep ecology theory and Marx's labour theory of value to help explain methods of providing accurate cost information. Companies have a greater ability to improve management decision on cost reductions and provide more precise environmental and social performance disclosures (Cormier, Gordon & Magnan 2004; Russo & Perrini 2009). In order to address stakeholders' and public interests, this study further utilize stakeholder theory to help in identify stakeholders' and public's concerns in environmental and social performance disclosures. Thus, stakeholder theory is discussed more fully in the following section.

2.1.3 Stakeholder theory

Stakeholder theory helps in the identification of stakeholders and explains the ethical and moral obligations of management in considering stakeholders' interests (Freeman 1984; Freeman & Reed 1983). It describes stakeholders of a business and how a business caters to the needs of its stakeholders. In addition, Donaldson and Preston (1995) indicated that, originally, stakeholder theory emphasized shareholders' interests, and they made a case for the theory's normative base where the moral, ethical, and legal claims of all stakeholders of organizations are advocated. Previous studies (e.g. Buchholz & Rosenthal 2004; Cormier, Gordon & Magnan 2004; Schwarzkopf 2006) point out that stakeholder theory helps explain improvements in business decision-making, as well as providing disclosures to create better relationships between companies and their stakeholders.

Freeman (1994) described significant roles and duties of management in the welfare of an organization’s members, as well as maintaining greater relationships between the company and its stakeholders. However, this results in firms’ wage rates becoming higher while qualities of products are low, suppliers are affected, and stock markets being more difficult to increase in value. Freeman argued that stakeholder theory of firms is totally different and advocates that stakeholder theory needs to rely on ‘normative core’, which is related to ethical and moral obligations in decision-making processes of firms and/or managers when acting on behalf of their stakeholders, customers, and/or suppliers (Freeman 1994, p.44).

Buchholz and Rosenthal (2004) believe that stakeholder theory has no critical role in, or formal process for, making decisions to support the demands of stakeholders—which is problematic. This results in some stakeholders being given more power to support their own interests, while firms and managers need to make decisions in order to maintain relationships (Buchholz & Rosenthal 2004). Hasnas (1998) questioned whether financial performance can be increased through stakeholder management, and whether firms should place equal weight on all stakeholders’ demands. This would ensure that firms view their responsibilities to society as normative (ethical) (Hasnas 1998).

Donaldson and Preston (1995), in describing why stakeholder theory should be taken into account, believe it helps explain firms’ behaviours and characteristics in supporting stakeholders’ demands or interests. Ullmann (1985) employed stakeholder theory to explain associating social disclosures with economic and social performance by combining three dimensions—stakeholder power, strategic posture, and economic performance—to develop a framework. Ullmann indicated that stakeholder power helps in the identification of stakeholders’ interests which need to be considered by companies; strategic posture describes companies’ concerns about environmental and social issues emanating from stakeholders’ demands; and economic performance is concerned with social issues—all three support companies in their endeavours to add value to their environmental performance (Elijido-Ten 2005). Regarding stakeholder power, stakeholder theory explains stakeholders' interests in the development of social and environmental performance (Schwarzkopf 2006). It also explains the relationship between a company and its stakeholders by providing disclosures of environmental and social performance to help address stakeholders' concerns (Cormier, Gordon & Magnan 2004; Schwarzkopf 2006).

Roberts (1992), in his study, employed economic performance, strategic posture, and stakeholder power from Ullmann's (1985) framework. He found that in the context of social disclosure, stakeholder theory helps in the identification of economic and social performance in relation to social responsibilities, as well as strengthening stakeholder power. In the meantime, companies can improve business decision-making using accurate cost information of environmental and social impacts to develop economic performance (Buchholz & Rosenthal 2004). Gilbert and Rasche (2008) suggested ways to create enhanced organizational performance in relation to increased stakeholder trust, to develop product quality, and to reduce government fines/penalties. Ruf et al. (2001) employed stakeholder theory to investigate the complicated relationship between corporate social performance (CSP) and financial performance in relation to changes in society and the economy. Their findings showed that although improvement in CSP has positive impacts on financial performance, economic and social performance needs could still be enhanced. This, in turn, would benefit companies in meeting the significant concerns of their stakeholders (Ruf et al. 2001).

In the designed SMAS conceptual model, stakeholder theory is considered appropriate in determining the key concerns and objectives of stakeholders and the public. Firstly, **stakeholder power** in the system's design helps address stakeholders' interests by accurately measuring costs of environmental and social impacts by providing cost information for disclosure. These interests are translated to measures by companies which, in turn, are incorporated as system characteristics for data inputs required for reporting and internal decision-making. This process could help create more accurate cost information to support environmental and social internal decision-making and external disclosures. As stakeholder theory relies on ethical and moral obligations (Freeman 1994), such a system could also assist companies in determining the accuracy of cost information for environmental and social internal decision-making.

Secondly, in the designed SMAS conceptual model, **strategic posture** is concerned with employing accurate cost information of environmental and social impacts to incorporate into companies' reports. This approach is supported by stakeholder theory when it comes to seeking to measure the cost of ethical and moral obligations. Such a system provides companies with a way to create a better relationship with stakeholders by disclosing trustworthy reports. In addition, the system could assist companies to be more aware of their ethical and moral obligations by measuring costs (environment and social impacts) to support their reporting function. Accurate cost information could also be used to successfully support internal decision-making when managing these costs of production processes. Finally, the system could improve **economic performance** of companies by enhancing their social awareness and corporate responsibility to their employees, communities, society, and the environment (Maak & Pless 2006). By implementing such a system, companies could claim to be 'green organizations' concerned with preserving natural resources and reducing environmental damage (Carbon Trust 2005; EPA Victoria 2007). Thus, companies could also improve their economic, environmental, and social performance, as well as creating better relationships with their stakeholders (Cormier, Gordon & Magnan 2004; Schwarzkopf 2006).

As stakeholder theory plays an important role in examining the relationship between a company and its stakeholders, a SMAS informs companies to pay more attention to accurately measuring costs of environment and social impacts for management decisions and reporting purposes. Stakeholder theory in a SMAS helps determine key concerns and objectives of stakeholders while explaining ethical and moral obligations in measuring environmental and social costs. These concerns can be translated to measures which, in turn, are incorporated as system characteristics for data inputs required for reporting and internal decision making.

Thus, in the design of a management accounting system, it is necessary to fuse deep ecology theory and Marx's labour theory of value; and helps explain methods of providing accurate cost information of environment and social impacts. Subsequently, companies can create more accurate cost information to support environment and social internal decision making and external disclosures.

This study further identifies effective management accounting practices for incorporation in a designed sustainability management accounting system (SMAS) conceptual model. As there is considerable disagreement in the literature as to definitions and coverage of key variables and system characteristics to be incorporated into a SMAS, the relevant literature is reviewed to establish the most appropriate characteristics to be used to support the focus of the research and to define key terms. These aspects are detailed in the following sections.

2.2 Accounting and its expanding role

2.2.1 Traditional accounting

Traditional accounting has two components, namely, financial accounting (FA) and management accounting (MA). Financial accounting aims to provide analysis of financial performance to guide decision-making on investments and performance management, as well as to support the information needs of external stakeholders (Holland 2004; IFAC 2005; UNDSD 2001). In contrast, management accounting is widely used for internal decision making to measure cost of inputs (materials and labour) while treating all other costs as overheads. Management accounting has historically treated environmental costs as overheads, thus being hidden among production and service processes (Hill, McAulay & Wilkinson 2006). Berry (2005) mentions that management accounting provides companies with a method to create cost information to support business decision-making in every part of business management, planning, and control to reach business goals. Management accounting is also used to measure business and management performance by introducing an activity based costing (ABC) approach to capture full costs of products and to provide cost information for internal decision-making on investments (Armstrong 2006; Berry 2005). This leads to allocating costs to activities for more accurate determination of product and service pricing. This results in an ABC approach which plays an important role in cost analysis, identification, and allocation.

Activity based costing (ABC)

ABC as a concept first appeared in a journal article in 1988 and focused on cost management systems and measurement performance of production costs (Kaplan & Coorper 1998). Since then, ABC has developed to appropriately identify and allocate production costs to individual costs or cost centres. This created the capability to provide cost information to support decision-making and financial reporting (Kaplan & Coorper 1998). Kaplan and Cooper designed the ABC approach to help organisations use cost information to support enhanced decision-making on product prices, product designs, and operational processes (Armstrong 2006). Thus, ABC has been considered as an appropriate cost analysis tool in identifying product costs and/or assigning costs of each production activity to individual product costs (Geri & Ronen 2005). CIMA (2006, p.3) defined activity based costing (ABC) as:

> '…an approach to the costing and monitoring of activities which involves tracing resource consumption and costing final outputs. Resources are assigned to activities, and activities to cost objects based on consumption estimates. The later utilize cost drivers to attach activity costs to outputs'.

Geri and Ronen (2005) claim that ABC is based on a subjective cost system related to cost identification and allocation of traditional full costing. Notwithstanding this, researchers have mentioned that there is a variable costing system and cost analysis that depends on purpose or implementation of users (organizations) (Thyssen, Israelsena & Jørgensenb 2006). ABC is claimed to be an appropriate accounting tool to guide business decision-making relating to cost analysis, as well as for allocating overheads (Northrup 2004). In analysing and allocating cost, the process helps companies to understand 'hidden costs' which may be transferred into production activities (Northrup 2004). ABC, therefore, plays an important role in cost analysis and cost allocation of each production activity and provides companies with a way to use individual product costs as cost drivers (Armstrong 2006).

Since environmental and social costs have become significant concerns to stakeholders, companies are required to measure these costs and disclose them in financial reports (IFAC 2005; UNDSD 2001). Thus, companies could rely on activity based costing (ABC) to deal with cost analysis and allocation of these costs. Previous studies (e.g. Armstrong 2006; Cãpusneanu 2008; Northrup 2004; Sendroiu et al. 2006) show that ABC was developed to identify and allocate costs of each production activity to individual costs or cost centres in order to measure cost reductions in, for example, materials and/or labour. In doing so, Cãpusneanu (2008) supports an ABC approach as 'green accounting' to measure environmental costs in relation to reducing production costs. Cãpusneanu also found that ABC was able to measure reductions in high levels of raw materials by changing product designs, including using recycled materials to support production processes.

According to Hill, McAulay, and Wilkinson (2006), environmental and social costs—although hidden among production and service processes—are treated as overheads by the ABC approach (IFAC 2005). Nachtmann and Al-Rifai (2004) employed ABC to successfully manage cost identification and avoid allocating to overheads. They found that ABC does not correctly measure costs of environmental and social impacts as appropriate product costs, therefore, companies are not able to fully cost products while providing cost information to support financial reporting (Bebbington et al. 2001; Englund & Gerdin 2008; The Sigma Project 2003). Geri and Ronen (2005) claim that with ABC it is not possible to estimate profits when product costs are complicated. Thus, companies are not able to improve business decision-making on cost management (Geri & Ronen 2005), and lack the ability to measure reductions in wastes, solids, and/or emissions (UNDSD 2001). The application of ABC needs to be explored further, as suggested by Thyssen et al. (2006).

However, Innes, Mitchell and Sinclair (2000) examined perceptions of ABC users and non-users and found that ABC users were more satisfied with the development of financial performance. In contrast, ABC non-users experience complexities in cost calculation practices and approaches (Innes, Mitchell & Sinclair 2000). Thus, by employing ABC, companies are not only able to successfully manage cost identification and/or allocation, but also to measure cost reductions and analyse cost-benefits (Armstrong 2006; Northrup 2004; Sendroiu et al. 2006). To manage this particular aspect, Kaplan and Cooper (1998) sought to improve the capturing of product costs while creating accurate cost information for companies' disclosures (Thyssena, Israelsena & Jørgensenb 2006).

Nonetheless, it would be appropriate that an ABC approach has not previously been used to improve business decision making in the management of environmental costs (Geri & Ronen 2005), and it is, therefore, one of the main foci of this study. An ABC approach needs to be developed to further improve its accuracy in allocating environmental and social costs, as suggested by Nachtmann and Al-Rifai (2004). This could assist companies in creating more accurate cost information for internal decision-making, and provide a flow on effect to external reporting and disclosures (Nachtmann & Al-Rifai 2004). Although ABC approach is not relevant to costing methods, the basic principle or technique of ABC application (such as activity cost driver, process cost driver, and/or cost management performance) helps in measuring cost savings and designing cost opportunities (CIMA 2006). Activity based costing (ABC) is currently developing in terms of green accounting or environmental accounting to find ways of minimizing negative impacts on the environment and ecological systems (Cãpusneanu 2008; Jasch 2009). ABC application in relation to cost allocation and analysis should be introduced to sustainable development companies to help develop their understanding of how to design cost opportunity of the main environmental activity (Jasch 2009).

Accordingly, in the design of a SMAS, ABC is considered an appropriate method identifies and measure cost allocation and for analysis of environmental and social impact costs. Such a system could be applied to include the application of the

ABC approach to assign these costs to individual products (Cãpusneanu 2008; IFAC 2005; Sendroiu et al. 2006). As ABC has traditionally treated environmental and social costs as overhead expenditures (IFAC 2005), a combination of environmental and social management accounting concepts in the design of the system could help in the identification and measurement of these costs (Gray & Bebbington 2001). This approach not only separates identification and measurement from overheads, but also prevents them being hidden among production and service processes (Jasch 2009). Therefore, this could mean that companies have the ability to fully capture production costs, as well as create more accurate cost information for business decision-making regarding environment and social impacts of their activities.

In relation to this, as the basic principle of ABC application is mainly related to cost measurement and management performance for decision-making, this study designed a SMAS conceptual model for environmental and social cost identification and measurement for sustainable development firms. An initial aim of this approach is to enhance environment and social internal decision-making on cost savings and cost measurement, as well as providing more precise external reporting. This study, therefore, employs the sustainability accounting concept to support its main focus on internal decision-making and measurement of environmental and social impact costs.

2.2.2 Sustainability accounting

Within sustainability accounting, the word 'sustainability' was developed based on sustainable development for environmental and social performance of organizations (CIPFA 2004). Sustainability accounting provides companies with a business tool to manage environmental and social costs, as well as providing cost information for business decision-making and disclosure (UNDSD 2001). Sustainability accounting aims at maintaining the balance between human activities and environmental patterns to sustain development in the long-term (Berkel 2003). As sustainability accounting has been involved in sustainable development, various scholars have given meanings that are aimed at the long-term improvement in environmental and social performance, as described below.

The WCED (1987, p. 43) defined sustainable development as *'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'*. According to Lamberton (2005) sustainable development is economic, ecological and social development which is related to making the right decisions, rather than those presented in reports. Meanwhile, Payne and Raiborn (2001) summarized sustainable development from a variety of literature as taking organisational responsibility regarding concerns about environmental and social issues, while still achieving business goals. Wackernagel et al. (2001) asserted that sustainable development has been used to measure the development of sustainable progress within companies and relies on policy-makers and experimentation. In addition, the CIPFA (2004) provided an additional definition of sustainable development as maintaining the balance between extracting resources to support business activities and preserving natural and environmental systems for future generations. Based on the literature, for this study sustainable development has been defined as the need of a company to make the right decisions about business management in relation to environmental and social performance, while improving the quality of society and the environment where companies operate (e.g. CIPFA 2004; Lamberton 2005; Payne & Raiborn 2001; WCED 1987). This means a company needs to correctly identify costs related to improving its environmental and social performance to incorporate in sustainability reporting.

Furthermore, sustainability accounting has been described as relating to sustainability. Bebbington and Gray (2001) claimed that sustainability aims at maintaining equilibrium of global environmental and natural resources damaged by human activities. An initial aim of this was to maintain the balance of environmental and ecological system in the long-term (Bebbington & Gray 2001). Meanwhile, Vanegas (2003) asserts that sustainability means the preserving of the basic supports of human life and natural habitats—for example, air, water, land and/or food. According to Goodland (2002), sustainability means maintaining positive impacts from influences of human, social, economic and environmental concern. However, Wright (2002) argued that sustainability is about retaining a balance between economic, social and environmental factors which influence humans' decision-making. The Sigma Project (2003, p 7) has defined sustainability accounting as:

> '…the generation, analysis and use of monetarised environmental and socially related information in order to improve corporate environmental, social and economic performance. A more complete and technical name could be 'Sustainability Financial Accounting', to differentiate this approach (focused on monetised data) from wider forms of sustainability reporting'.

Due to the variety of definitions of sustainable development and sustainability mentioned above, this study has relied on the concept of sustainability accounting as a business decision-making tool for organizations in managing environmental and social costs. A design of a sustainability management accounting system could provide companies with enhanced internal decision-making in relation to the management of environmental and social costs (The Sigma Project 2003). As sustainability accounting aims at wisely dealing with reductions in negative impacts on society and the environment (Taplin, Bent & Aeron-Thomas 2006), any accounting system developed should employ environmental and social management accounting approaches to deal with these matters. The system developed could be adopted in business accounting and reporting to facilitate companies' development in three dimensions: economic, social, and environmental performance (Ball 2002a; Milne 1996). This is necessary because development of economic performance needs to be sustained for future measurement of environmental and social aspects in disclosure reports to the public (CIPFA 2004).

A number of recent studies (e.g Lamberton 2005; Schaltegger & Wagner 2006; Taplin, Bent & Aeron-Thomas 2006) examined sustainability accounting in terms of physical and monetary measurements to improve financial management. The suggestions emanating from these studies show the need for sustainability accounting to include improvements in the quality of society, humans, the environment, and natural capital—rather than just focusing on a company's economic performance. Nonetheless, Gray (2006) pointed out that sustainability accounting should incorporate improvements in social and environmental reporting in terms of external disclosures to meet shareholder expectations of sustainable organizations. Sustainability accounting also provides a company with the measurement of external (environmental and social) and internal (financial) costs, and full cost accounting is implemented to support internal and external disclosure such as sustainability reporting and corporate social responsibility reporting (CSR) (ICAEW 2004; Lamberton 2005).

In designing a sustainability management accounting system in line with the concept of sustainability accounting, this study measures cost of environmental and social impacts using environmental and social management accounting to manage accounting information in order to ensure sustainability (Schaltegger & Burritt 2006). Such a system could assist companies in providing more accurate cost information to support disclosures for internal decision-making and to address concerns of stakeholders (Unerman, Bebbington & O'Dwyer 2007). By employing sustainability accounting concepts in an appropriate system, companies could also measure and evaluate environmental costs—including costs of sustainability, costs of natural inventory, and input-output analysis (Gray, 1993 cited in Lamberton 2005). This would assist companies to develop three areas of performance—environment, social, and economic—in reports to stakeholders. In the following section, environmental accounting concepts (the first of these areas) are considered by using an environmental management accounting approach to support development of a conceptual model of a sustainability management accounting system.

2.2.3 Environmental accounting

To meet the concerns of stakeholders in incorporating environmental costs into financial reporting, environmental accounting (EA) is considered appropriate to evaluate internal and external costs of the environment resulting from production and service processes (The Sigma Project 2003; UNDSD 2001). Environmental accounting has been employed as a business tool to not only manage costs of environmental protection, but also to provide financial reports for business management of environmental performance (Burritt & Saka 2006). Environmental accounting is a key concept of business decision-making in relation to the environmental cost analysis when correctly allocating costs to products (Cãpusneanu 2008; EPA 1995). Environmental accounting also aims to analyse, evaluate and identify environmental costs in order to estimate costs for future production (UNDSD 2001). According to Cãpusneanu (2008), environmental accounting seeks to deal with management accounting by planning, reporting and evaluating negative impacts of environmental and life cycle costs, and is considered to be 'green accounting'. In Cãpusneanu's view, environmental accounting provides companies with a method to analyse and report accurate accounting information in order to work towards enhanced decision-making. Moreover, Burritt and Saka (2005) state that EA is employed as a business tool to provide financial information and to manage business performance of the environment.

Pramanik, Shil, and Das (2007) also applied environmental accounting concepts to incorporate environmental and economic performance into financial reports while guiding decision-making processes. However, financial reports appeared inaccurate and unreliable when companies were unconcerned about the development of environmental performance in the form of environmental protection and social awareness (Pramanik, Shil & Das 2007). Meanwhile, Qian and Burritt (2007) employed an environmental accounting concept to manage waste and disposal, as well as identifying environmental costs and impacts of waste in Australia. The use of environmental accounting helps identify physical data of waste flows in production processes while precisely reporting the results of waste management (Qian & Burritt 2007). Qian and Burritt also suggest that environmental accounting practices need to be explored in future research as, to date, little study has been conducted in this area.

In the United States, negative impacts on the environment and the high cost of natural resources have significantly influenced net income (decline) in agricultural industries while contributing to production processes (James, H., Michael & Kelly

2000). By adopting an environmental accounting approach, negative impacts on the environment can directly affect net national product (NNP) [4] while measuring performance of the environment within agriculture industries (Asheim 1994). Furthermore, Tiezzi (1999) studied external impacts on price components and levels of emissions in production processes of agricultural industries. The price components were introduced as shadow prices when the volumes of emissions were high. This is because there was a significant relationship between company income and costs of emissions. While levels of income were high, it affected high costs of emissions; when costs of emissions declined, the value of agricultural income was low (Tiezzi 1999). Therefore, it can be seen that the relationship between environmental costs (waste and/or emissions) and product costs have a significant impact on improving economic and environmental performance. While companies are experiencing difficulties in measuring environmental costs, these costs may create negative impacts on productivity when, for example, the use of power in production processes creates an environmental impact (IFAC 2005).

In the meantime, Beer and Friend (2005) developed a Environmental Engineering Group Environmental Costing (EEGECOST) model using an EA approach to examine environmental cost allocation for investment purposes. This model classifies environmental costs into five cost types: site costs, corporate costs, impact costs, internal intangible costs, and external costs while allocating these within environmental cost (media groups[5]) categories. Within an EEGECOST model, there is no environmental cost recognized as overhead within the environmental cost category (Beer & Friend 2005). Meanwhile, in providing

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[4] 'Net National Product or National income may be defined as the net value of commodities and services produced by the nation's economic system. It is 'net' in that the value of output of all commodities and services is reduced by the value of commodities (fuel, raw materials, and capital equipment) consumed in the process of production' Kuznets, SS 1937, *National income and capital formation*, Ayer Publishing, New York
Net National Product (NNP) can also measure value added from several objectives within organizations among others to potentially create environmental performance and social wellbeing Asheim, GB 1994, 'Net National Product as an Indicator of Sustainability ', *The Scandinavian Journal of Economics*, vol. 96, no. 2, pp. 257-65

[5] 'Environmental media groups [include] air and climate, wastes, wastewater, soil and groundwater, noise and vibration, biodiversity and landscape, radiation, and other costs which do not fit into any of [these] categories' Beer, PD & Friend, F 2005, 'Environmental accounting: A management tool for enhancing corporate environmental and economic performance', *Ecological Economics*, vol. 58, pp. 548-60.

energy reports for Bangladeshi oil, gas and mineral industries, the use of traditional management accounting practices to manage environmental impacts is seen as problematic and results in inaccuracies when demands for fossil fuels is increased (Bose 2006). These inaccuracies were related to accounting information of natural resource usage such as oil, gas, and coal and/or the method of disclosure when reporting environmental preservation. There is also no accounting information for waste, energy, and water concerns represented in the companies' reports when reporting environmental damage prevention and/or pollution protection (Bose 2006). Bose (2006), therefore, suggested that companies should ensure that a management accounting approach creates reliability from a stakeholder perspective when classifying environmental costs to support financial reports. Companies should, therefore, employ environmental accounting to provide environmental reporting, as well as being aware of current research trends in relation to environmental performance and disclosures (Bose 2006).

As a consequence, environmental accounting (EA) is an appropriate accounting approach assisting companies to not only identify and measure costs of environment in production processes, but also to create accurate cost information to support environmental performance disclosures. Environmental accounting also provides companies with a measurement of environmental costs to help estimate reductions in emissions and waste. By adopting environmental accounting, companies are perceived to be more concerned about environmental preservation and resource depletion through disclosing performance of environmental aspects to their stakeholders. Companies can also create a positive reputation as a green producer in the marketplace. Environmental accounting has two components: environmental management accounting (EMA); and environmental financial accounting (EFA) (IFAC 2005). Environmental management accounting assists companies to create more accurate cost information for business decision-making and management of environmental costs. Meanwhile, environment financial accounting focuses on providing environmental disclosures to external stakeholders (governments, shareholders, etc.) (Burritt & Saka 2006). In designing a SMAS, this study employs environmental management accounting

(EMA) to address measurement of environmental costs in production processes—while environmental financial accounting is taken as a given.

Environmental management accounting (EMA)

Environmental management accounting (EMA) plays an important role in identifying, estimating and analysing environmental costs (materials, energy, water, waste and emissions) and providing accurate financial reports (IFAC 2005; Schaltegger & Burritt 2000). Environmental management accounting aims to reduce negative impacts on the environment, capture costs of environmental production and improve material efficiency, as well as producing accurate information in relation to financial and cost accounting (UNDSD 2001). This is mainly related to management of physical (materials, energy, water and waste) and monetary units (environmental costs, earning and/or savings). Thus, by implementing environmental management accounting, companies are better able to manage flows of materials, energy, and water, and other environmental-related costs in addition to analysing unit inputs and outputs of resources—as well as identifying the allocation of physical costs in production processes (Schaltegger & Burritt 2000).

Environmental management accounting also aims to develop environmental performance of organizations by providing cost information for business decision-making on management of environmental costs and contaminants (PWC 2002). Thus, companies can use environmental management accounting as a business strategy for developing environmental and economic performance to reach sustainable business goals (Bennett & James 1998). Environmental management accounting also provides organizations with ways to develop resource efficiency and environmental performance. This is related to the use and flow of materials, environmental cost identification and recognition of unit inputs and product outputs (Bennett, M. & James, P. 1998).

For this study, environmental management accounting (EMA) was used as an effective management accounting tool for environmental cost identification and measurement (IFAC 2005) to support management decisions on cost savings thus creating eco-efficiency processes (Schaltegger & Burritt 2000). An effective management accounting system measures environmental costs from unit inputs (materials, energy, and water) and product outputs (waste and emissions) that companies employ to support their production processes (Jasch 2009). This includes use and flow of material, water, energy, emissions, pollution prevention, and waste management. These costs were separately identified from overheads, and then allocated to appropriate products based on activity based costing system (Sendroiu et al. 2006). Environmental management accounting in an appropriate system should also manage the use and flow of resources, energy, and water to measure reductions in these costs and contaminants (IFAC 2005; The Sigma Project 2003; UNDSD 2001). Furthermore, a system could provide companies with a way to accurately create environmental cost information to support internal decision-making, as well as estimating costs for future productions (IFAC 2005; Bent and Richardsen 2003` cited in Pittman & Wilhelm 2007; The Sigma Project 2003).

Gadenne and Zaman (2002) uncovered EMA practices by Australian companies and documented accountants' perceptions of providing EMA information for reporting purposes. Gadenne and Zaman claimed that Australian companies appeared to develop business strategies to meet the requirements of a socially and environmentally sensitive organization. However, they identified the need for recording environmental costs using ABC to be intergrated in financial reports, as well as a need to develop appropriate EMA systems (Gadenne & Zaman 2002). Burritt and Saka (2006) examined the relationships between EMA practices and measures of eco-efficiency of a Japanese company and found that the link between EMA practices and measurement was incomplete. Thus, EMA practices should be developed as an accounting system to support disclosure of environmental impacts while creating value for sustainable organizations (Burritt & Saka 2006).

In discovering the relationships between environmental and economic performance of an electricity company in the United States, Burnett and Hansen (2008) found that measuring pollution reduction enables a company to improve eco-efficiency. It is preferable that the implementation of environmental accounting should encompass a environmental management accounting system (Burnett & Hansen 2008). This provides a company with the measurement of environmental costs from unit inputs (raw materials, energy, and water), as well as non-product outputs (wastes and emissions) (Gale 2006a) and, at the same time, helps evaluate reductions in these costs and contaminants (IFAC 2005). Essentially, environmental cost information has the ability to support business decision-making on management of resources by recording the use and flow of physical (resources, energy, and water) and monetary (financial, cost savings, and earnings) units (Burritt, Herzig & Tadeo 2009). Dunk (2007) examined the relationship between quality of product and competitive advantage and found that environmental management accounting plays a significant role in creating a more competitive marketplace as firms tend to focus on the development of environmental performance.

Sendroiu et al. (2006) also employed environmental management accounting for environmental cost identification and management, while providing accurate financial information to guide internal decision-making in Romanian firms. In their investigation, Sendroiu et al. implemented an activity based costing (ABC) concept to identify and allocate environmental costs and resources such as materials and energy while measuring benefits of environmental performance. The study concluded that environmental management accounting assists companies to identify and measure environmental costs hidden in production processes. Companies can then measure the reduction in environmental impacts that lead to enhanced decision-making regarding operating activities; management accountants and environmental managers better understand concerns about environmental and social issues; and organizations became enabled to more wisely measure the impact of economic development on environmental performance (Sendroiu et al. 2006). Consequently, by employing environmental management accounting, companies benefit not only from enhanced cost identification and/or measurement, but also from the development of improved business decision-making. Overall, such measures have the additional benefit of improving the economic and environmental performance of organizations, as well as creating a perception of green producers in the marketplace.

Meanwhile, Frost and Wilmshurst (2000) examined the understanding of industries in adopting environment-related management accounting and controlling processes in relation to environmental awareness reports of organizations. Industry groups provided environmental reports which seemed to be inaccurate and unreliable for research practices. However, most industries did not understand or comply when presenting costs of waste and energy for disclosure in annual reports (Frost & Wilmshurst 2000). Thus, Frost and Wilmshurst (2000) suggested that costs of and to the environment need to be identified and correctly allocated to certain production activities and that survey questionnaires must clearly relate to environmental concerns of organizations to benefit future research, both socially and environmentally. The PWC (2002) interpreted the results of the Cormack Manufacturing Company in examining the development of financial and environmental performance by using environmental management accounting (EMA). Cormark was able to develop decision-making processes about investment in natural resources and environmental aspects that included increases in financial outcomes.

Overall, the literature suggests that environmental management accounting (EMA) is appropriate for this study as it aims to develop a conceptual model of a SMAS. EMA allows for the identification of costs of environmental impacts, use and flow of resources, energy and water, as well as presenting a tool for measuring reductions in contaminants. Thus, by implementing an appropriate management accounting system, companies could accurately identify and measure environment costs before allocating to the individual product costs (Burritt, Herzig & Tadeo 2009). Companies could also improve environmental performance (UNDSD 2001) while promoting themselves as environmentally-aware organizations (Burritt, Herzig & Tadeo 2009). It would enable companies to record cost information more accurately to support disclosure of environmental performance, although currently this does not cover social issues (IFAC 2005). Therefore the study seeks to integrate social management accounting (part of social accounting approach) into the development of a sustainability accounting system. This could assist companies to become more involved in sustainability management accounting (Jasch & Stasiškienė 2005), with social accounting widely seen as being concerned with improvement in social performance (Mook, Richmond & Quarter 2003).

2.2.4 Social accounting

The consideration of social issues in accounting practices has been around for many decades, a situation that remains unchanged today where companies are required to be increasingly concerned about reducing negative impacts on society, employees and the environment (Raynard 1998). This requires companies to incorporate development in social performance into financial reports in the form of a corporate social responsibility (CSR) report. As traditional management accounting has tended to ignore social and public interest, social accounting has been introduced to companies as an essential accountability tool, underpinned by concerns for improvements in the quality of employees, the community, and society as a whole (Lindblom & Tinker 1984). The key element of social accounting is to provide social cost information to address stakeholders' and public concerns, while conventional accounting has focused more on economic performance (Lindblom & Tinker 1984).

During the 1970s and 1980s, social accounting was not necessarily a consideration in the public debate, due to complexities in practices (Gray 2001). This resulted in companies recording social costs as overhead expenditures, rather than allocating them to a single product (Hazilla & Kopp 1990). Subsequently, disclosure of social performance in the form of corporate social responsibility (CSR) reporting still has elements of inaccuracy when disclosing cost information on social impacts (Tinker, Lehman & Neimark 1991). Tinker, Lehman and Neimark' s study indicated that social accounting is under investigation still while stakeholders become more highly concerned about social information providing in corporate social responsibility (CSR) reporting. Tinker, Lehman and Neimark (1991) also indicated that accounting information of social impacts is not only evident to the development of social performance but companies' behaviours need to be also determined. Thus, in providing cost information for disclosure in CSR reporting, companies need to consider their moral and ethical obligations in taking social issues (quality of society, employees and the environment) into account (Tinker & Gray 2003). Rob Gray (2006), who has been interested in social and environmental issues for 30 years, mentioned that firms need to pay more attention to the development of social performance rather than providing disclosures designed to enhance companies' images and/or reputations (Owen & Swift 2001).

According to Gray (2006), social accounting is a significant accounting tool for organizations to identify and measure expenditures involved with developing society, employees and/or the environment. By encompassing social accounting, companies are able to deliver more accurate corporate social responsibility (CSR) reports to address stakeholders' interests in relation to improvement in society as a whole (Gray 2001). This is because stakeholder power has resulted in companies needing to take social responsibility into account when selling large volumes of products to gain higher profits (Gray 2001). Owen and Swift (2001) also believe that firms need to take more responsibility in reducing negative impacts on society and to report on social performance to create value for their stakeholders. In addition, firms can employ cost information to support social decision-making, as well as addressing stakeholders' demands (Owen & Swift 2001).

However, Mook, Richmond and Quarter (2003) argued that social accounting has not been successfully employed by firms because the measurement of social costs has negative impacts (increased costs) on product costs. Therefore, companies tend to ignore measuring these social costs and/or provide funds to support their social performance (Hazilla & Kopp 1990; Mook, Richmond & Quarter 2003). Mook (2006) stated that social accounting is more concerned with ethical and moral obligations of organizations, thus providing social information to support both economic decision-making and external reporting initiatives. Social accounting more likely focuses on a wider scope involving improvement in the quality of local communities and social well-being, rather than solely financial performance aspects (Mook 2006). Thus, by incorporating social management accounting in a SMAS conceptual model, companies would more ethically measure social expenditure to support improvements in social efficiency while creating more accurate cost accounting of social impacts for management decision strategies (Quarter, Mook & Armstrong 2009).

Mook (2006) has developed a number of social accounting models based on conventional accounting practices to deal with environmental and social issues. Nonetheless, these models were designed to integrate economic performance and social information in financial disclosures for non-profit organizations (Mook, Richmond & Quarter 2003). Thus, social accounting should be further developed as a conceptual model or framework for improvement in social decision-making and social issues for profit companies (Gray 2006; Spence 2009).

Pyatt and Roe (1977) claimed that a company needs an appropriate accounting approach such as social accounting to measure the cost (as well as expenditures) of social impacts to enhance employees' work skills and/or living standards. Pyatt and Roe developed a social accounting matrix (SAM) framework to improve wage rates in Sri Lanka. This helped Sri Lanka to successfully improve economic performance as a new way to support development. However, this is not related to the enhancement of society as a whole (Pyatt & Roe 1977). At this point, western organizations disagree on the ability of social accounting to reduce social impacts and, thus, support stakeholders' concerns (Tinker & Gray 2003). In addition, Tinker and Gray (2003) supported the notion that the absence of a social accounting approach results in companies not taking social impacts into account. Thus, social accounting should be considered in future research as a way to develop social and economic performance of organizations while adding value to sustainable organizations (Spence 2009). Social accounting will capture social impact costs from different directions, such as lay-off of employees, healthcare and safety, and quality of working conditions and incorporate such information into financial reports (Gray & Bebbington 2001; Mook 2006).

Social accounting has two components: social financial accounting (SFA) and social management accounting (SMA). Social financial accounting helps companies to provide information on their social performance in the form of corporate social responsibility (CSR) reporting (Gray & Bebbington 2001; Gray et al. 2001). This report facilitates companies disclosing information of social impact costs in order to improve external reporting relating to the significant interests of stakeholders (Cullen & Whelan 2006; Richmond, Mook & Quarter 2003). In the design of a SMAS conceptual model, social management accounting is considered appropriate to measure social impact costs to support social internal decision-making—while social financial accounting is taken as given being covered by CSR.

Social management accounting (SMA)

Social management accounting (SMA) aims to measure costs of social impacts to improve the quality of society, employees, and some aspects of the environment—all of which are of significant concern to companies' stakeholders (Mobley 1970). Social management accounting provides companies with a way to accurately create cost information for social internal decision-making and social performance reporting (Gray 2006). This cost information can be used to guide business decision-making in measuring and managing social costs within organizations (Gray 2006; Gray et al. 2001). Companies employ this cost to support their corporate social responsibility (CSR) reporting in order to create better relationships with stakeholders (Tinker, Lehman & Neimark 1991). Thus, by adopting social management accounting, companies are perceived as being more socially aware organizations in the eyes of their stakeholders and within the marketplace (Gray et al. 2001).

Nevertheless, social management accounting to measure costs of social impacts has not been embraced by companies as social costs could raise the total costs of products (Mobley 1970). In the meantime, social accounting has not demonstrated to companies how they could benefit by providing expenditures such as social costs to improve the quality of life for employees, society, and some parts of the environment (Spence 2009). Thus, most companies do not intend to employ social management accounting to capture costs of these social impacts (Tinker & Gray 2003). Subsequently, disclosure of social performance in the form of corporate social responsibility (CSR) reporting appears inaccurate when disclosing social impact information to stakeholders and/or the public (Tinker, Lehman & Neimark 1991). Companies most likely report their social performance only to create a particular image or positive reputation in the marketplace, and also experience difficulties with their internal decision making on management of these costs (Gray 2006; Gray et al. 2001).

Gallhofer and Haslam (2003) argued that companies need to take social issues into account while utilizing social management accounting to ascertain the cost or expenditure for improvements in society, for employees, and the environment. This would not only create better relationships with stakeholders, but also improve social internal decision-making processes by management of social costs (Mook, Richmond & Quarter 2003). As the improvement in quality of society, employees and the environment are of interest to stakeholders, companies are compelled to disclose their social performance in the form of CSR (Borga et al. 2009; Geibler et al. 2006). This results in social management accounting becoming necessary for companies in order to measure the costs of social impacts while creating greater benefits from selling large numbers of products in the marketplace (Chwastiak & Lehman 2008). This helps companies to not only develop social performance, but also to improve economic performance in the long term (Schaltegger & Wagner 2006). Importantly, cost information could be employed to develop internal decision-making in relation to social issues, as well as providing appropriate funds to support social aspects (Schaltegger & Wagner 2006). This assists companies to create positive reputations as socially aware organizations in the eyes of their stakeholders and in the marketplace (Borga et al. 2009; Jasch & Stasiškienė 2005).

The development of a social accounting framework should, thus, provide companies with a way to identify expenditure on social impacts while incorporating cost information in companies' reports, as suggested by Spence

(2009). This framework could facilitate companies' ability to capture costs of social impacts within society to disclose to their stakeholders (Quarter & Richmond 2001). These impacts could encompass a variety of social issues such as laying-off of employees, deficiencies in healthcare, safety and/or quality of working conditions (Mook 2006), all of which can be collected as social impact costs (Quarter & Richmond 2001). As such, these costs are of interest to company stakeholders, and companies are required to report them in the form of corporate social responsibility (CSR) reporting. This is not only to support the demands of stakeholders, but also to enhance social internal decision-making using cost management and measurement (Gray 2006; Gray et al. 2001). If social accounting could be developed as part of an accounting framework or model, this would assist companies to become more socially and environmentally aware organizations (Gray 2002a). The proposed social management accounting framework, therefore, should integrate economic and social performance while adding value by enhancing the sustainability of organizations (Mook, Richmond & Quarter 2003; Quarter, Mook & Armstrong 2009).

In Australia, the priority in conducting environmental and social research was to create positive images of environmental performance reporting, as well as reducing social impacts (Deegan 1996). Deegan found that Australian companies have paid most attention to concerns about building their environmental performance, rather than improving the quality of society. Companies need cost information to support disclosures about the environment to generate an image and reputation as green organizations in the marketplace (Deegan 1996). Thus, this presents an opportunity to develop a conceptual framework of a sustainability management accounting system combining environmental and social management accounting aimed at assisting Australian companies in providing more accurate cost information of environment and social impacts. Nevertheless, there is limited research which explores social and environmental management accounting (SEA), as it is a new aspect of accounting practice (Bebbington 1997). In addition, combining environmental and social issues could go a long way to improving accounting's approach to these issues. Companies are, therefore, lacking awareness of the need to measure environmental and social impact costs and to become socially and environmentally aware organizations (Gray 2002a).

Consequently, this study considers social management accounting (SMA) as an appropriate accounting approach for measurement of social impact costs within organizations. In the design of a management accounting system, social management accounting provides companies with a method of creating cost information more accurately which, in turn, supports social internal decision-making in the development of social performance. This is because companies today need to capture full cost of products, including environment and social impacts in order to disclose three areas of performance in the form of a triple bottom line report—economic, social, and environment. This provides companies with a way to capture full cost of products for internal decision-making, as well as supporting their disclosures. Subsequently, companies can also successfully set the right price for products and services using this approach and system (Englund & Gerdin 2008; Lamberton 2005; The Sigma Project 2003).

2.2.5 Accounting concepts underlying the SMAS conceptual model

Accounting concepts underlying the design of a SMAS conceptual model were based on the literature review. Figure 2-1 represents the relationship between activity based costing (ABC) application, environmental management accounting (EMA) and social management accounting (SMA) practices in a designed SMAS conceptual model. A SMAS is designed from traditional management accounting in which activity based costing has historically treated environmental and social impact costs as overheads. Thus, activity based costing (ABC) application needs to be further developed to improve cost allocation and analysis of environment and social impacts. A SMAS also applies environmental management accounting (EMA) practices, which is a subset of environmental accounting, to help in cost identification and measurement of environmental impact. Furthermore, social management accounting (SMA) practices, which are a component of social accounting, is integrated in a SMAS to help in cost measurement of social impacts. The measurement of environmental and social impact costs by companies is the main focus of this study. The link between EMA, SMA and ABC in a SMAS conceptual model based on the literature review—depicted in Figure 2-1—is the foundation of this study.

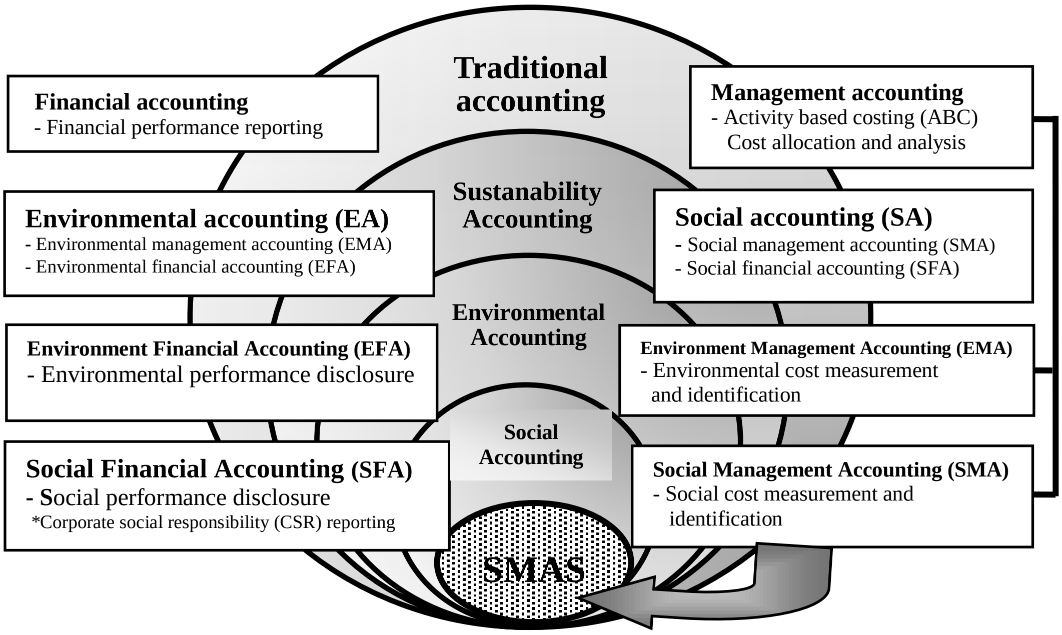


Figure 2-1 Accounting concepts underlying the SMAS conceptual model

2.2.6 Environmental and social cost dimension in a SMAS

It is important to clarify what is meant by cost measurement for decision-making relating to environment and social impacts. Historically , cost information was used to support internal and external reporting while management decision making was not always enhanced (Eldenburg & Wolcott 2005). As a result, use of resources within production activities (e.g. materials, energy, and/or water) were not appropriately allocated in measuring and managing production, and costs were inaccurate (Eldenburg & Wolcott 2005). Recently, cost information has been utilized to successfully improve business decision-making using internal reporting as a guide. However, costs of environment and social impacts are rarely recognized and/or appropriately identified as product costs (Gale 2006a; IFAC 2005; UNDSD 2001). These costs are often poorly allocated, leading to decision-making on management and measuring reductions in contaminants being inefficient (Gadenne & Zaman 2002; Gale 2006a; Pittman & Wilhelm 2007). The following section provides a discussion on recognition and identification of environmental costs and measurement of social impact costs respectively.

Environmental cost

Environmental costs are associated with use of material, energy, water, emissions, and wastes which need to be reduced to enhance quality of environmental and ecological systems, as well as creating social efficiency in the eye of stakeholders and marketplace (Gray, Bebbington & Walters 1993). Environmental costs also refer to corporate waste management, pollution prevention, and/or controlling for waste, recycling, packaging, and product design to minimize negative impacts of environment(Gray & Bebbington 2001) while creating financial efficiency (IFAC 2005). Environmental costs have traditionally been recognized as overhead expenditures that companies could provide to identify each production activity and/or service process (U.S. EPA 2008). As stakeholders become increasingly interested in the development of economic and environmental performance, companies are required to incorporate environmental costs into financial reports for disclosure in the form of a triple bottom line report (Berkel 2003; Gadenne & Zaman 2002; Hubbard 2009). In the meantime, companies use cost information to support business decision making processes on cost measurement (Berkel 2003). In addition, National Greenhouse and Energy Reporting (NGER) legislation in Australia requires companies to report lower levels of energy consumption and carbon emission depletion in producing products and providing services (Department of Climate Change 2008b). Companies need to provide environmental and social performance indicators in relation to their use of natural resources, as well as improvements to society, employees, and the environment as part of the Global Reporting Initiative (GRI) (KPMG 2007). Thus, companies can measure not only environmental costs, but also the wise management and use and flows of resources, energy and water entering their production processes (Bose 2006; Gale 2006a). This could help companies reduce high levels of energy usage, as well as creating lower carbon emissions (Gale 2006a; UNDSD 2001). A number of previous studies have been identified where costs are measured and are associated with environmental factors in relation to the production and/or service processes, as discussed below.

The UNDSD (2001), for example, claimed that environmental costs should be measured separately from overhead expenditures. Sustainable companies could provide information on penalties or fines relating to environmental prevention and/or emissions management such as wastes, solid, and emissions (non-product outputs). Schaltegger and Muller (1998), cited in Cãpusneanu (2008), indicated that environmental costs can be identified from all expenditures companies may spend in managing reductions in wastes and emissions, including negative impacts on the environment, and environmental penalties/fines. Gale (Gale 2006a) measured costs of environment from three categories—use of raw materials, energy, and water in production processes; management of wastes, solids and/or emissions created from producing products and providing services; and expenditures provided for waste, solid, and/emission permits. Savage, Ligon and Lomsek (2001) also recognized environmental costs as funding provided to reduce negative impacts on the environment. Consequently, environmental costs could be measured from various dimensions of overhead expenditures that depend on the needs of companies to support their environmental performance.

According to IFAC (2005), environmental costs are classified into four categories widely accepted by international organisations as best practice, namely:

1. *environmental costs incurred from environmental activities such as waste management and control and/or pollution prevention;*
2. *costs identified from materials and/or labour by traditional accounting;*
3. *environmental domain costs calculated from use of water, air, and/or land size; and*
4. *hidden costs that are visible in accounting data.*

However, these environmental cost categories are not easy to identify and measure to support each production activity (IFAC 2005). Therefore, IFAC's (2005) categories provide a clearer identification of environmental costs in order to meet the needs of production processes while providing comprehensive information to accountants, firms, countries, and/or stakeholders, as shown below:

1. *'Material costs of product outputs* – costs of water, materials, and/or energy purchased to support production processes;
2. *Material costs of non-product outputs* – costs of wastes and/or emissions created from use of material, energy, and water;
3. *Waste and emission control costs* – costs of waste and emission management, pollution reductions, and/or environmental treatment;
4. *Prevention and other environmental costs* – costs of environmental prevention, environmental management, and/or environmental protection;
5. *Research and development costs* – costs of environmental concerns in relation to preventing environmental damages; *and*
6. *Less tangible costs* –internal and external costs that are related to improvement in product quality, companies' images, companies' reputations, and/or stakeholders' relations' (IFAC 2005, p.38)

In fact, companies have always assigned environmental costs to overheads using traditional management accounting approaches such as activity based costing (ABC) (Seidel & Thamhain 2002). This may result in inaccuracies in cost information of environmental aspects when incorporated into financial reports (IFAC 2005). Companies are also experiencing difficulties in measuring reductions in these costs and their contaminants (IFAC 2005; UNDSD 2001), as well as lacking the ability to provide accurate cost information for internal environment decision-making and external disclosures (Savage, Ligon & Lomsek 2001).

Corson (2002) argued that measurement and/or identification of environmental costs motivates companies to be more concerned about creating value for humans and natural systems when evaluating emissions and wastes. Companies can also improve economic performance by managing reductions of these costs and their contaminants. In the aircraft industry, for instance, environmental costs are measured from noise and emissions management that have positive results on social and economic performance (Lu, C. & Morrell 2006). Firms are charged according to the levels of noise and emissions from the number of flights and other types of noise and/or emissions (Lu, C. & Morrell 2006). This can significantly reduce negative impacts on the environment and society, as well as becoming ‘green organizations’ and being more competitive in the marketplace (EPA Victoria 2007). Meanwhile, Seidel and Thamhain (2002) used the activity based costing (ABC) approach to identify environmental costs from unit inputs entered into production activities and unit outputs from producing products. This approach helps companies to possibly classify environmental costs for each production activity before assigning costs to appropriate products. Companies can also provide accurate cost information for disclosures (Bose 2006), as well as estimating reductions in emissions and wastes (IFAC 2005; UNDSD 2001). It can be seen that the measurement of environmental costs could help companies to improve their environmental performance by reducing the negative impacts on environmental and natural systems. Companies could also maintain their development of economic/finance performance by reducing not only costs of production processes, but also emissions and wastes.

In the design of a sustainability management accounting system (SMAS), environmental costs are separately identified from overhead expenditures using the environmental management accounting (EMA) concept to measure four areas within organizations. Firstly, a SMAS collects environmental costs from unit inputs (e.g. raw materials, energy, water, and/or air) that are entered to support production processes in each activity. Secondly, environmental costs are identified from costs that appear as a result of changes in product designs, products in production (unfinished goods), material replacement, recycled materials and/or energy, purchase materials, and/or reused water or waste. Thirdly, environmental costs are calculated from unit outputs (non-product outputs), including higher volumes of emissions, waste and/or disposals limited by government requirements. Table 2-1 classifies environmental costs as a matrix of measurement within the design of a SMAS.

Table 2-1 Measurement of environmental cost matrix

Sources of environmental costs	Unit inputs	Production processes	Unit outputs
Production activities	Direct materials, indirect materials, energy, water, wastes, air others	Packaging materials Merchandise Operating materials, others	Emissions, solids, disposal, wastes, noise others
Administration activities		Marketing Admin activities Transport/logistics others	Product in processes End of life products Recycle materials, equipments, and/or other utilities e.g. papers others
Improvement in environment and society			Penalties/fines - Environmental protection Waste management Pollution prevention others
	Environmental costs		

Source: IFAC (2005)

Finally, a SMAS captures environmental costs from expenditure on penalties/fees of environmental regulations in relation to pollution prevention and/or waste or disposal management. Apart from that, in the case of environmental costs being found relevant to overhead expenditures to improve environmental performance, a SMAS also recognizes these as environmental costs and assigns them to individual products. Thus, the measurement of environmental costs in a SMAS could provide companies with an appropriate method to accurately create cost information, thereby supporting business internal decision making. Companies could also employ cost information to incorporate into disclosures when reporting environmental performance in the form of triple bottom line reports to their stakeholders.

Social cost

Social costs are claimed as external costs that companies might expend to improve quality of society, employees and the environment (Hazilla & Kopp 1990). These costs refer to expenditure relating to the support of employees' health and safety, training, working conditions, and/or some elements of environmental and natural systems (Bovea & Vidal 2004). Social costs have been identified as private costs that could result in increases in the total cost of products, therefore, companies have an ethical and moral obligation to measure these costs (Hazilla & Kopp 1990). Companies need to be more aware of taking responsibility for their employees, society, and the environment (Mook, Quarter & Richmond 2003). This results in companies most likely providing disclosures to create enhanced images of their organizations in providing accurate cost information for disclosure (Owen & Swift 2001). In addition, this becomes the reason why social costs are of significant concern to stakeholders who are increasingly pushing companies to disclose developments in social performance in the form of corporate social responsibility (CSR) reporting (Geibler et al. 2006).

Mook, Richmond and Quarter (2003) studied integrated social accounting for nonprofits organizations in Canada and claimed that social costs could create negative impacts on operational performance – which impacts on a company's intention to measure these costs for improving quality of society and community benefits. However, there is more discussion about improving social performance of organizations such as creating economic and social value added contributing to stakeholders' interests (Mook, Richmond & Quarter 2003). Frame and Cavanagh (2009) contend that companies analyse benefits to society based on monetary concerns when comparing knowledge and awareness of waste and disposal management programs. The benefits to society were always considered as appropriate operations and an important part of management decisions on measurement of social impacts costs to support social well-being and community development (Frame & Cavanagh 2009). This shows that social impact costs were analysed to benefit society and/or employees by relying on companies' profits. In this case, the measurement of social costs facilitates companies to not only reduce negative impacts on society and the environment, but also to maximize profits when products are sold at larger volumes (Corson 2002). This also provides companies with a way to create an enhanced reputation as socially aware organizations concerned with improving quality of life for humans, reducing poverty, and preserving environmental and natural systems (Corson 2002).

Nelson (2005) studied improvements in advertising and marketing of the beer industry in relation to changes in structure, competitive advertising, and measurement of social costs. Nelson found that a company needs to promote social concerns, including problems of addiction, health, violence and criminal activity, and/or losses of productivity and education (Nelson 2005). This not only adds value to economic performance, but also creates better opportunities in the marketplace. Apart from that, as a polluter, a company should not neglect the prevention of negative environmental and natural patterns as they are costs to society as a whole (ICAEW 2004). However, ICAEW (2004) claimed that social costs and benefits appeared to receive less attention when fully costing products to support financial disclosures. At this point, social impacts are only of slight concern compared to environmental issues when providing cost information to support sustainability reporting (ICAEW 2004; The Sigma Project 2003).

In the design of a SMAS, social management accounting (SMA) concepts are utilized to appropriately measure social impact costs that companies could provide to support employees, society and the environment, as shown in Table 2-2. The table illustrates the measurement of a social costs matrix incorporated in a SMAS. A SMAS can identify these costs by considering appropriate funds that companies may provide to develop their social performance. This also creates cost information to improve social internal decision making on management of social impact costs. A SMAS measures social impacts costs from internal factors (e.g. working conditions, training programs, special offers for employees, and/or promotion and/or advertising) and external factors (e.g. community services, customer satisfaction, and/or research and development). Therefore, social costs in a designed SMAS are identified from social factors. These costs are of significant concern to company stakeholders to disclose as part of corporate social responsibility (CSR) reporting, as mentioned by previous studies (e.g. Geibler et al. 2006; ICAEW 2004; Lamberton 2005). As social costs are recognized as private costs, a SMAS would identify these costs as company expenditure provided to reduce negative impacts on employees, society and local community wherein a company operates (Bedford 1971).

Table 2-2 Measurement of social cost matrix

Sources of social costs	Unit inputs	Production processes	Unit outputs
Qualities of employees	Salary / wages Working conditions Training Health care and safety Others	Employees' decision making Over-time Working hours Others	Lack of performance due to working conditions Employee absenteeism Sick/business leave Maternity leave Vacations/holidays Others
Benefits of employees		Bonuses Rewards Other special offers	Leaving jobs Lay-off s Others
Social responsibilities			Customer satisfaction Customer health and safety Products recalls Community services Local community development Social welfare Employees' self-development programs Research and product development Compulsory costs of government regulations Others
	Social impact costs		

Source: Hazilla and Kopp (1990)

As a consequence, social costs in a design of a SMAS are measured by the needs of companies to disclose their social performance to support stakeholders' demands. This includes improvement in social internal decision-making of organizations in relation to the management of these costs. System characteristics identified from environmental and social performance indicators (GRI 2006, 2010b, 2010a) are provided. The accounting concepts and cost measurement discussed above underpin the conceptual model of a Sustainability Management Accounting System (SMAS) (Figure 2-2) to capture the identified gaps in the literature—which will be addressed in the following section**.**

2.3 Research gaps

Based on the literature review, there appears to be no complete model that contains all characteristics identified from the literature to form a *holistic SMAS*. Various points of view in the literature (e.g. Berkel 2003; Lamberton 2005; Taplin, Bent & Aeron-Thomas 2006) promote the idea that sustainability accounting is a significant accounting approach and organizations can adopt it to help make internal and external decisions when managing environmental costs. Activity based costing (ABC), as currently practised successfully, identifies and allocates both direct and indirect costs to individual costs of products; however, traditional ABC recognizes *environmental costs* as overheads (in the main) while having difficulty in measuring reductions in costs and contaminants (Beer & Friend 2005; Bose 2006; Gale 2006a; IFAC 2005; Qian & Burritt 2007; UNDSD 2001). Thus, ABC needs to be further developed (within the proposed conceptual model) in order to more accurately measure cost and quantity information about environmental (and social) factors (Gadenne & Zaman 2002; Hubbard 2009; Nachtmann & Al-Rifai 2004).

Although, environmental management accounting is an appropriate accounting tool designed for environmental cost management (Burnett & Hansen 2008; Burritt & Saka 2006; Sendroiu et al. 2006), it does not incorporate *social impact costs* which are becoming a significant concern for stakeholders and the public (IFAC 2005). This results in social costs being ignored but, if measured, could significantly create negative impacts on production costs (Hazilla & Kopp 1990; Mook, Richmond & Quarter 2003). The literature suggests that managing reductions in environmental costs could add value to an organization while providing more accurate reporting results in a triple bottom line statement (Berkel 2003; Dunk 2007; Gadenne & Zaman 2002; Gale 2006a; Hubbard 2009; Sendroiu et al. 2006).

For the most part, the literature fails to addresses social accounting issues, particularly within social management accounting. Social costs should be measured so that informed decisions can be made to reduce negative impacts on society, environment, and employees (Mook, Richmond & Quarter 2003; Pittman & Wilhelm 2007; The Sigma Project 2003) and provide more accurate cost information which can then be reported in the form of a triple bottom line report to support stakeholders' demands (Hubbard 2009).

To fill this gap, this study designed a conceptual model for a Sustainability Management Accounting System (SMAS) utilizing *environmental management accounting and social management accounting concepts* by *applying an activity based costing approach*, as suggested by previous studies (e.g. Gadenne & Zaman 2002; Hubbard 2009; Nachtmann & Al-Rifai 2004; Sendroiu et al. 2006). The literature review has shown that these concepts are not widely explored in the literature, particularly in relation to social performance. In addition, environmental costs need to be separately identified and allocated to individual costs of products in order to expose them, rather than being concealed in overheads, when measuring reductions in these costs and contaminants. Meanwhile, *social impact costs* need to be measured in order to develop social performance reporting that addresses the significant concerns of company stakeholders. Companies are now seeking appropriate accounting approaches and systems to relate existing financial reports to *triple bottom line reporting*, in order to more fully disclose social and environment performance to stakeholders while supporting *internal decision making*.

Figure 2-2 shows the link between environmental management accounting (EMA) concepts and activity based costing (ABC) approach and social management accounting (SMA) concepts and activity based costing (ABC) approach. EMA concepts are employed to help in cost identification and measurement of environmental impacts. ABC approach helps in cost allocation and analysis thus assigning environmental impact costs to individual production activity where these costs are consumed. For social impact costs, SMA concepts in a SMAS measure social expenditures that companies expend on social and community development, then allocating these costs. In the meantime, ABC approach allocates these costs to single production activity where appropriate.

Therefore, the designed conceptual model of a SMAS becomes necessary to measure environmental and social impact costs as an effective management accounting system for Australian non-service manufacturing companies. This is because they are required to accurately identify and measure these costs and provide disclosures in the form of a triple bottom line report—economic, social, and environmental performance—as well as a corporate social responsibility (CSR) report. It is important for companies to capture cost information of environmental and social impacts to support environment and social internal decision-making in relation to the management of these costs.

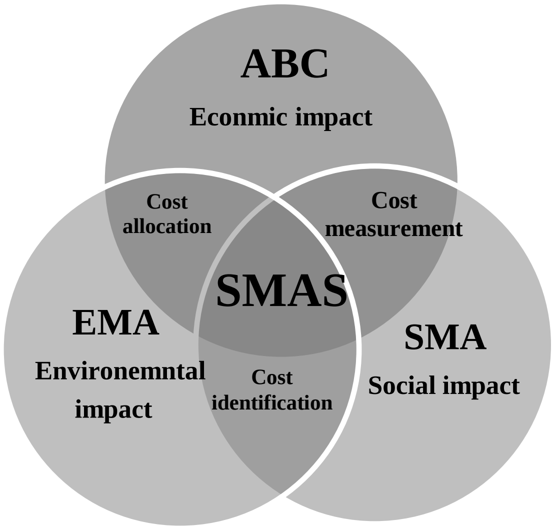


Figure 2-2 A sustainability management accounting system (SMAS) conceptual model

Apart from that, as all types of manufacturing industries are required to report energy consumption and emissions abatement as a requirement of National Greenhouse and Energy Reporting (NGER), a SMAS could help measure the use of unit inputs to potentially evaluate reductions in unit outputs (waste and/or emissions). In addition, by implementing a SMAS companies would also be able to meet the requirements of the Global Reporting Initiative (GRI) in reporting social and environmental performance indicators. This, in turn, will assist companies to become more socially and environmentally aware organizations while creating a positive reputation as a 'green producer' in the global marketplace. Thus, this study attempts to fill the gaps identified in the literature, as summarized in Table 2-3. The descriptive in Table 2-3 concludes this chapter; the research design adopted for this study is outlined in the following chapter (Chapter 3).

Table 2-3 A summary of research gaps

Area	Research Gaps
Environmental management accounting (EMA)	A designed SMAS conceptual model utilizes EMA practices to accurately identify and measure costs of environmental management, waste treatment costs, and pollution prevention. EMA in a SMAS would accurately identify environmental data for enhanced internal decision-making to reduce negative impacts on environment, natural and ecological patterns.
Social management accounting (SMA)	A SMAS also employs SMA to measure social expenditures provided for improvement in quality of life of employees, community, and social well-being. SMA in a SMAS provides more accurate cost accounting of social impacts, leading to enhanced social decision-making in providing social expenditures
Activity based costing (ABC)	A SMAS further designs an ABC application by expanding on cost allocation and analysis for environmental and social impacts. ABC in a SMAS aims to create more accurate cost information of environment and social impacts. ABC would help in identifying these costs from overheads while allocating to single production activity where these costs are consumed.
Environmental costs	More sources of expenditures spent on energy consumption targets, carbon emissions abatement, environmental prevention, wastes management costs, and/or regulations/fines are identified as environmental costs. Environmental costs are allocated to single production activity where these costs are consumed. Cost information is used to support decision-making on cost efficiency along with the development of environmental performance and environmental reporting purposes.
Social impact costs	More sources of social expenditures paid on improvement in quality of life of employees, working performance and living standards are identified as social impact costs. Social expenditures are measured to create data accuracy for social internal decision-making and provide corporate social responsibility (CSR) reporting initiatives.
A SMAS conceptual model for decision-making and external reporting purposes	A SMAS is designed as a holistic management accounting system for sustainable organizations to accurately create data accuracy of environment and social impacts. This study designs a SMAS conceptual model to separately identify and measure environmental and social data from overheads to incorporate in financial disclosures and support management decisions on cost effectively inducing environment-friendly and social well-being. Thus, more accurate cost accounting data of environment and social impacts could help create economic, environmental, and social value added for sustainable value chain organizations. A SMAS provides more precise financial reporting when disclosing development performance in the form of a triple bottom line – economic, environment, and society.

CHAPTER 3: RESEARCH DESIGN

A review of the relevant literature, outlined in the previous chapter, shows that an effective management accounting system of sustainability accounting would facilitate the accurate measurement of costs of environmental and social impacts incurred by organisations. The review further emphasises that environmental management accounting and social management accounting concepts and approaches could be employed to help identify and measure these costs and impacts. In addition, environmental and social cost information needs to be allocated to appropriate production activities to fully cost products for management decision-making and external disclosures. In doing so, companies could create value as sustainable organizations when disclosing operational performance in the form of a triple bottom line reporting—economic, social, and environmental. This chapter states the research questions, propositions and theoretical framework for the design of a SMAS conceptual model. The research investigation and its theoretical perspectives are also described in relation to the design of the model.

3.1 Research problem definition

This study seeks to answer one main research question in attempting to fill the key gaps identified in the literature (Chapter 2). It is difficult for companies seeking to create more accurate cost information of environmental and social impacts to enhance management decision-making without adopting a holistic system. In order to be able to conceptualise a system, system characteristics need to be identified and evaluated so that the most appropriate characteristics can be built into a SMAS conceptual model. This would allow for more realistic cost information of products or services on which to base decisions. Furthermore, in designing a SMAS conceptual model it is necessary to enunciate the required systems characteristics best suited to meet the informational needs of sustainable organizations drawing on best environmental and social management practices, as well as being consistent with accounting concepts and national reporting guidelines and government requirements. Thus, the main research question solicits these system characteristics for a SMAS conceptual model.

Research question

RQ: *What system characteristics could companies employ in designing a SMAS to meet the needs of EMA and SAM practice while adding sustainable value to an organization?*

One purpose of this study is to identify a set of system characteristics that could separately identify costs of environment (rather than allocate them as overheads), as well as measuring reductions in these costs and contaminants (Gale 2006a; IFAC 2005; Sendroiu et al. 2006). Additionally, the system characteristics identified could measure social impact costs as separately identifiable expenditure of organizations (Hazilla & Kopp 1990) so that, combined with traditional and environmental costs, they can capture the full cost of products and provide cost information for enhanced internal management decision-making (Bebbington et al. 2001). Thus, these characteristics could capture data on metrics required by environmental management accounting and social management accounting concepts and practices. In order to arrive at a set of best practice characteristics, the following sub-research questions emerge:

SR1: *To what extent do current accounting systems capture and report environmental costs to support internal decision making for reducing emissions and wastes?*

SR2: *How are companies intending to change their accounting systems to meet environment and social internal decision making needs that will support future reporting requirements?*

SR3: *To what extent is leading practice in environment and social accounting systems and reporting being adopted by manufacturing companies in Australia?*

Answers to these sub-research questions focus on current and future practices regarding the characteristics that need to be incorporated into an accounting information system; and whether Australian manufacturing companies have adopted leading practice. Companies could employ the information system developed to capture costs of environment and social impacts and assign them to each production activity. The system would assist companies in enhancing their internal management decision making regarding the management of these costs, as well as measuring reductions in emissions and wastes (IFAC 2005; UNDSD 2001). However, it is argued that cost accounting information needs to be more accurate when disclosing in the form of triple bottom line reporting (Berkel 2003; Gray et al. 2001), therefore, appropriate management accounting practices are needed to deal with environmental and social issues in preparing cost accounting information for external disclosure (Gadenne & Zaman 2002; Gale 2006a).

3.3 Theoretical framework and its theoretical perspectives

The study sought to identify appropriate system characteristics of sustainability accounting that could be employed by companies from different manufacturing sectors. Firstly, Australian companies could employ system characteristics of sustainability accounting concepts and approaches to measure costs of environment and social impacts. Sub-research question (**SR1**) was addressed to investigate system characteristics employed by companies in their sustainability accounting systems:

> **SR1:** *To what extent do current accounting systems capture and report environmental costs to support internal decision making for reducing emissions and wastes?*

Systems characteristics were expected to provide companies with appropriate management accounting tools to measure and identify environmental costs relating to resource extraction, resource consumption and/or recycling materials/equipments within production processes (James, P. & Bennett 1994). The system could also collect environmental costs from supply chain upstream (e.g. materials, energy and water) and supply chain downstream (e.g. emissions, solids and/or wastes) (Gadenne & Zaman 2002; Gale 2006a). Companies could manage use and flows of materials, energy and water while evaluating reductions in use of resources and contaminants (IFAC 2005; UNDSD 2001). By applying system characteristics, companies would be able to capture cost accounting data on metrics from environment and social impacts while fully costing for internal management decisions (Bebbington et al. 2001; Hazilla & Kopp 1990). Companies could also employ cost accounting information (Eldenburg & Wolcott 2005) of environmental and social impact costs to support sustainability disclosures (Borga et al. 2009). Nonetheless, as environmental costs (e.g. emissions, wastes, air, disposal wastes) are collected into overhead expenditures (Gale 2006a; IFAC 2005; Sendroiu et al. 2006), companies could experience difficulty in the identification and allocation of environmental and social impact costs. Sub-research question (**SR2**) was created to investigate changing companies' accounting systems to create more accurate cost information to enhance management decisions and future disclosures.

> **SR2:** *How are companies intending to change their accounting systems to meet environment and social internal decision making needs that will support future reporting requirements?*

By changing accounting systems, companies could separately identify environmental costs from overheads and collect social costs from expenditure provided to support working conditions of employees and/or quality of society as a whole (Gray 2006; ICAEW 2004; Khisty 2006). This would enable companies intending to change their accounting systems to more accurately record costs of environment and social impacts (Bebbington 2007a) and, thus, enhance their management decision making and external disclosure reporting (Berkel 2003; Gadenne & Zaman 2002; Hubbard 2009; Lamberton 2005). Full cost of products could be captured from internal and external organizations, including environmental and social impact costs, then allocated to a single production activity (Englund & Gerdin 2008; Lamberton 2005; The Sigma Project 2003). By changing accounting systems, companies could also provide triple bottom line and corporate social responsibility (CSR) reporting and add shareholder and stakeholder value (Berkel 2003; Gray 2006). This new accounting system would result in companies being recognized as leading practice companies in meeting the requirements of environmental management accounting and social management accounting concepts and practices. Sub-research question (**SR3**) was posed to investigate the need of companies to apply leading practice in their sustainability accounting systems.

> **SR3:** *To what extent is leading practice in environment and social accounting systems and reporting being adopted by manufacturing companies in Australia?*

Leading practice in management accounting would provide companies with ways to capture environmental and social impact costs from internal and external organizations (Gadenne & Zaman 2002; Gale 2006a; Gray 2001, 2002a). Companies could create cost information while fully costing to report internal and external disclosures of environmental and social performance (Bebbington et al. 2001; Englund & Gerdin 2008). This would result in more accurate cost information for enhanced management decision-making to reduce negative impacts on society, employees and the environment (Pittman & Wilhelm 2007; The Sigma Project 2003). Apart from that, best practice companies could adopt sustainability accounting systems (Schaltegger 2004) for incorporating environmental and social performance into financial reporting to support stakeholders' interests (Hubbard 2009). This facilitates companies to ensure their sustainability while becoming 'green producers' and socially aware organizations in the eyes of their stakeholders and in the marketplace. Figure 3-1 illustrates the identification and measurement of environmental and social impact costs for management decisions and disclosures using system characteristics of sustainability accounting. Furthermore, leading practice companies were recognized as those with effective management accounting practices employed to identify management accounting best practices within a case study in order to improve a designed SMAS conceptual model.

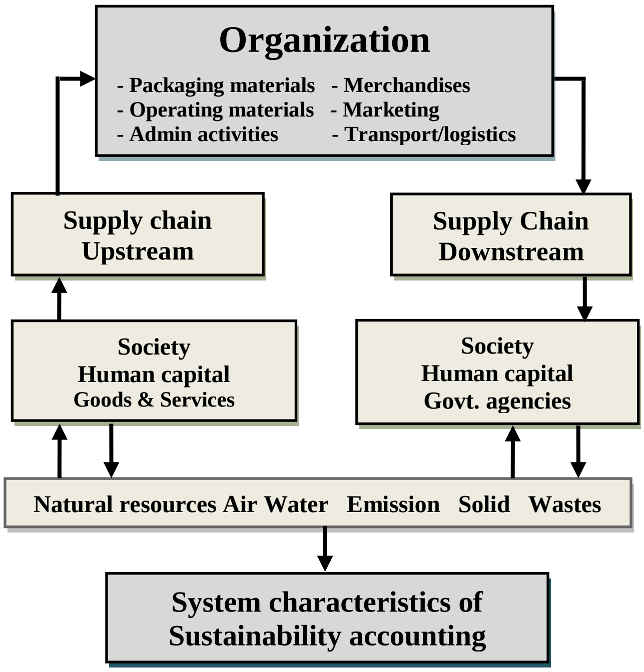


Figure 3-1 Conceptual framework for system characteristics of a SMAS

In the second stage, proposition (**P1**) was formulated to investigate management accounting best practices in providing data accuracy of environment and social impacts to enhance cost management decisions and support reporting initiatives.

> **P1:** *Best practice companies identify costs of environment and social impacts, as well as measuring reductions in contaminants to reduce negative impacts on humans, society, employees and the environment.*

Best practising companies were expected to develop their environmental performance and add value as sustainable organizations (Jacob 1994), thus effectively implementing *environmental management accounting (EMA)* concepts in their environmental cost identification and measurement (IFAC 2005; UNDSD 2001). *Shallow ecology movement* was employed to explain the need to measure costs of environment, uses and flows of resources, energy and water consumption in production processes. The theory was then employed to examine the extent of measuring reductions in unit inputs (resources, energy and water) to reduce production costs and contaminants (Barrow 1999). *Shallow ecology movement* was used to help examine reductions in emissions and wastes within production processes, thus reducing negative impacts on the environment and society

(Barrow 1999). As a result, companies are able to capture environmental costs within production processes and from external organizations (suppliers and customers) while wisely managing the use and flows of resources (materials, energy and water) in production activities (Gale 2006a; Sendroiu et al. 2006). In order to meet the criterion of a sustainable organization, companies need to identify social data for social internal decision-making and external reporting initiatives. Sustainable companies need to cultivate the development of environmental and social performance which, in turn, adds to shareholder value in the eyes of stakeholders and the public. Nonetheless, as EMA has not been involved with social issues (IFAC 2005), companies could employ social management accounting (SMA) concepts and practices in their social cost identification and measurement.

Social management accounting (SMA) could be implemented by organizations to help in cost identification and measurement of social impacts. The measurement of social impact costs by companies could provide expenditure for the development of social performance in relation to the quality of life of employees and society—and a greener environment (Mook, Richmond & Quarter 2003; Richmond, Mook & Quarter 2003). By adopting social management accounting (SMA) concepts, companies would be able to capture costs of social impacts to support disclosures for business decision-making and establish better relationships with their stakeholders (Gray 2006; Gray et al. 2001). *Marx's labour theory of value* was applied to examine moral obligations and norms of companies in preparing cost information to support social performance disclosures. In addition, measuring social impact costs could result in higher profit margins when products are sold in larger volumes in the marketplace (Jasch & Stasiškienė 2005). *Marx's labour theory of value* would also explain the need for companies to provide cost accounting data relating to social impacts to support social performance disclosures (Jasch & Stasiškienė 2005). As a result, companies could enhance their social internal management decisions in relation to measuring costs to support social aspects, while also promoting themselves as socially aware organizations and adding value as sustainable organizations (Epstein & Roy 2001; Hazilla & Kopp 1990) to meet best practice needs.

Furthermore, best practising companies could also allocate cost information of environment and social impacts to a single production activity using a cost centre and/or cost driver of *Activity based costing* (ABC) (Bebbington et al. 2001; Neumann et al. 2004). Environmental and social impact costs could successfully measure activities, costs reductions and control (Armstrong 2006; Cãpusneanu 2008; Northrup 2004; Sendroiu et al. 2006). Thus, companies may avoid allocating cost information to overheads (Nachtmann & Al-Rifai 2004) when fully costing for external disclosures and internal management decisions (Gadenne & Zaman 2002; Gray et al. 2001). As a consequence, best practising companies would be able to identify and measure costs of environmental and social impacts when assigning to appropriate production activity based on cost allocation and analysis of ABC approaches (Figure 3-2).

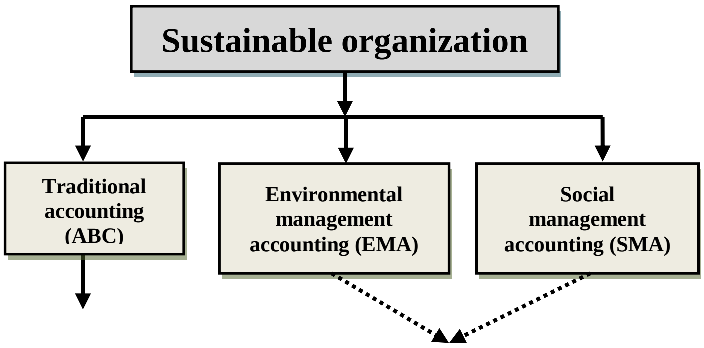


Figure 3-2 Conceptual framework for an integration of EMA, SMA, and ABC of a SMAS

Companies would be able to fully-cost products (environmental and social impacts) to support management decisions, as well as sustainable development disclosures, thus involving themselves in sustainability accounting concepts to meet the needs of a sustainable organization. Thus, proposition (**P3**) was generated to examine management accounting best practices in managing internal management decisions using cost information of environment and social impacts.

> **P3:** *A SMAS provides best practice companies with an enhanced environmental and social costs management system to improve internal management decisions and to support stakeholders' and public concerns.*

In the third stage, proposition (**P3**) sought to establish management accounting systems of best practising companies in employing cost accounting data of environment and social impacts to enhance internal management decisions, as well as supporting the concerns of stakeholders, including the public. Since companies need to provide physical and monetary information on the use and flows of resources (IFAC 2005), a SMAS would help measure costs of environment and social impacts. A SMAS would also help manage the timing of impacts when the flow of products in the markets is likely to change the value of stock over a period (The Sigma Project 2003). In this regard, *stakeholder theory* was used to determine moral responsibilities and norms in measuring cost accounting data. The theory was firstly applied to consider *stakeholder power* that companies need in identifying which stakeholders are interested in financial disclosures (Ullmann 1985). Stakeholder theory would help examine the use of renewable resources within 'green' production processes (Maak & Pless 2006), thus creating positive reputations in relation to environmental preservation. This impacts on stakeholders' intentions when investing in sustainable organizations in the long-term (Maak & Pless 2006). Then, as environmental and social disclosures are of interest to company stakeholders, stakeholder theory was employed to examine the identification and measurement of these costs as *strategic posture*. Finally, stakeholder theory was used to examine the development of *economic performance* by measuring cost reductions of environment and social impacts to incorporate in financial disclosures—thus adding value to stakeholders (Ullmann 1985).

As a result, a SMAS provides companies with a method to capture physical and monetary units while employing cost accounting data to enhance management decisions and manage timing impacts on flows and stock of resources. A SMAS would help fully costing to support business decision-making on external disclosures to support stakeholders' demands. In this stage, as stakeholder theory relies on 'normative core' (Freeman 1994), it helped explain the need of companies to provide financial disclosures to add value to stakeholders (Freeman 1984; Freeman & Reed 1983). In doing so, ethical and moral responsibility in measuring cost accounting data is sought. This study employed stakeholder theory to help explain the influence of stakeholders' interests on the development of environmental and social welfare.

Consequently, as well as supporting their own interests, a SMAS would enable companies to increase stakeholder trust by disclosing environmental and social disclosures (Buchholz & Rosenthal 2004). Stakeholder theory was, therefore, considered appropriate in helping the communication and transparent disclosure of economic, environmental, and social performance (Maak & Pless 2006). A SMAS conceptual model would enable the tracking and reporting of timing impacts related to movements in stocks and flows of products/services to disclose costs and benefits of operational performance of organizations. This movement relates to measurement of costs and benefits tracked from external impacts on the economy, society and the environment (The Sigma Project 2003). Figure 3-3 shows the benefits of applying an effective management accounting system for sustainable development organizations.

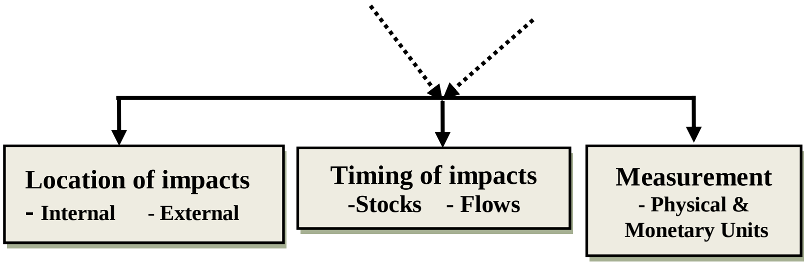


Figure 3-3 Conceptual framework for a SMAS and its sustainable development

Finally, the fourth proposition (**P4**) was generated to inform sustainable companies on applying a SMAS conceptual model for environmental and social cost identification and measurement to create value added of sustainable value chain organizations.

> **P4:** *A SMAS provides best practice companies with a mechanism to add value in economic, social and environment areas of performance.*

Proposition 4 identified a SMAS conceptual model as an effective management accounting mechanism that could assist companies to develop three specific areas, namely, economic, social and environmental performance. Consequently, by incorporating three fused theories in the theoretical framework to develop a

SMAS conceptual model, it supports a SMAS to fully collect direct costs from materials and labour; and indirect costs of overheads, social and environmental costs (Bebbington et al. 2001; ICAEW 2004; Lamberton 2005). This framework meets the requirement of sustainability accounting concepts and practices for enhancement of management decisions and environmental and social disclosures (Goodland 2002; Gray 2006; Jasch & Stasiškienė 2005). Companies could create a sustainable value chain organization in relation to three performance areas: economic, social and environment (Ball 2004; Berkel 2003; Lamberton 2005; Taplin, Bent & Aeron-Thomas 2006). Furthermore, a SMAS could provide companies with a way to disclose these three areas of performance through integrated triple bottom line reporting to stakeholders and the public (Borga et al. 2009; Schaltegger & Wagner 2006; Sikdar 2007). Figure 3-4 illustrates the business opportunities of applying a SMAS thus creating economic, social, and environmental value added.

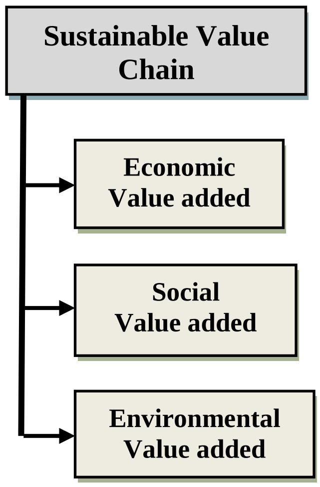


Figure 3-4 Conceptual framework in a SMAS for sustainable value chain organizations

Figure 3-6 illustrates the full theoretical framework as the starting point for the development of a sustainability management accounting system (SMAS) conceptual model.

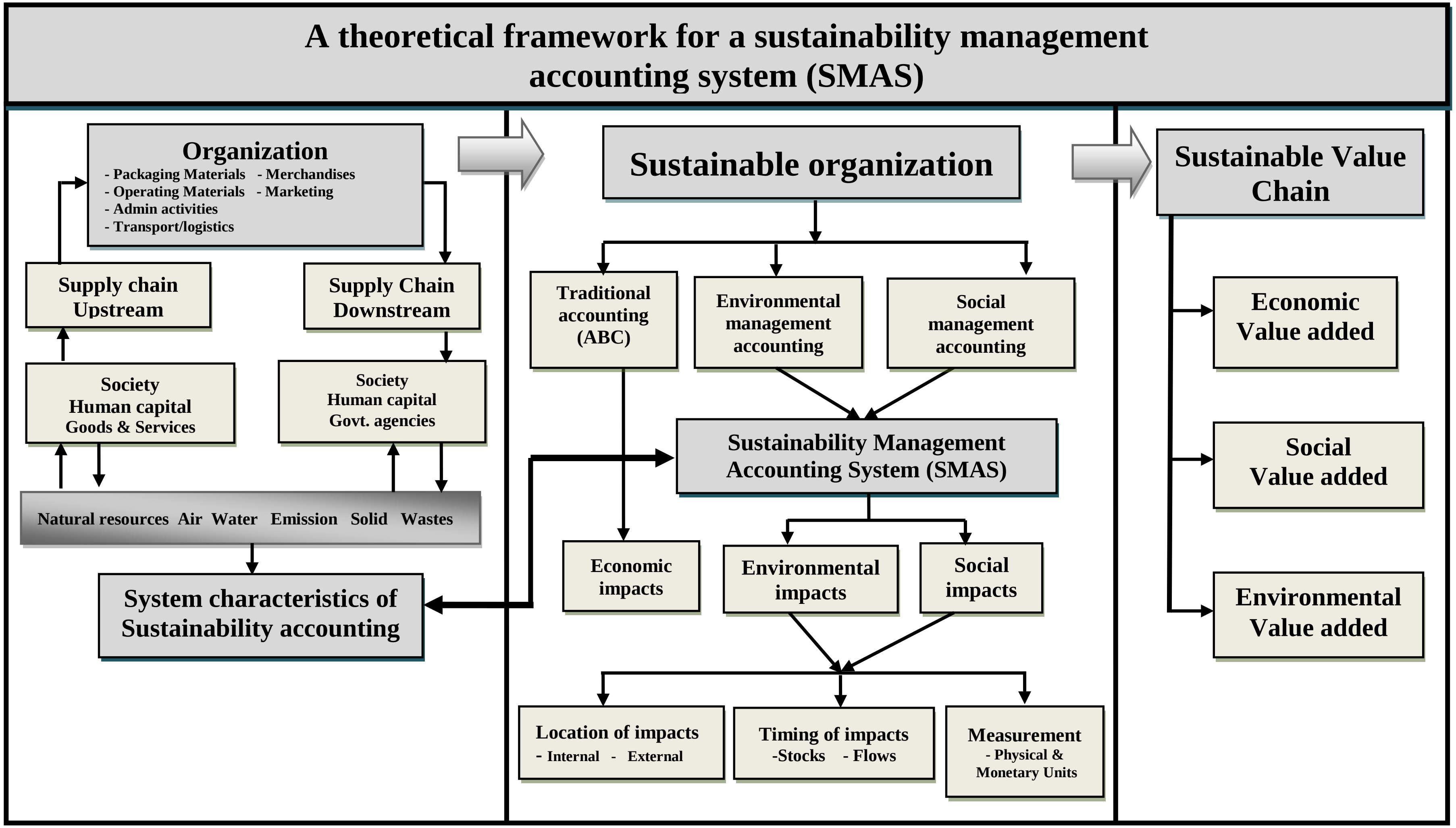


Figure 3-5 A theoretical framework for a SMAS conceptual model

Accordingly, a theoretical framework for a designed SMAS conceptual model was created by investigating system characteristics of sustainability accounting systems for environmental and social impact costs. An integration of environmental management accounting and social management accounting concepts and practices helped in the identification and measurement of environmental and social impact costs. By extending activity based costing application it allows full costing (including environmental and social impact costs) and cost analysis before allocating to appropriate production activities. Three prior theories (*deep ecology theory, Marx's labour theory of value*, and *stakeholder theory*) were fused to help examine cost identification and measurement of environment and social impacts.

3.4 Propositions

This study posed four propositions that focus on appropriateness of, and improvements in, employing systems characteristics solicited; and comparing these characteristics with Australian firms that have adopted best practice. The propositions addressed in this study directly focus on a particular aspect within the scope of the study to reflect the results of research questions posed. Thus, evidence collected to answer sub-research questions was used to validate the following propositions.

> ***P1:*** *Best practice companies identify costs of environment impacts, as well as measuring reductions in contaminants to reduce negative impacts on humans, society, employees and the environment.*

Best practice companies could apply effective management accounting systems using sustainability accounting concepts to successfully deal with environmental and social issues. These systems could apply *environmental management accounting* (EMA) and *social management accounting* concepts and practices for environmental and social cost identification and measurement. The systems would assist best practice companies to identify what traditionally are treated as overhead expenditures relating to environmental costs within production processes and/or external organizations (Gadenne & Zaman 2002; Gale 2006a;

IFAC 2005). Companies could also measure social impact costs from expenditures to improve the living standard of employees and quality of society generally, as well as reducing negative impacts on the environment (Gray 2006; Hazilla & Kopp 1990; Mook, Richmond & Quarter 2003). In addition, best practice companies could apply an *activity based costing* (ABC) application to help in the cost allocation and analysis of environmental and social impacts (Eldenburg & Wolcott 2005). Fully costing environmental and social impacts will enable organisations to develop enhanced internal management decision-making for future production while reducing emissions and wastes (Armstrong 2006; Cãpusneanu 2008; Northrup 2004; Sendroiu et al. 2006). As a result, best practice companies could be involved in sustainability accounting concepts and take environmental and social issues into account to maintain natural resource balances and add long-term value to their organizations and society. The following proposition focuses on providing accurate cost accounting information of environmental and social impacts for sustainable organizations.

> ***P2:*** *Best practice companies provide more accurate environmental and social cost information for internal decision-making and to support external reporting disclosures.*

Best practice companies could prepare cost accounting data of environment and social impacts to enhance internal management decisions in relation to use and flows of natural resources within production activities. Cost information could be employed to wisely measure reductions in environmental costs and contaminants (emissions and wastes) to maintain a ecological balance and improve the natural environment and humanity (Dixon & Fallon 1989). The incorporation by best practice companies of cost information of environment and social impacts in a triple bottom line report will facilitate the disclosure and performance of economic, environment, and social well-being (Berkel 2003; Dunk 2007; Gadenne & Zaman 2002; Gale 2006a; Sendroiu et al. 2006). It would also allow the reporting of social performance in the form of corporate social responsibility (CSR) reporting while becoming more competitive in the marketplace (ICAEW 2004; Lamberton 2005). Such measures would ensure that companies take social well-being into account by considering moral values and ethical codes to reduce negative impacts on society as a whole (Russo & Perrini 2009). Environmental and social cost information may not only enhance business management decisions in relation to these costs, but also create value as sustainable organizations in the eyes of stakeholders and the public. This study recognizes best practice companies as those with effective management accounting practices of sustainability accounting for environmental and social cost measurement. Thus, the proposition posed below aims at identifying best practice companies to develop an improved SMAS conceptual model.

> ***P3.*** *A SMAS provides best practice companies with an enhanced environmental and social cost management system to improve internal decision making and to support stakeholders' and public concerns.*

As a SMAS conceptual model was designed to facilitate cost identification and measurement of environment and social impacts, best practice companies could fully capture product costs while creating more accurate cost accounting information (ICAEW 2004; Lamberton 2005). This cost information could be used for improvement in environmental and social internal decision-making (Eldenburg & Wolcott 2005), as well as supporting stakeholders' interests (Berkel 2003). According to Eldenburg and Wolcott (2005), cost accounting information, including financial and non-financial data, can be used a strategic tool to enhance decision quality for future production, organizational vision, and/or operational plans. Thus, a SMAS conceptual model could provide best practice companies with a method of employing cost information to successfully measure reductions in environmental costs (Gadenne & Zaman 2002; Sendroiu et al. 2006), including emissions abatements (Gale 2006a; Milne 1996). Companies could also develop stocktaking procedures to manage reductions in material consumptions within production processes. In this case, a SMAS provides companies with a way to cope with changing values of natural resources (Maler 1991) that can directly affect flows of products to markets (UNDSD 2001). As a result, best practice companies could be more successful in their management of environmental cost efficiency, as well as uses and flows of resources within production processes.

Thus, a company could be seen as a sustainable organization and one that is attempting to reduce its negative impact on the environment and society (Bebbington, Brown & Frame 2007; Gray 2002a). The final proposition was posed to examine economic, social, and environmental value adding of sustainable value chain organizations by applying a SMAS conceptual model. Routine

> ***P4.*** *A SMAS provides best practice companies with a mechanism to add value in economic, social, and environment areas of performance.*

The concerns of stakeholders has put pressure on companies to develop economic, social, and environmental performance in order to add value as sustainable organizations (Morimoto, Ash & Hope 2005). Consequently, a SMAS could be a new management accounting mechanism that helps enhance environment and social internal decision-making on cost savings opportunities and cost identification and measurement. A SMAS conceptual model is designed as an effective management accounting approach to help the long-term enhancement of economic, social, and environmental dimensions. Moreover, an integrated management accounting application within a SMAS conceptual model assists management in cost-effective compliance, and in meeting the requirements of environmental regulation and policies (IFAC 2005). As a result, companies could create operational efficiency by minimizing use of natural resources (material, energy, and water) in production processes and improving quality of life of employees, the community and society. More accurate cost accounting data also has the potential to generate sustainable growth and new business opportunities, thus increasing economic performance and environmental and social efficiency (Berkel 2003). Companies could create a competitive advantage when volunteering sustainable development disclosures to add sustainable value chain organizations to ensure sustainability is achieved.

Increasingly, more accurate cost accounting information can also be employed to support internal and external disclosures while developing tracking and reporting systems to add shareholder value (Borga et al. 2009; Morimoto, Ash & Hope

2005). Companies have the means to prepare cost accounting information to externally report their progress in using less energy and emissions abatement to comply with National Greenhouse and Energy Reporting (NGER) requirements. This includes triple bottom line reporting and Global Reporting Initiative (GRI) sustainability reporting guidelines relating to the development of three performance aspects, namely, economic, society, and environment. It allows companies to meet the required levels of emission trading system (ETS) or Cap and Trade Scheme that the Australian Government has currently mandated to be operational (Department of Climate Change 2008b). Consequently, a SMAS would facilitate the implementation of an effective management accounting approach relating to environmental and social responsibility to achieve sustainability and maintain long-term competitiveness..

3.5 Chapter summary

Chapter 3 has described the research design, beginning with one research question emanating from the research problem and hence, formulating sub-research questions to investigate system characteristics of a sustainability accounting concept. The investigation included identification and measurement of environmental and social impact costs in sustainable organizations. Subsequently, the following section of the chapter defined key definitions of measures employed, along with environmental and social cost measurement within a theoretical framework. A theoretical framework for a sustainability management accounting system (SMAS) conceptual model, fused with relevant theories, has been detailed and processes of investigation explained. The final section described the study’s propositions in investigating the design of a SMAS conceptual model reflecting the consideration of sub-research questions (as summarized in Table 3-1). The following chapter (Chapter 4), details the research methodology employed in this study, including aspects of data collection and measurement procedures.

Table 3-1 A summary reflection of research questions and propositions

Research question *RQ1:* What system characteristics could companies employ in designing a SMAS to meet the needs of EMA and SMA practices while adding sustainable value to organization?

Sub-research questions	Areas of measurement	Propositions	The reflection
SR1: *To what extent do current accounting systems capture and report environmental costs to support internal decision making for reducing emissions and wastes?*	Current system characteristics or management accounting system	***P1:*** *Best practice companies identify costs of environment and social impacts as well as measure reductions in contaminants to reduce negative impacts on humans, society, employees and the environment.*	Meet the requirements of EMA and SMA concepts and practices
SR2: *How are companies intending to change their accounting systems to meet environment and social internal decision making needs that will support future reporting requirements?*	Environment and social internal decision making	***P2:*** *Best practice companies more accurately provide environmental and social costs information for internal decision making and to support external reporting disclosures.*	
SR3: *To what extent is leading practice in environment and social accounting systems and reporting being adopted by manufacturing companies in Australia?*	Economic, social, and environmental performance	***P3:*** *A SMAS provides best practice companies with an enhanced environmental and social costs management system to improve internal decision making and to support stakeholders' and public concerns.*	Design a SMAS conceptual model for sustainable organizations
		P4: *A SMAS provides best practice companies with a mechanism to add value in economic, social, and environment areas of performance.*	

CHAPTER 4: RESEARCH METHODOLOGY

This chapter details the research methodology employed in this study to investigate the research questions and propositions discussed in Chapter 3. The chapter begins with a description of the research methods adopted, and then goes on to explain procedures of data collection using a triangulation approach. The measurement procedures are outlined, describing the development of the survey and interview instruments—as well as how sample groups for the survey and case studies were selected. Thus, data analysis techniques and procedures are discussed in the following section.

4.1 Mixed method and concurrent triangulation design

The study applied mixed methods (quantitative and qualitative approaches) to collect and analyse data using triangulation for credibility, thus avoiding social bias and building strong results from the study (Creswell 2009; Gorard 2004; Neuman 2006). A quantitative approach was employed to gain companies' responses to the Carbon Disclosure Project (CDP) in Australia and New Zealand employing system characteristics for environmental and social cost identification and measurement. Meanwhile, a qualitative approach was used to investigate management accountants in Australian companies as case studies. The investigation was relevant to creating cost accounting data on environment and social impacts to successfully enhance internal management decisions, as well as supporting financial disclosures.

Although mixed methods have been used in data collection and analysis, this was productive in analysing various sources of data and in supporting the interpretation between the two methods (Creswell 2009; Somekh & Lewin 2005). In addition, the implementation of mixed methods was flexible and depended on the research design and/or researcher first collecting data by either qualitative or quantitative methods (Creswell 2003). Creswell (2009) also claimed that mixed methods enable the application of quantitative results to support the interpretation of qualitative results. This creates reliability and trustworthiness of data collection

(Somekh & Lewin 2005). Swanson and Holton (2005) illustrated sequential designs and concurrent designs of quantitative and qualitative in mixed methods that mainly differ in the sequence, priority of data collection, and/or investigation, as shown below.

a. ***Sequential explanatory design:*** Sequential explanatory design begins with quantitative data collection as the first phase. It then collects data using qualitative research methods as the second phase. The results of a quantitative study from survey, experiments, and/or correlation study are employed to explore in-depth qualitative data from focus groups, case studies, interviews, and/or observations.
b. ***Sequential exploratory design:*** In contrast to the first design, the first phase begins with qualitative data collection while using quantitative methods for data collection as a second phase. This design mainly helps researchers to develop unknown variables of quantitative instruments. It also explores qualitative results from a small group of the population that is randomized from a larger group.
c. ***Concurrent triangulation design:*** This design is used to simultaneously collect data from both quantitative and qualitative research methods in parallel. The initial aim is to help researchers compare the particular data with general and/or validated data between quantitative and qualitative. The researcher can make a comparison between detailed qualitative data and more normative quantitative data.
d. ***Concurrent nested design:*** This design is slightly different to the previous design in that even though quantitative and qualitative data are collected at the same time, data is given less emphasis than the other. The researcher addressed research questions and/or hypotheses of the quantitative methods and applied different constructs than research questions of qualitative methods.

For this study, *concurrent triangulation design* was adopted in mixed methods, where equal emphasis was afforded to both quantitative and qualitative results. The results of quantitative methods were used to enrich interpretations of qualitative data (Punch 1998). The triangulation strategy design helps make comparisons between the quantitative data and qualitative data while generating validated and substantiated results (Creswell 2009; Swanson & Holton 2005). Thus, in this study, quantitative and qualitative data were collected simultaneously, using quantitative results as the basis to investigate the results of qualitative research methods.

4.2 Measurement and instrumentation

The measurement approach and procedures regarding sub-research questions and propositions have been highlighted in the previous chapter. This section provides more details on each sub-research question and proposition while indicating data collection and instruments employed for this study.

4.2.1 Measurement

Quantitative measurement

The measurement of quantitative data aimed at investigating system characteristics of sustainability accounting practices employed to help in the identification and measurement of environment and social impacts. Descriptive analysis methods were employed to measure companies' profiles in order to identify sixty-two companies' responses selected from different manufacturing companies in non-service sectors. The measurement aimed to recognize which sectors and size of companies captured environmental and social data for management decisions and reporting purposes. The measurement was also related to disclosing the development of environmental and social performance in the form of corporate social responsibility (CSR) reporting systems. Furthermore, cluster analysis methods were employed to measure items of environmental and social performance indicators in the questionnaire. Items in this questionnaire were correlated into each group of objects using a 5-point Likert-type scale. The scale ranged from *not at all* (coded as 1), *monthly* (coded as 2), *quarterly* (coded as 3), *half yearly* (coded as 4), to y*early* (coded as 5) (see Appendix 1).

Items on environmental performance indicators in the questionnaire were relevant to measurement of resources (materials, energy, and water) in production processes, as well as evaluating reductions in emissions and wastes. Meanwhile, items on social performance indicators involved labour practices and working performance, human rights, social well-being and product responsibility (e.g. customer services, call centres, and/or product life cycles). Thus, participants were required to indicate how often companies measured and reported environmental and social impact costs internally or externally, as well as identifying these costs for future reporting purposes. The results of high correlation falling into final clusters answered sub-research questions SR1, SR2, SR3 respectively.

> **SR1:** *To what extent do current accounting systems capture and report environmental costs to support internal decision making for reducing emissions and wastes?*

The measure for sub-research question 1 sought to establish where cost accounting data of environment was employed to measure reductions in emissions and wastes, thus maintaining ecological and natural systems. Items 1-6 were measured in appropriate periods (monthly, quarterly, half yearly, and yearly) to gauge natural resources (material, energy, and water) management in production processes. The measurement also sought to identify which timeframes were considered by companies when collecting environmental data for management decisions on energy reduction programs (items 7 and 8). In relation to this aspect—total volume of direct materials—companies may need to measure monthly to estimate reductions in emissions and wastes. In this regard, companies may be concerned with the measurement of these costs in different periods or timeframes, depending on the major need of each indicator. Items 9-11 measured total usage of water consumption in production processes, including use of recycled water and negative impacts on biodiversity when removing large volumes of water in protected areas—with the aim of reducing water consumption in production processes.

Items 12-19 measured total volume of direct/indirect GHG emissions in tonnes of CO_2 equivalent to estimate reductions in carbon emissions. Cost information was expected to support decision-making on providing carbon emission reduction programs that helped measure total volume of material used in production processes to estimate reductions in greenhouse gas emissions (Gale 2006a; IFAC 2005; Sendroiu et al. 2006). The measurement was further relevant to identifying total volume of emissions and wastes from internal and external organizations to support decision-making on environmental efficiency (items 20-25). Thus, the system characteristics employed by companies to identify environmental costs were measured to meet the environmental management accounting (EMA) concepts or practices of creating cost accounting information for decision-making. Companies need to create cost efficiency by minimizing use of natural resources (material, energy, and water) while estimating reductions in total volumes of GHG emissions in tonnes of CO_2 equivalent.

However, as environmental costs are not simple to identify when hidden among production and service processes, companies may face difficulties in providing accurate cost accounting data for enhanced decision-making processes while being unsuccessful in managing these costs and evaluating emissions and wastes abatement. As a result, environmental performance indicators indicated as *not at all* were measured as companies currently being uninterested in measuring these costs, but possibly intending to measure them in the future. The measurement of sub-research question 2 was relevant to changing management accounting systems for more accurate cost accounting data of environment and social impacts to support management decisions in future.

> **SR2:** *How are companies intending to change their accounting systems to meet environment and social internal decision making needs that will support future external reporting obligations?*

Environmental performance indicators for SR1 were also employed to measure SR2 in terms of future intentions for environmental cost identification and measurement to support management decision-making and reporting purposes.

High correlations falling into each final cluster (*monthly*, *quarterly*, *half yearly*, and *yearly*) indicated the appropriate timeframe companies intend to adopt in their accounting systems in order to create more accurate cost accounting data. The timeframes provided were measured within appropriate periods to capture cost information that depends on the need of organizations to support internal management decisions on environmental and social issues in the future. In contrast, companies indicating '*not at all*' for many indicators signify that these costs were not of concern for management decisions or for supporting financial disclosures. Companies may disclose external reporting to create particular images and/or positive reputations for environmental and social concerns, as claimed by previous studies (e.g. Deegan 1996; Gray 2006; Gray et al. 2001; Owen & Swift 2001). In relation to this, social performance indicators were measured to seek the future intentions of companies to identify social data for management decisions and social performance disclosures.

Items 1-8 measured cost collection of social impacts from expenditure on improvement in quality of employee life, working performance and living standards. Companies' responses to items in the questionnaire were expected to identify social management programs, including percentages of employees receiving a regular performance and career development review and ratio of basic salary of males to basic salary of females for each employee category. The measurement further involved local community development in areas where companies operate. This included community management programs/practices provided to bring benefits to communities (items 9-14). Items 15-20 measured product responsibility programs provided to support health and safety impacts of products/services that are assessed for improvement and life cycle of products. The measurement was also relevant to product information required by procedures, customer satisfaction programs/practices, marketing communication, promotion, and/or sponsorship provided to support customer benefits. The measure of social performance indicators signified that current practices of companies intend to create accurate cost accounting of social impacts for enhancement of social internal decision-making on cost measurement and social reporting initiatives.

Consequently, environmental and social performance indicators in the questionnaire sought to measure future intentions of companies in identifying these costs to report internally and/or externally. The indicators investigated where the needs of environmental and social impact costs would be used for decision-making purposes in the future. These indicators also measured appropriateness in capturing cost information to disclose triple bottom line reporting to support increased concerns of stakeholders. In this regard, the measurement of SR2 illustrates how companies are attempting to change their current accounting systems to effectively measure cost of environment and social impacts to support their decision-making processes and external disclosures in the future. Companies could become 'best practice companies' in dealing with environmental and social cost measurement, as well as creating value as sustainable organizations. Sub-research question 3, therefore, measured how leading practice adopted by Australian non-service manufacturing companies could enhance their sustainability accounting systems.

> **SR3:** *To what extent is leading practice in environment and social accounting systems being adopted by manufacturing companies in Australia?*

The measurement of SR3 was related to leading practice adopted by companies for environmental and social cost identification and measurement to meet sustainable organization needs. Environmental and social performance indicators measured for SR1 and SR2 were employed to identify appropriate leading practice periods (timeframes) in capturing environmental and social impact costs. Thus, the highest correlation of each frequency period/timeframe in response to SR1 and SR2 signified the extent of leading practice that companies need to accurately create cost accounting data of environment and social impacts to disclose either internally or externally. Leading practice companies could employ environmental and social data to support decision-making, thus creating eco-efficiency and improved environmental and social performance. Enhancing their environment and social internal management decision-making in relation to cost efficiency will ultimately balance their economic, social, and environmental performance. It will also result in better relationships with stakeholders when providing triple bottom line reporting to support their demands. Leading practice also facilitates companies to evolve into sustainable organizations concerned about environmental and social issues. Consequently, the results of the survey in this qualitative study identified leading practice supports measurement of effective management accounting of sustainability accounting systems.

Qualitative measurement

The measurement of qualitative data aimed at identifying an effective sustainability accounting system that best practice companies could employ for environmental and social impact cost identification and measurement. Data was collected from management accountants dealing with environmental and social issues (Gadenne & Zaman 2002) by using in-depth interview along with a benchmarking model (see Figure 4-1). This was to ensure that all responses were investigated in the same manner and data reliability was achieved. Gadenne and Zaman (2002) also suggest that the strategic environmental posture of Australian companies should be studied using more in-depth interview and case studies. Meanwhile, to study social well-being in Australia, researchers need to more precisely examine how companies identify and measure cost accounting data of social impacts to support discourses (Gray 2006). This is because although Australian companies propose to develop environmental dimensions, social responsibilities have not completely been taken into account (Gadenne & Zaman 2002). This creates inaccuracies in social costs employed and incorporated in financial reporting and/or to support social management decisions. Thus, fifteen non-service manufacturing companies were identified as case studies and were examined to establish the appropriateness of, and accuracy in, creating cost information of environment and social impacts to answer to four research propositions. The measurement of propositions needs to meet data accuracy needs, internal decision-making efficiency and sustainable organization targets.

P1: *Best practice companies identify costs of environment and social impacts, as well as measuring reductions in contaminants to reduce negative impacts on humans, society, employees and the environment.*

Proposition 1 was measured to meet best practising companies' needs in identifying environmental and social impact costs for improvement in environmental and social performance. The measurement was relevant to separately identifying environmental and social impact costs from overheads while allocating to a single production activity. Environmental costs need to be captured from internal and external organizations to create a positive reputation in corporate sustainability and to achieve cleaner production initiatives (Gale 2006a). In addition, management accountants should play a role in accurately identifying environmental costs from waste treatment, resource management, waste disposal, and/or site maintenance (IMA 1995). Thus, participants in the study were asked *how companies identify and measure cost of environmental impacts from internal and external organizations to enhance environmental performance.* The responses were measured to seek the source of appropriate environmental cost identification and measurement from both internal (production processes) and external organizations, including emissions and waste disposal, products in production, and purchasing of materials. Companies would be expected to manage use and flows of resources while preparing cost information to estimate cost reductions and limit waste and emissions from future production (Barrow 1999; Gale 2006a; Sendroiu et al. 2006). Best practice companies would also be expected to succeed in environmental cost efficiencies and reduce resource extractions to protect environmental and ecological systems.

In addition, as the measurement of environmental costs can lead to wise management of the use and flows of materials, energy, and/or water in production processes, companies would benefit from better opportunities to evaluate reductions in emissions and wastes (UNDSD 2001). Gale (2006a) found that companies paid three times more for production costs such as purchasing materials, operating costs (e.g. labour, infrastructural costs, and/or emissions and wastes) and disposal costs. This not only impacts on high production costs and financial performance of organizations, but also damages environmental and ecological systems by emitting high levels of contaminants into the air. Thus, the measurement was expected to identify how companies perceive and deal with their responsibilities in relation to environmental issues and take environmental and natural aspects into account while creating benefits for society and communities in surrounding areas. A further interview question was set to investigate *how companies reduce environmental pollution to improve environmental performance and eco-efficiency of organizations*. The researcher expected that best practice companies should consider estimating reductions in environmental costs, use of natural resources and carbon contaminants. It is anticipated that best practice companies would wisely manage use and flows of materials, energy and water to support production processes by using lower volumes of natural resources and/or recycling wastes, materials and/or equipment. Best practice companies would be concerned with avoiding resource extractions, reducing environmental pollution, and managing waste and disposal abatement. These aspects are designed to reduce overall negative impacts on the environment and society, while maintaining environmental and ecological systems for better quality of life worldwide.

Thus, social responsibility needs to be taken into account to enhance living standards of employees, create a positive impact on society, and support environmental protection. As such, social expenditure should be provided to create more accurate cost information for management decisions on cost management (Gray 2002a). Although social costs have been of less concern by companies (Richmond, Mook & Quarter 2003), full cost information should be incorporated in financial disclosures in order to enhance business decision-making (Gray et al. 2001; Owen & Swift 2001). Participants were asked to explain *how companies reduce negative impacts on society while improving the quality of life of employees, social well-being, and environmental preservation*.

The responses measured the extent to which best practice companies are concerned about the development of the social performance of organizations. When products are produced in large volumes to support high consumption, social expenditure provides support to the working performance and living standards of employees. Companies create surplus values in markets while acknowledging the development of social well-being of communities in surrounding areas. This helps to create a positive reputation as a socially-aware organization in the eyes of stakeholders and the public when disclosing social performance reports. Consequently, companies need to identify social impact costs separately from overhead expenditures to create more accurate cost information. In relation to this, the measurement of proposition 2 was related to enhancing environment and social internal decision-making and external reporting initiatives.

> ***P2:*** *Best practice companies more accurately provide environmental and social cost information for internal decision-making and to support external reporting disclosures.*

Proposition 2 was measured to meet data accuracy needs for enhancement of internal decision-making on cost savings and carbon emissions abatement and reporting purposes (Jasch 2009). This is because traditional management accounting has treated environmental costs as overheads which results in inaccurate cost accounting data in supporting environmental management decisions and environmental performance disclosures (IFAC 2005; UNDSD 2001). IMA (1995) has suggested companies create environmental strategies to improve management decisions in relation to environmental cost measurement because environmental costs significantly help cost reductions in corporate operations, technology, product designs, and/or production of goods or providing services (ACCA 1995). The measurement of environmental cost also assists in the development of environmental preservation while creating greater benefits to humanity and general business success (ACCA 1995). In addition, social costs should be captured to create more accurate cost information to enhance business decisions on cost identification and measurement. Accurate cost accounting data should be utilised as a management decision strategy to create better working performance in the production of larger volumes and high quality of products. As a result, companies could fully cost to create more accurate cost information on environment and social impacts and, at the same time, develop enhanced internal management decisions for reporting purposes.

As mentioned above, IMA (1995) has provided priority guidelines for use in organizations when using corporate environmental strategies to integrate into managerial decisions on all aspects of environmental issues. These changes relate to cost reductions, improvement in long-term corporate profitability, adding value to stakeholder satisfaction and confidence, increased competiveness in the 'green' market, as well as meeting national and global reporting requirements (IMA 1995) such as NGER or GRI. Participants were those management accountants dealing with environmental and social issues and they were asked to explain *how companies enhance internal management decisions in relation to improvements in environmental and social issues.* The measurement expected that best practice companies were able to provide cost accounting data of environment and social impacts—thus fully costing for better management decisions and environmental and social disclosures (Hubbard 2009; ICAEW 2004). Companies should successfully improve financial performance using reliable cost accounting information such as management decision strategies (Pramanik, Shil & Das 2007). Eldenburg and Wolcott (2005) also claimed that the priority of cost accounting information provides companies with a way to make accurate decisions on cost management, measurement and analysis. Thus, best practice companies were expected to create more accurate cost information to not only succeed in managing decision-making on cost reductions, wastes and emissions abatement, but also to support external disclosures.

Furthermore, proposition 2 was also measured to meet sustainable organization needs while adding value in the areas of economic, environment and society (Epstein & Roy 2001) . As corporate sustainability has been of significant concern to companies' stakeholders, companies need to incorporate environmental and social cost information in financial disclosures when disclosing economic, environmental and social performance (Epstein 2008). The initial aim here is to disclose sustainable development reports to support stakeholders' concerns and to ensure that companies achieve corporate sustainability (Berkel 2003). In addition, Gadenne and Zaman (2002) stated that environmental costs need to be annually reported in financial disclosures, rather than identifying them as net profits and/or losses in the balance sheet. Meanwhile, social costs should be incorporated in financial reporting to disclose the social performance of organizations (Gray 2002a, 2006; Gray et al. 2001). Participants were asked to explain *how precisely companies provide environmental and social disclosures to support stakeholders' and public concerns*.

The responses were measured to seek where best practice companies precisely provided environmental and social disclosures to add value to shareholders as perceived by stakeholders and the public (Berkel 2003; Gray 2006; Gray et al. 2001). Companies created more accurate cost information of environmental and social impacts to incorporate in financial reporting in the form of a triple bottom line report and corporate social responsibility (CSR) reporting. It is desirable that companies build better relationships with their stakeholders and become more competitive in the marketplace; and successfully promote themselves as environmentally and socially aware organizations in the marketplace. In this regard, participants' responses were measured to identify effective management accounting for environmental and social dimensions to support a developed SMAS conceptual model. The measure for proposition 3 was related to identifying how a SMAS creates sustainable organizations for best practice companies.

> ***P3.*** *A SMAS provides best practice companies with an enhanced environmental and social cost management system to improve internal decision making and to support stakeholders' and public concerns.*

Proposition 3 was measured where a SMAS conceptual model facilitates companies to meet sustainability accounting needs when employed to help in the identification and measurement of environmental and social impact costs. As sustainability accounting seeks to mainly capture sustainable costs such as environmental costs and social impacts to fully cost for management decisions (Gray 1993), this helps in creating more accurate cost accounting data. Companies disclose environmental and social performance to promote corporate sustainability as 'green' producers in the marketplace. This is because markets create greater opportunities for businesses when legislative requirements are met (Ledgerwood 1997). Thus, *participants' responses were measured to identify an effective management accounting practice for environmental and social cost identification and measurement*.

A SMAS was identified as an effective management accounting required to meet the needs of *environmental management accounting* (EMA) and *social management accounting* (SMA) concepts and practices. An effective management accounting system should fully capture production costs, including environment and social expenditures. It assists best practice companies to wisely manage their use of recycling materials, renewable energy, and/or reused wastes to avoid resource extractions and/or environmental damage (Milne 1996). Cost information was also used to successfully measure reductions in environmental costs and contaminants (Gale 2006a; Sendroiu et al. 2006). Thus, an effective management accounting system facilitates best practice companies to reduce negative impacts on environment and society by adopting a sustainability accounting system in line with current environmental and social concerns (Corson 2002; Gray 2002a; James, P. & Bennett 1994). In addition, cost information could be employed to support external disclosures when disclosing environmental and social performance of organizations (Carbon Trust 2005; EPA Victoria 2007). Further, this could support companies in their endeavours to be a sustainable organization by taking environmental and social issues into account to ensure corporate sustainability.

Participants' responses were also measured regarding the appropriateness of and accuracy in allocating environmental and social costs to a single production activity—and an effective management accounting system could expand on *activity based costing* (ABC) application. As ABC has identified environmental and social costs as overheads, companies may have difficulty in precisely allocating these costs for management decisions and reporting purposes (IFAC 2005; Sendroiu et al. 2006). Thus, a holistic system of sustainability accounting could help improve environment and social cost dimensions, as mentioned by previous studies (e.g. Berkel 2003; Gadenne & Zaman 2002; Lamberton 2005; Taplin, Bent & Aeron-Thomas 2006). This study develops a SMAS conceptual model to assist in cost allocation and analysis by expanding on ABC applications and, ultimately, contributing to enhanced management accounting practices. This could create more accurate cost accounting data before assigning cost information to appropriate production activities. It should also improve the reliability of cost accounting to support management decisions in relation to cost reductions and emission abatement (Beer & Friend 2005; Borga et al. 2009; Burnett & Hansen 2008; Gale 2006a). Moreover, a SMAS could effectively manage timing impacts in changing value of stock and flows of materials in production processes (The Sigma Project 2003). Furthermore, it will assist in disclosure of physical and monetary information in relation to use and flows of resources, environmental management, and waste and emission abatement (IFAC 2005) and, in turn, support stakeholders' interests and the related concerns of society (Maak & Pless 2006). As a result, companies could enhance their corporate sustainability while adding shareholder value and creating better business opportunities in the marketplace (Carbon Trust 2005; EPA Victoria 2007). The measure for proposition 4 was to ascertain the needs of corporate sustainability and sustainable value adding for best practice companies.

> ***P4.*** *A SMAS provides best practice companies with a mechanism to add value in economic, social, and environment areas of performance.*

Proposition 4 was measured to seek how a SMAS conceptual model could help in creating economic, environment, and social value added for sustainable organization needs. Primarily, a SMAS could help in the identification and measurement of environmental and social impacts while fully costing for more accurate cost accounting information. Cost information could be incorporated into internal and external reporting while disclosing in the form of a triple bottom line and creating corporate social responsibility (CSR). It is the intention of Australian companies to meet the legal/regulation compliance of environmental and social performance (Gadenne & Zaman 2002). Secondly, a SMAS could assist companies to precisely prepare sustainability reports to not only meet the requirements of NGER and GRI, but also to successfully support internal management decisions-making and business decisions. Such sustainability reporting creates an internal self-driving mechanism in relation to environmental and social cost management (Herremans & Herschovis 2006a). In addition, as traditional management accounting has inadequately measured environment and social impact costs (Yongvanich & Guthrie 2006), it resulted in inaccurate environmental and social reporting when guiding business decision-making. A combination of environmental management accounting and social management accounting concepts and practices in a developed SMAS could create more accurate cost information. The combination could also help best practice companies to wisely manage use and flows of resources while creating lower levels of wastes and emissions to maintain the balance of environmental and ecological systems. Furthermore, it would improve resource management, environmental preventions, and social well-being (James, P. & Bennett 1994), thus adding value to three performance aspects—economic, social, and environment.

Finally, by applying a SMAS, sustainability reporting will ensure sustainable development of organizations is appropriately measured to meet the concerns of stakeholders—whose interests impact on companies endeavouring to create better opportunities—and improve their organisational decision-making processes (Gasparatos, El-Haram & Horner 2009). The adoption of a SMAS will also meet the legal/government requirements, environmental policy, and commitment of organizations in relation to environmental and social aspects (Johnson, G. 1997). Importantly, sustainable development reports could be employed to enhance management decisions in relation to cost identification and measurement of environmental and social impact costs for future production, with companies becoming more competitive in the marketplace and increasing stakeholders' trust (Buchholz & Rosenthal 2004; Gilbert & Rasche 2008). Companies would be regarded as 'green' and 'social' while gaining greater benefits from higher economic performance in the long-term (Schaltegger & Wagner 2006). The following section provides details of data collection and instruments relating to the survey and interviews.

4.2.2 Data collection and instruments

Survey instrument

A set of survey instruments was created to investigate the role of chief accountants, controller accountants, chief financial officers and management accountants in dealing with environmental and social issues (refer to Appendix 1). There were two parts to the questionnaire which aimed to identify system characteristics of sustainability accounting and companies' profiles—including participants' backgrounds. In the first section of the questionnaire, targeted participants from non-service manufacturing companies were asked questions relating to the identification and capturing of costs of environment for internal or external disclosure. This included their intent to measure these costs in future reporting and relate to environmental performance indicators in managing use and flows of materials, energy and water within production process of non-service manufacturing companies. It also included evaluating reductions in environmental costs and contaminants (e.g. emissions and wastes). In addition, social performance indicators were involved in measuring labour practices and working conditions, human rights, quality of society and product responsibility. In the second section, the questions sought to elicit information about company profiles and participants' backgrounds, including their education and work experiences in relation to environmental and social issues. Company profile information also included questions seeking to identify aspects such as manufacturing sector and ANZSIC Code relating to its sector, as well as department/section of respondent.

A large number of items were generated to enhance reliability of management accounting best practice, including any system characteristic employed in measuring and identifying costs of environment and social impacts. Thus, the multiple items assisted the researcher in reducing errors while identifying appropriate management accounting practices from survey data. These items were mostly adopted from Global Reporting Initiative (GRI), which were relevant to the environmental and social performance indicators.

In the questionnaire, a 5-point Likert-type scale was used—ranging from *not at all* (coded as 1), *monthly* (coded as 2), *quarterly* (coded as 3), *half yearly* (coded as 4), to *yearly* (coded as 5). This was to evaluate whether companies provide costs of environment and social impacts to report internally or externally. The range from *not at* all to *yearly* helped the researcher to classify which performance indicators (environment and social) were mostly measured by companies using effective management accounting practices. This type of scale assisted the study to clearly identify the management accounting practices, including any system characteristics of these companies. The instructions provided helped respondents to clearly select the frequency of environmental and social cost measurement within a year. This also referred to future intention that companies may have to measure and report—internally and/or externally. This study aimed to survey non-service manufacturing companies in Australia and New Zealand relevant to 'numeric description of trends, attitudes, and opinions' of respondents (Creswell 2009, p. 145; Neuman 2006). In addition, characteristics of current and future systems were collected to identify effective management accounting practices in collecting cost accounting data of environment and social impacts. The results were employed to develop a list of interview questions in relation to environmental and social cost dimensions.

Interview check lists

Interview check lists were generated to explore environmental and social cost identification and measurement of fifteen Australian companies selected from non-service manufacturing sectors identified in the survey. Questions were created using the results of the survey (see Appendix 2). Items related to management accounting best practices in identifying, measuring and collecting costs of environment and social impacts. The questions mainly focused on appropriateness of and accuracy in preparing cost information to enhance management decisions and reporting purposes. This included measuring reductions in environmental costs and contaminants. For social costs, the questions asked were related to improvements in the quality of employees, social well-being, environmental prevention policy and strategy of organizations. Interview check-lists facilitated this study to clearly understand current management accounting practices for environmental and social cost identification that Australian companies employ to create cost accounting data. These costs have traditionally been hidden among production process and could impact on the total costs of products (social costs), thus, companies need an effective management accounting practice to deal with this matter. The exploration of management accounting practices, which is the subject of this research, helped analyse processes and techniques of management accounting of best practice companies in dealing with environmental and social impact costs. It was anticipated these findings would help in the development of an improved SMAS conceptual model. Pre-testing of the survey instrument was made before data collection of qualitative data began.

4.2.3 Pre-testing instrument

The survey instrument was pre-tested in several stages before actual data collection was initiated. This was to ensure that the survey questionnaire met the purpose of the study. Collins (2004) stated that pilot testing of questionnaires helps researchers to ensure that the results of the study are valid and reliable. Pilot testing also assists researchers to revise the design of questionnaires (e.g. question wording, content, and/or instruction) to ensure that questions are understood and accepted by all respondents (Collins 2004). Pretesting and/or piloting of questionnaires provides researchers with a method to create appropriate criteria of each question while reviewing questions on which to base findings (Bowden et al. 2002). Even though a researcher may provide clear and acceptable questions, he/she needs to adequately test respondents' understanding to ensure a higher number of responses (Fowler, Floyd Jackson 1992). Fowler (1992) found that the identification of, or pretesting of questionnaires assists researchers in reducing systematic errors in the survey investigation. A researcher who provides unclear questions could face biased estimates by having a lower number of responses

(Fowler, Floyd Jackson 1992). Therefore, this study prepared pretesting of the questionnaire to identify appropriate questions including wording, key terms, and content designed to create enhanced understanding by respondents.

The following steps in pretesting the survey questionnaires were taken to ensure appropriate measurement. Firstly, five PhD candidates were asked to review the questionnaires and provide feedback. Secondly, the survey instrument was reviewed by a professor who is an expert in quantitative research study, and a doctor of philosophy who is an expert in sustainability management accounting. Thirdly, a set of survey questionnaires was reviewed by a number of accountants and financial managers in order to provide feedback and suggestions to improve the final format. Finally, twenty-five manufacturing companies were asked to complete pretesting questions in order to ensure that respondents adequately understood the wording and content of the questions. After some revisions based on the pilot testing, data collection commenced using the methods describing in the following section.

4.3 Data collection and procedures

Data collection and procedures were designed by utilizing a triangular data collection approach that began with survey questionnaires, followed by interviews (Neuman 2006). As investigation of survey questionnaires did not meet the target of 250 companies' responses, secondary data of non-service manufacturing companies in response to the CDP (2009) was employed to respond to survey questionnaires. Survey questionnaires investigated sixty-two manufacturing companies selected from non-service sectors (53 Australian companies and 9 New Zealander firms). Although these companies were from different countries, they have similar cultures of management accounting practices/systems using the same ANZSIC codes (NPI 2010). Next, chief accounting officers, financial controllers, and sustainable management teams selected from 15 non-service manufacturing companies (case studies) participated in in-depth interviews. As the interviews were related to improvements in the impact on environment and society, appropriate sampling methods and strategy were needed to select sample groups. This aspect is discussed next.

4.3.1 The sampling methods and strategy

This study employed purposive sampling methods to select non-service manufacturing sectors to be surveyed and studied. Purposive sampling methods were utilized to select sixty-two companies in response to the CDP (2009) as secondary data in quantitative study. In addition, this study also selected fifteen companies from the same sectors identified for the survey as case studies by using a purposive sampling method. As a non-probability sampling method, purposive sampling provides a way to conveniently obtain essential information from a specified sampling group (Cavana, Delahaye & Sekaran 2001). A purposive sampling method contains three types of purposive sampling (Cavana, Delahaye & Sekaran 2001,p. 263-265):

a. *Judgement sampling design*—this design assists in selecting a sampling group that is able to provide required information while involving the choice of subjects. A study provides certain types of research questions to question individually in order to obtain information being sought. A judgement sampling design can be useful when certain questions are created to investigate a specific group of the population. In addition, this design facilitates selecting a sampling group from a specific population that is difficult to reach (Neuman 2006).

b. *Snowball sampling design*—this design is employed when there is a need to gain answers from elements in the population that have specific characters, knowledge, and/or skills. This method could help use a judgement sampling method to select an initial sample group for investigation. Then, this group could provide information (e.g. names) for further interviewing. Nonetheless, in snowball sampling method it is difficult to locate the specific number or area of a study's interests as well as accessing the specific data. In addition, problems or bias may occur when faced with a limited view of a population and generalisability of findings. However, this method can be extremely successful in research to investigate subjects who are difficult to access and can provide essential information for investigation.

c. *Quota sampling design*—this method assists a study to ensure that a certain number of a sampling group to be studied is based on the assignment of a quota. A number of the population appearing in organizations or society become stratified samples which results from selecting non-randomly. However, a study can use quota sampling data for the first multiple stages of the study. For instance, if data is found useful in the first stage, a study can use this data to design for further research.

According to Davis (2005), judgment sampling design has been chosen by researchers and managers who wanted to investigate the representative populations relevant to the purposes of their studies. In the meantime, quota sampling design has become a subset of judgment sampling employed to specify type and/or number of sampling groups (Davis 2005). This helps in the selection of an appropriate sampling group to be studied, as well as identifying the right number of populations for investigation (Neuman 2006).

Accordingly, a purposive sampling method was considered appropriate for this study to select a specific sampling group from ten manufacturing companies from non-service sectors including mining and metal products, food, beverage and tobacco, textile, clothing, footwear and leather, petroleum, coal, chemical and associated product, machinery and equipment, electricity, gas and hot water supply, construction, retail trade (excluding motor vehicles and motorcycles), repair of personal and household goods, air transport, and telecommunication. From these sectors, only 62 companies (53 Australian companies and 9 New Zealander firms) responded to the Carbon Disclosure Project questionnaire (CDP 2009) in relation to environmental and social performance indicators required by the NGER (Department of Climate Change 2008a) and GRI (2006). This study further selected fifteen Australian companies from non-service sectors identified in the survey using purposive sampling methods for investigation as a case study.

First, this study utilized a judgement sampling design to identify companies that were applying sustainability accounting systems in their environmental and social cost measurement. Certain questions sought to individually probe chief accountants, controllers, chief financial officers and management accountants in relation to sustainability accounting practices within organizations. The questions referred to the measurement of environmental and social impact costs, as well as evaluating reductions in these costs and contaminants. This included providing cost information to support decision making and financial reporting, as per the aims of the study. A quota sampling design then was utilized to identify a number of populations (fifteen companies) to be interviewed. By combining judgment and quota sampling design, it assisted this study to appropriately identify a sampling group that met the purpose of the study while the number of a sampling group or population chosen became sufficient to be investigated. As a result, the purposive sampling method provided this study with a way to select appropriate case studies for investigation and to gain full information from investigation among sector groups (Neuman 2006; Patton 1990; Yin 2009). Data collection and procedures using quantitative methods is discussed next.

4.3.2 Quantitative data collection procedures

In response to the CDP (2009) companies were asked to evaluate items on questionnaires created by this study relating to the measurement of environmental and social performance indicators. In addition, sustainability reports identified the development of social performance, as well as taking social responsibility into account. Although, secondary data has been considered as a second consequence, it has played an important role in most marketing research projects to collect and analyse before commencing investigation of primary data (Patzer 1995). Secondary data has also helped the researcher to save time and has been a cost effective way of collecting data (Davis 2005). Apart from that, secondary data has been considered appropriate to support the results of other data collection such as survey and/or interviews. The results of the study are more reliable and trustworthy, thus avoiding social bias (Neuman 2006). As a consequence, secondary data was considered appropriate for this study to be used instead of survey.

4.3.3 Qualitative data collection procedures

In the qualitative approach, data was collected using in-depth interviews with chief accountants, controllers, chief financial officers and management accountants dealing with environmental and social issues in fifteen non-service manufacturing companies in Australia. Liamputtong and Ezzy (1955) illustrated advantages and limitations of in-depth interviews as:

Advantages

- identified as an excellent method to investigate participants' experiences and ideas (Denzin 1989);
- allows social aspects (e.g. social process and/or negotiated interactions) to be investigated (Daly, McDonald & Willis 1992);
- develops a new theory and understanding during examining pre-existing theory;
- participants are well-prepared to discuss any sensitive questions while responding with less influence; and
- participants benefit from being interviewed by a researcher

Limitations

- possible lack of appropriate time and budget resources that the research needs in gaining data;
- time-consuming (Fontana & Frey 1994) when research develops experiences and understandings from interview to interview; and
- can be difficult when requiring sensitive discussion opinions and/or ideas from participants.

According to Cavana et al. (2001,p. 138), a great advantage of interviews is they takes less time while 'removing conversation barriers and encourages the flow of information'. Before conducting an interview, a researcher needs to create a good pattern for the interview protocol. This pattern should involve entrance time investment that allows a researcher to build a relationship with participants; an activity of investigation that refers to the skills and knowledge of creating questions, paraphrasing, and/or probing skills; an intimacy of deeper interview protocols that a researcher needs to reduce complexity when dealing with sensitive and emotional issues; and time for the researcher to rebuild natural defences if required (Cavana, Delahaye & Sekaran 2001, see more p. 139-141).

In this study, after permission was obtained from the companies regarding their involvement in the interview, a list of interview questions relating to management accounting practices of manufacturing companies used to measure costs of environment and social impacts was then provided. These included cost identification and allocation while capturing full costs of products to support internal decision making. The study also monitored ethical and moral obligations of organizations in providing cost information for disclosure. With a company's permission, the interviews were audio-taped to assist with transcription of responses from participants. Note-taking was also used to write headings and main concepts being addressed. Tape recordings and note-taking were needed to improve the accuracy of interpretation of responses and allow rechecking at anytime (Richards 2005). Confidentiality of all business information was assured. No identifying information on participants or companies was recorded at any stage. Furthermore, no questions of a personal nature were asked, and any inconvenience was kept to a minimum. Participants also had the right to avoid answering any question that may breach company confidentiality. The participant was free to withdraw his/her consent and discontinue participation in the interview at any time. In instances where a participant did not want the interview audio-recorded from the start or during the interview he/she just needed to say so and the recording was duly stopped.

The interviews were conducted from 1 May 2010 to 25 June 2010. First, a letter was sent out to targeted personnel within companies (chief accountants, controller accountants, chief financial officers or management accountants) who had been granted permission by their company to be interviewed. Once the responses or permission was obtained from companies, a mutually convenient time, date and location were organised with a participant before investigation. This followed with a brief explanation of the initial aims of the interview, focus and results of the study, including procedures of the interview. The participants were informed about ethical research requirements of the University of Southern Queensland relating to respecting a participant's rights and interests. In providing this clarification to the participants, it aimed to ensure that all participants had understood the purpose of the study in the same way. According to (Fowler, Floyd J. 2002), clarification (e.g. focus, purpose, and/or ethic requirements) of the study also creates reliability and trustworthiness of data collection from participants. The participants are more genuine in their responses to the questions given, and results in data being more reliable (Fowler, Floyd J. 2002). In addition, to avoid bias, the role of the interviewer should encourage participants to answer from their opinion, attitudes, experiences, and knowledge—and a researcher should not react to participants' responses (Neuman 2006). As a consequence, during the interviews all participants had the right to answer or not answer any question, as well having the right to ask that the tape recording be halted at any time.

4.4 Data analysis

The data analysis section provides the analysis techniques and procedures used for both quantitative and qualitative methods.

4.4.1 Quantitative data analysis

Data screening and detecting outliers

Before investigation of sub-research questions, quantitative data was detected to check missing values and outliers. If data appeared missing, it was imputed with mean values from the rest of the responses. Normality is assumed for testing data using univariate outlier detection to screen outliers in order to deal with significant skewness and kurtosis when data appears as positive or negative values in the distributions (Hair et al. 1998). A large number of missing values within a survey instrument were not included, while remaining missing values were not imputed—thus avoiding potential bias. In addition, outlier cases were not considered for inclusion in data analysis. On investigation, a large number of observations were classified into manageable groups while performing data reduction from an entire population (Hair et al. 1998). This helped ensure the reliability and trustworthiness of data analysis of responses to SR1, SR2, and SR3.

Investigation of sub-research questions

To investigate sub-research questions, this study employed cluster analysis to correlate responses to SR1, SR2, and SR3. As cluster analysis has no 'rule-of-thumb' in selecting sample sizes (Dolnicar 2002, p. 2), this study analysed 62 responses from surveys. Cluster analysis aimed at classifying a set of populations into two or more groups of objects using similarity of the objects to specify individual characters (Hair et al. 1998). This analysis provided hierarchical cluster procedures to identify existing groups of observations while determining observations belonging to each group (Hair et al. 1998; Manning & Munro 2007). This helped data to be correlated into appropriate groups of objects when considering the relationships among groups. Hierarchical cluster has provided two analysis procedures—agglomerative and divisive methods. Agglomerative methods began with a large number of data obtained correlated to smaller groups of objects; whereas, divisive methods commenced from smaller groups of objects to larger numbers of specified characteristics (Hair et al. 1998). Within agglomerative methods, complete linkage helps maximize similarities of final clusters at the maximum distance. This allowed objects to fall into their own clusters in order to avoid chain samples or observations (Hair et al. 1998). Thus, hierarchical cluster analysis method provided the study with correlating procedures to firstly identify a large number of data. Data was then categorized into specified characteristics or groups of objects set by using similarity concepts. Data falling into final clusters is considered in the results of analysis, while missing values were omitted.

Figure 4-1 shows a simple raw-data analysis of cluster analysis methods employed to group similar responses to SR1, SR2, and SR3 into groups of objects. These groups were created using five timeframes: *not at all* (coded as 1), *monthly* (coded as 2), *quarterly* (coded as 3), *half yearly* (coded as 4), and *yearly* (coded as

5). A number of observations were set to correlate into each object, depending on the nature of responses. The questionnaire contained questions relating to measuring and preparing cost information to report internally and externally, as well as seeking cost information regarding future intentions. Respondents were correlated into five groups of objects (timeframes) to measure similarity of responses. As a result, each group, except for *not at all*, was identified as current practices of companies appropriately measuring these costs to support internal and external disclosure. In the meantime, each group of objects was also recognized as companies intending to change their management accounting practices to capture cost information in future reporting.

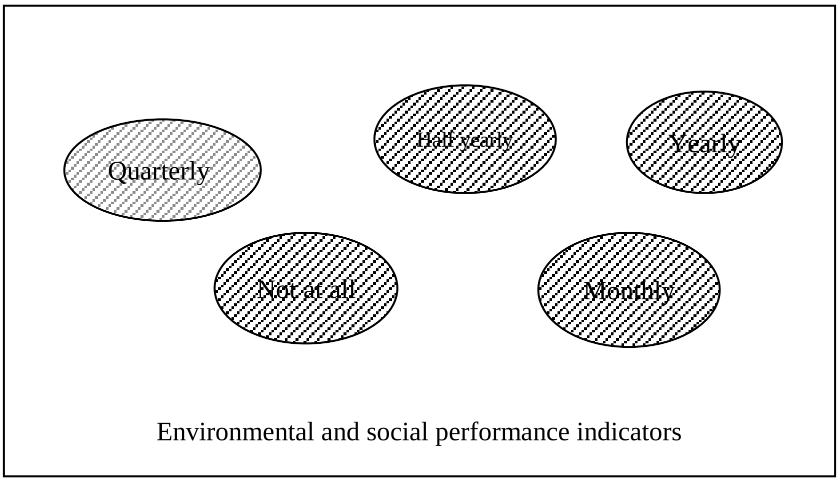
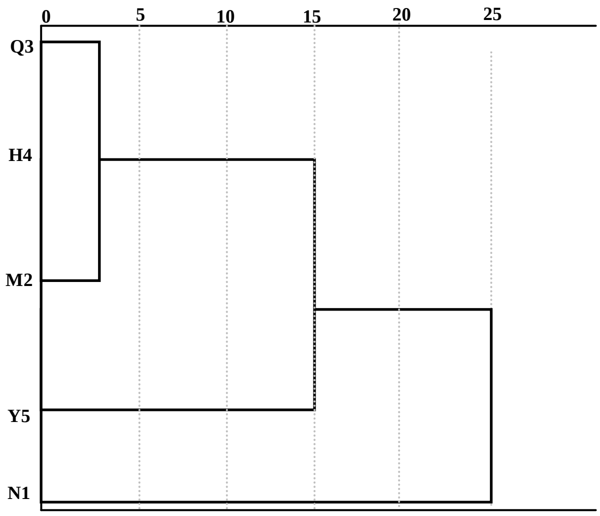


Figure 4-1 An example of the classification of timeframes in a cluster analysis

Furthermore, agglomerative analysis of hierarchical cluster was employed to agglomerate all objects into individual clusters while minimizing similarities (final cluster) at the maximum distance of the complete linkage approach (Hair et al. 1998). Each object (environmental and social performance indicators) fell into its own cluster to avoid chain samples or observations (Hair et al. 1998). Thus, high correlations falling into a final cluster based on frequency and depending on the nature of responses were identified as the number of current practices of companies measuring these costs for reporting purposes. Meanwhile, high correlation of future intention was identified as the number of companies aiming to capture costs for environmental and social disclosures. The results of data analysis were also interpreted as current companies adopting appropriate system characteristics of a sustainability accounting system to meet the requirement of environmental management accounting and social management accounting concepts and practices. Figure 4-2 depicts the complete linkage of hierarchical cluster analysis adopted from Aldenderfer and Blashfield (1984). In the meantime, the results of data analysis answered SR1, SR2, and SR3.



N1= Not at all, M2= Monthly, Q3= Quarterly, H4= Half yearly, and Y5= Yearly

Figure 4-2 An example of the Dendogram graph of cluster analysis

Thus the environmental and social performance indicators in responses to SR1, SR2, and SR3 were measured by observing financial and non-financial performance reporting for both current and future intention. Based on the indicator measures used in the survey, the maximum reportability index was identified at which level a company reported on all indicators—in line with the literature and Australian and/or international standards. The measurement was also seeking lower level responses of companies that currently provide financial reports and intend to measure costs of environment and social impacts in the future. In relation to this, the measurement was concerned with changing accounting systems to possibly support in the future which, subsequently, could more accurately report information on environment and social impacts for management decisions in relation to these impacts and support environmental and social performance disclosures (Gadenne & Zaman 2002; Gray et al. 2001). Companies could also avoid bias towards reporting internally with less emphasis on external reporting (Gadenne & Zaman 2002; Gale 2006a; IFAC 2005). Thus, companies could add value to stakeholders while supporting environmental and social concerns.

To measure if there are any differences between environment and social measures being reported, the sample was further disaggregated into these two components. Companies showing concern about identifying and measuring environmental costs in the future to support disclosures could be experiencing difficulty in capturing these costs as they are hidden among production processes (IFAC 2005; UNDSD 2001). Companies would therefore need to change their accounting systems in order to capture more accurate cost information to enhance management decision-making and disclosures (Berkel 2003; Gadenne & Zaman 2002). By changing accounting systems, firms could more efficiently evaluate reductions in environmental costs and contaminants such as wastes, emissions, and/or waste disposal—thus reducing negative impacts on the environment and society (Burnett & Hansen 2008; Gale 2006a). When production costs are reduced, it would have the added benefit of enhancing economic performance.

Social performance indicators reported by companies were measured for social costs and impact of doing business. Again, companies needed to change their accounting systems for social cost measurement in order to efficiently capture these costs for management decisions and to support social disclosures (Gray 2006; Richmond, Mook & Quarter 2003). As a consequence, the results from the survey that met the requirements of environmental and social management accounting practices (IFAC 2005; UNDSD 2001) were identified as system characteristics currently used and intended to be used. Cluster analysis was considered a useful analytical tool for this study to correlate a number of respondents' responses into manageable groups of interval data (Hair et al. 1998; Manning & Munro 2007). The results of the analysis were applied to support measurement of management accounting best practice in benchmarking a model adopted in qualitative data analysis methods.

This study further utilized K-means cluster to test significant values of cluster differences to ensure that timeframes identified by the companies' responses were appropriately employed to support the measurement in a benchmarking model. K-mean cluster analysis facilitated this study to compare significant values from two-cluster and four-cluster solutions before adopting distinct groups for interpretation or improvement in future (Hair et al. 1998). Thus, by using K-mean clusters, this created greater confidence in employing the results of the analysis to support the measurement in qualitative study.

4.4.2 Qualitative data analysis

This study employed a benchmarking concept to analyse qualitative data while adopting DMAIC of Lean Six Sigma Process Improvement Cycle as the measurement tool. Theoretical proposition strategies were employed to analyse management accounting practices along with analysis procedures. As the main objectives and design of propositions were based on case study, theoretical proposition strategies have been used to test the case studies relying on propositions (Yin 2003). As this study posed propositions based on case study, theoretical proposition strategies helped in data analysis to create a deeper understanding of existing business activities (Yin 1993, 2009). Theoretical proposition strategies were considered appropriate to analyse management accounting practices along with benchmarking model.

Within the benchmarking process, DMAIC of Lean Six Sigma Process Improvement Cycle was adopted as a measurement tool and an improvement approach to analyse data collection in relation to management accounting best practices within the case studies. DMAIC (Define, Measure, Analyse, Improve, and Control) has been known as an improvement tool for business success within the Six Sigma Project Planner of Sigma organizations (Pyzdek 2003; Segla International 2009). DMAIC has been widely used by following steps to not only improve business performance, but also to solve problems within an organization (Brussee 2004). Thus, DMAIC aimed at *defining* business activities, *measuring* existing business activities, *analysing* appropriate business practice to meet needs of business goals, *improving* appropriate business best practice, and *controlling* business improvement processes while achieving sustainability (Aberdeen Group

2006; Koning & Mast 2006; Lean Australia 2009). The implementation of DMAIC as an improvement tool helps in enhancing business decision-making, as well as adding value as a sustainable organization in relation to management efficiency (Aberdeen Group 2006; Koning & Mast 2006). Figure 4-4 below illustrates the DMAIC of Lean Six Sigma process improvement cycle adopted by this study within the benchmarking model.

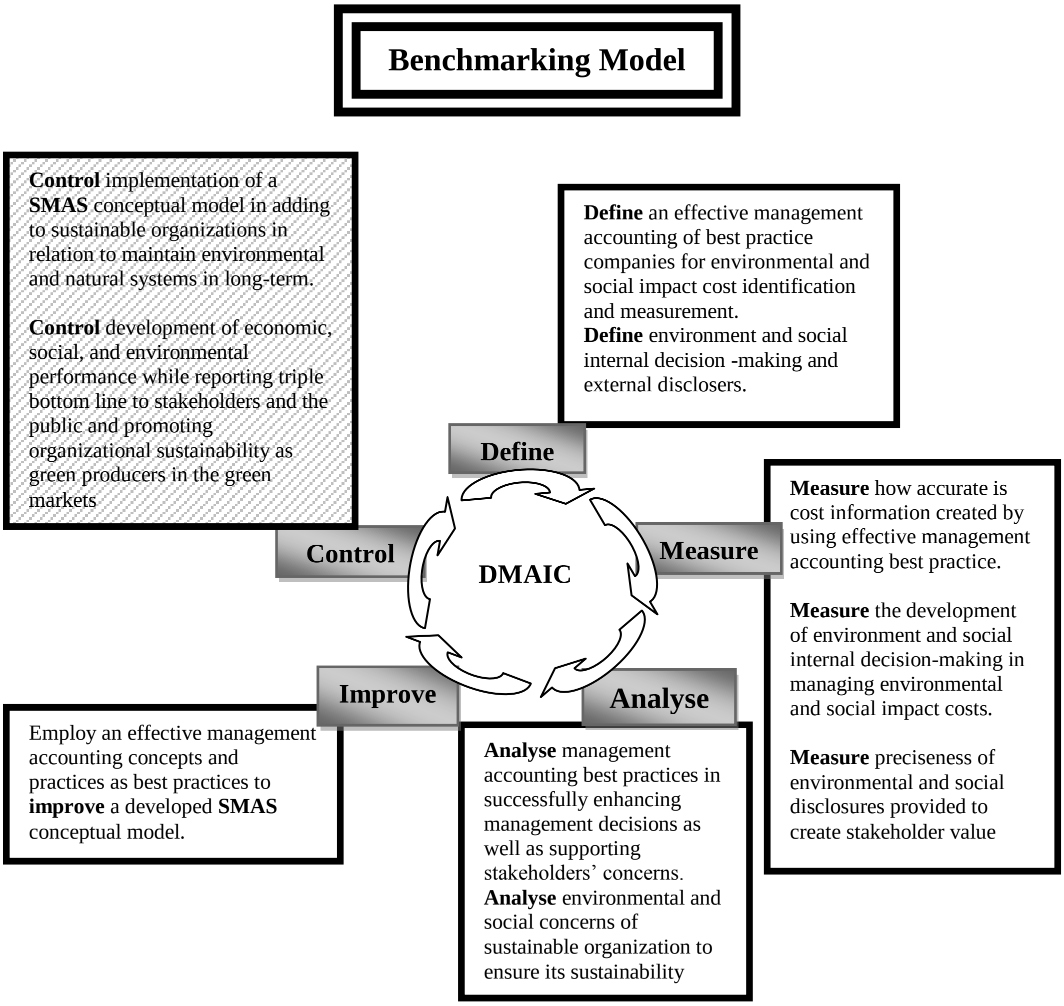


Figure 4-3 A Benchmarking Model

This study employed the DMAIC improvement cycle process to measure management accounting best practices by *defining* (D) current management accounting of best practice companies; *measuring* (M) existing management accounting practices among cases; *analysing* (A) appropriate management accounting of best practice among cases; and employing the results of analysis to *improve* (I) a designed sustainability management accounting system (SMAS) conceptual model. Nevertheless, as the control process was outside the scope of the study, it was not undertaken in the study as the conceptual model was not to be implemented. Thus, the controlling was taken as a given.

In defining current management accounting practices, this was relevant to how best practice companies identified and measured costs of environment and social impacts to create more accurate cost accounting data. In addition, this study also defined how companies identify and measure cost accounting data to enhance their environmental and social internal decision making. This relates to allocating these to a single product activity—thus avoiding cost allocation to overhead expenditures. In this regard, best practice companies were expected to wisely manage use and flows of resources (materials, energy, and water) while reducing resource extractions and reducing energy, water, carbon emissions and wastes. Companies have effectively provided supply chain management, evaluated alternative product designs, managed emission reductions within production processes, as well as minimized their carbon footprint by using lower volumes of materials, energy, chemicals, and/or transportation. Additionally, best practice companies were expected to identify social impact costs to create enhanced social well-being and concern for the quality of employees and humanity. In relation to this, ethical obligations and norms of companies were detected involving cost preparation for financial disclosures, as well as employing cost information to enhance environmental and social management decisions.

Management accounting systems of best practice companies were measured to meet the key aspects of sustainability accounting systems in relation to environmental and social cost dimensions. Measurement was also sought for appropriateness of and accuracy in preparing cost information to enhance management decisions and to support external disclosures. Companies were also considered as long-term sustainable organizations by reporting energy consumption and emission abatement to the National Greenhouse and Energy Reporting System (NGERS) before 31 October 2011. Companies created precise social cost information to support corporate social responsibility (CSR) reporting in order to add value as socially-responsible organizations.

Next, management accounting of best practice companies was analysed as an effective management accounting tool for environmental and social cost dimension among cases. In this stage, the results of the survey identified leading practices of sustainability accounting system used to support major requirements of environmental management accounting (IFAC 2005; UNDSD 2001) and social management accounting (Gray 2002a; Gray & Bebbington 2001), along with the analysis. All data collected from fifteen companies were compared for appropriate concepts and practices of sustainability accounting systems for management decisions and reductions in contaminants. Ethical and moral obligations in identifying social expenditures were analysed while seeking an improvement in the quality of employees, humanity and the environment. In this stage, the most appropriate management accounting concepts and practices were recognized as leading practice in sustainability accounting systems for environmental and social concerns. Management accounting of leading practice identified the gaps in business performance of each company while seeking useful information to improve a designed SMAS conceptual model (Karlof, Lundgren & Froment 2001).

Finally, management accounting best practice identified from the previous analysis stage were employed to improve a designed conceptual model of sustainability management accounting system (SMAS). Appropriate existing management accounting practices for environmental and social cost dimensions were employed to enhance the accuracy of cost information. Best practice in environmental cost identification and social cost measurement was identified to enhance environmental management accounting and social management accounting integrated into a SMAS conceptual model. For cost allocation, the implication of activity based costing (ABC) was applied to assign these costs to individual products (Bebbington et al. 2001; CIMA 2006). The improvement within a SMAS provided companies with a way to accurately create cost information while enhancing internal management decisions.

Benchmarking is claimed to be a business improvement tool using adopted comparative management practices to create more effective management (Karlof, Lundgren & Froment 2001). In The Netherlands, a benchmarking tool on the internet was employed to add value to farmers when comparing development of environmental and economic performance among others (volunteers) (Snoo 2006). In Western Australia, benchmarking was also used to measure environmental performance to achieve management accounting best practice for industrial discharges (Jenkins & Hine 2002). Horne and Hayles (2008) employed benchmarking to compare the thermal energy performance of housing in the United States, Canada, and Australia. This benchmarking process helped create new comparative information while informing policy and regulation in the comparison locations (Horne & Hayles 2008). Furthermore, Garcia et al. (2008) utilized a benchmarking tool to compare annual quality management indicators among three laboratories at the Public Hospital Network in Catalonia, Belgium. The results show that using benchmarking tools was considered appropriate to identify the results of management change while creating more understanding of the real situation within three laboratories (Garcia et al. 2008). Previous studies (e.g. Herremans & Herschovis 2006a; Karlof, Lundgren & Froment 2001; Najjar & Schniederjans 2006) concluded that benchmarking can inspire organisations to identify business opportunities by comparing similar business practices among different organizations. The information gained from a useful benchmarking tool enables improvement in business practices within an organization (Karlof, Lundgren & Froment 2001). As a consequence, a benchmarking concept provides companies with a way to identify where current practices should be improved by using the results of comparisons with other organizations.

This study, therefore, considered a benchmarking model as an appropriate measurement tool to compare existing business practices among non-service sector companies. The results of comparisons were employed to improve a designed SMAS conceptual model to create value to sustainable organizations. It was hoped a SMAS would provide effective management accounting of sustainability accounting systems to enhance cost identification and measurement of environmental and social impacts.

4.5 Chapter summary

This study employed mixed methods to combine quantitative and qualitative components for data collection and analysis using concurrent triangulation design to create reliability and trustworthiness of the results. Pre-testing of data collection instruments were made before distributing to the sample group. The sampling methods and strategy were designed appropriately using a purposive sampling method to select samples for survey and case studies. Further, data collection and procedures were designed to achieve the required targets of data. Finally, quantitative and qualitative data analysis designed by this study has been employed to measure survey questionnaires and case studies. The results of data analysis were employed to support a designed SMAS conceptual model. The following chapter, Chapter 5, provides an in-depth discussion on the quantitative findings of the study.

CHAPTER 5: QUANTITATIVE STUDY

As proposed in the previous chapter, a quantitative method of environmental and social data identification and measurement was employed to explore system characteristics of non-service manufacturing sectors in Australia and New Zealand. A survey was developed to determine system characteristics to provide companies with a way to create accurate data on environment and social impacts from the secondary data. Companies' responses to the carbon disclosures project questionnaire were answered to items in a survey. Firstly, this chapter provides results and findings of descriptive statistics analysis, and the results of frequency analysis of responses to scale response rate. Secondly, the results of cluster analysis are report on the items in the questionnaire, agglomerated into each timeframe—*not at all, monthly, quarterly, half yearly* and/or *yearly*. K-means clusters were employed to examine significant testing values of environmental and social performance indicators to ensure the agglomerative results of cluster analysis meet improvement needs. The results indicate significant values of cluster differences. Finally, the chapter concludes with a summary of results.

5.1 Descriptive statistical analysis

5.1.1 Attributes of the sample

The sampling group (62 companies) was selected from a total population of 2,589 companies in Australia and 235 companies in New Zealand listed from different sectors by OSIRIS (2010) as a sampling frame. These sectors were drawn from 454 Australian companies and 30 New Zealander firms as a sampling frame based on the purpose of the study and findings. These companies were from mining and metal product manufacturing (AU=177), food, beverage and tobacco (AU=34, NZ=5), petroleum, coal, chemical and associated product (126), machinery and equipment (28), electricity, gas and hot water supply (AU=27, NZ=5), construction (AU=18, NZ=2), retail trade and repair of personal and household goods industries (AU=29, NZ=10), air transport (AU=3, NZ=1), and telecommunication (AU=12, NZ=7). These sectors responded to Carbon Discloser

Project questionnaire and involved 62 companies in total: 53 from Australian and 9 firms from New Zealand. Thus, responses from these companies were analysed as secondary data in response to survey items posed in the questionnaire. Descriptive statistical analysis examined response rates, the results for which are provided in Table 5-1.

Table 5-1 Descriptive statistic results of non-service manufacturing sectors

Non-service sectors		ANZSIC Codes	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mining and metal product manufacturing	080-091	9	14.5	14.5	14.5
	Food, beverage and tobacco manufacturing	121-122	6	9.7	9.7	24.2
	Textile, clothing, footwear and leather manufacturing	131-135	1	1.6	1.6	25.8
	Petroleum, coal, chemical and associated product manufacturing	170-184	4	6.5	6.5	32.3
	Machinery and equipment manufacturing	241-240	14	22.6	22.6	54.9
	Electricity, gas and hot water supply	261-292	7	11.3	11.3	66.2
	Construction	301-329	10	16.1	16.1	82.3
	Retail trade, except motor vehicles and motorcycles; repair of personal and household goods	411-412	2	3.2	3.2	85.5
	Air transport	490-500	7	11.3	11.3	96.8
	Telecommunication industry	580-590	2	3.2	3.2	**100.0**
	Total		**62**	**100.0**	**100.0**	
Missing	System		0	0		
Total			**62**	**100.0%**		

Source: ANZSIC codes adopted from NPI (2010)

Table 5-1 shows that for n=14, 22.6% of machinery and equipment manufacturing companies have provided environmental and social data to support disclosures, follow by construction (n=10, 16.1.5%), mining and metal product manufacturing (n=9, 14.5%), food, beverage and tobacco manufacturing (n=6, 11.1%), and electricity, gas and water supply (n=7, 11.3%). Meanwhile, there was a similar percentage (n=7, 11.3%) from petroleum, coal, chemical and associated product manufacturing and transport that responded to the Carbon Disclosure Project in identifying environmental and social data for disclosures. Telecommunication industries represented n=2, 3.2% followed by textile, clothing, footwear and leather manufacturing, and telecommunication industries (n=1, 1.6%) disclosing environmental and social performance of their organizations.

Company sectors were analysed from primary geographic where companies are based. Sixty-two companies were from state wide (n=22, 35.5%), interstate (n=23, 37.1%, and internationally (n=17, 27.4%) (Table 5-2).

Table 5-2 Descriptive statistic of industry sectors

Industry sectors		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	State wide	22	35.5	35.5	35.5
	Interstate	23	37.1	37.1	72.6
	Internationally	17	27.4	27.4	**100.0**
Missing	System	0	0	**100.0**	
Total		**62**	**100.0**		

This study further examined company sizes by revenue/turnover identified from less than 1,000 million USD (n=27, 43.5%), 1,001 – 10, 000 (n=24, 38.7%), 10,001 – 25,000 (n=5, 8.1%), 25,001 – 50,000 (n=3, 4.8%), and up to 50,000 million USD (n=3, 4.8%). Table 5-3 shows that industry size played a significant role in disclosing environmental and social performance: smaller organizations paid more intention to reduce negative impacts on environment and society.

Table 5-3 Descriptive statistic of industry size by revenue/turnover

Revenue/turnover in US$		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1,000	27	43.5	43.5	43.5
	1,001 - 10,000	24	38.7	38.7	82.3
	10,001-25,000	5	8.1	8.1	90.3
	25,001-50,000	3	4.8	4.8	95.2
	Up to 50,000	3	4.8	4.8	**100.0**
Missing	System	0	0	**100.0**	
Total		**62**	**100.0**		

In terms of sustainable development reporting those companies provided disclosure to stakeholders and public. Companies provided both environmental disclosures and corporate social responsibility (CSR) reporting (n=33, 53.2%)

while companies did not report either environmental or social performance (n=12, 19.4%). However, companies disclosed single environmental reporting to stakeholders and the public (n=13, 21.0%) followed by corporate social responsibility (CSR) reporting (n=4, 6.5%), as shown in Table 5-4.

Table 5-4 Descriptive statistic of companies' sustainability reporting

Companies' sustainability reporting		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not yet disclosed	12	19.4	19.4	19.4
	Environmental disclosure	13	21.0	21.0	40.3
	Corporate Social Responsibility (CSR) Reporting	4	6.5	6.5	46.8
	Both	33	53.2	53.2	100.0
Missing	System	0	0		
Total		**62**	**100.0**		

5.1.2 Companies' responses to the items in the questionnaire

Descriptive statistical analysis of responses to questionnaire items is reported in Table 5-5 and 5-6. The results of descriptive statistical analysis are not described in detail as they are considered exploratory study. The tables show percentages of the proportion of the response rates. However, this study utilized the results of survey to support sub-research questions and findings by using cluster analysis methods to classify companies' responses to each object (not at all, monthly, quarterly, half yearly, and yearly).

Table 5-5 Frequencies – environmental performance indicators

How often does your firm measure indicators below to report either internally or externally? And how often will your firm intend to report in future?

Environmental performance indicators	Column A Current practices												Column B Future intentions					
	Internal						External											
Indicators	Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median	Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median	Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median
1. Total volume of direct materials in final products	**35 (56.5%)**	**18 (29%)**	**3 (4.8%)**	**1 (1.6%)**	**5 (8.1%)**	**1**	**57 (91.9%)**	**- -**	**- -**	**- -**	**5 (8.1%)**	**1**	**56 (90.3%)**	**1 (1.6)**	**- -**	**- -**	**5 (8.1%)**	**1**
2. Total volume of non-renewable materials (e.g., minerals, metals, oil, gas, coal)	**37 (59.7%)**	**20 (32.3%)**	**4 (6.5%)**	**1 (1.6%)**	**- -**	**1**	**- -**	**- -**	**- -**	**- -**	**- -**	**1**	**60 (96.8%)**	**- -**	**- -**	**- -**	**2 (3.2%)**	**1**
3. Percentage of recycled material used	**34 (54.8%)**	**20 (32.3%)**	**3 (4.8%)**	**1 (1.6%)**	**4 (6.5%**	**1**	**57 (91.9%)**	**- -**	**- -**	**- -**	**5 (8.1%)**	**1**	**56 (90.3%)**	**- -**	**- -**	**- -**	**6 (9.7%)**	**1**
4. Total volume of direct energy consumption (e.g., natural gases, coal, oil, biomass energy, solar, and/or wind)	**9 (14.5%)**	**21 (33.9%)**	**- -**	**- -**	**32 (51.6%)**	**5**	**22 (35.5%)**	**5 (8.1%)**	**- -**	**- -**	**35 (56.5%)**	**5**	**20 (30.2%)**	**- -**	**- -**	**- -**	**42 (67.7%)**	**5**
5. Total volume of indirect energy consumption (e.g., electricity, heating and cooling, steam, and other forms of energy)	**8 (12.9%)**	**22 (35.5%)**	**- -**	**- -**	**32 (51.6%)**	**5**	**19 (30.6%)**	**7 (11.3%)**	**- -**	**- -**	**36 (58.1%)**	**5**	**19 (30.6%)**	**- -**	**- -**	**- -**	**43 (69.4%)**	**5**
6. Total amount of energy saved by process design, conservation, and/or changes in employees' behaviours	**14 (22.6%)**	**21 (33.9%)**	**- -**	**- -**	**27 (43.5%)**	**2**	**24 (38.7%)**	**7 (11.3%)**	**- -**	**- -**	**31 (50.0%)**	**3.5**	**19 (30.6%)**	**- -**	**- -**	**- -**	**43 (69.4%)**	**5**
7. Energy reduction program and measurement to reduce energy requirement - percentage of less energy used per day in production processes	**17 (27.4%)**	**17 (27.4%)**	**1 (1.6%)**	**- -**	**27 (43.5%**	**2**	**25 (40.3%)**	**8 (12.9%)**	**- -**	**- -**	**29 (46.8%)**	**2**	**19 (30.6%)**	**- -**	**- -**	**- -**	**43 (69.4%)**	**5**
8. Energy reduction program and measurement to reduce indirect energy consumption	**19 (30.2%)**	**16 (25.8%)**	**1 (1.6%)**	**- -**	**26 (41.9%)**	**2**	**28 (45.2%)**	**6 (9.7%)**	**- -**	**- -**	**28 (45.2%)**	**2**	**21 (33.9%)**	**- -**	**- -**	**- -**	**41 (66.1%)**	**5**
9. Total usage of water by sources – surface water, wetlands, rivers, lakes, and/or ocean, ground water, rainwater, wastewater, etc.	**51 (82.3.%)**	**6 (9.7%)**	**1 (1.6%)**	**- -**	**4 (6.5%)**	**1**	**57 (91.9%)**	**- -**	**- -**	**- -**	**5 (8.1%)**	**1**	**57 (91.9%)**	**- -**	**- -**	**- -**	**5 (8.1%)**	**1**
10. Percentage of water recycled/ reused – wastewater recycled back to the same processes or different processes and other organizations' activities	**46 (74.2%)**	**7 (11.3%)**	**- -**	**- -**	**9 (14.5%)**	**1**	**50 (80.6%)**	**2 (3.2%)**	**- -**	**- -**	**10 (16.1%)**	**1**	**51 (82.3%)**	**- -**	**- -**	**- -**	**11 (17.7%)**	**1**
11. Description of activities, products, and/or services that have impacts on biodiversity in protected areas	**56 (90.3%)**	**4 (6.5%)**	**- -**	**- -**	**2 (3.2%)**	**1**	**59 (95.2%)**	**1 (1.6%)**	**- -**	**- -**	**2 (3.2%)**	**1**	**61 (98.4%)**	**- -**	**- -**	**- -**	**1 (1.6%)**	**1**
12. Total number of direct greenhouse gas emissions in tonnes of CO_2 equivalent	**6 (9.7%)**	**16 (25.8%)**	**1 (1.6%)**	**- -**	**39 (62.9%)**	**5**	**15 (24.2)**	**6 (9.7%)**	**- -**	**- -**	**41 (66.1%)**	**5**	**12 (19.4%)**	**- -**	**- -**	**- -**	**50 (80.6%)**	**5**
Total						**27**						**28.5**						**36**

Note: this percentage is the proportion of the number above

Table 5-5 Frequencies – environmental performance indicators (cont.)

How often does your firm measure indicators below to report either internally or externally? And how often will your firm intend to report in future?

Environmental performance indicators (cont.)	Column A Current practices												Column B Future intentions					
	Internal						External											
Indicators	Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median	Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median	Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median
13. Total number of other indirect GHG emissions in tonnes of CO_2 equivalent – generated from employee commuting and/or business travelling.	6 (9.7%)	16 (25.8%)	1 (1.6%)	- -	39 (62.9%)	5	15 (24.2%)	6 (9.7%)	- -	- -	41 (66.1%)	5	11 (17.7%)	- -	- -	- -	51 (82.3%)	5
14. Program/methods/ measurement of GHG emissions reductions that meet the emission reduction requirements of NGER	7 (11.3%)	16 (25.8%)	1 (1.6%)	- -	38 (61.3%)	5	17 (27.4.%)	6 (9.7%)	-	- -	39 (62.9%)	5	12 (19.4%)	- -	- -	- -	50 (80.6%)	5
15. Emissions in tonnes of CFC -11 equivalent of ozone depleting substances	7 (11.1%)	17 (27.4%)	1 (1.6%)	- -	37 (59.7%)	5	16 (25.8%)	6 (9.7%)	-	- -	40 (64.5%)	5	12 (19.4%)	- -	- -	- -	50 (80.6%)	5
16. Total volume of production materials used to reduce GHG emissions?	15 (24.2%)	15 (24.2%)	1 (1.6%)	- -	31 (50.0%)	4	22 (35.5%)	6 (9.7%)	-	- -	34 (54.8%)	5	18 (29.0%)	1 (1.6)	- -	- -	43 (69.4%	5
17. Total volume of spills including location, volume, and materials	48 (77.4%)	5 (8.1%)	1 (1.6%)	- -	8 (12.9%)	1	52 (83.9%)	2 (3.2%)	-	- -	8 (12.9%)	5	48 (77.4%)	- -	- -	- -	14 (22.6%)	1
18. Total volume of wastes in tonnes by disposal methods	45 (72.6%)	7 (11.3%)	1 ((1.6%)	- -	9 (14.5%)	1	50 (806%)	3 (4.8%)	-	- -	9 (14.5%)	1	49 (79.0%)	- -	- -	- -	13 (21.0%)	1
19. Total volume of internationally transported, imported, exported, and/or treated hazardous wastes	23 (37.1%)	13 (21.0%)	1 (1.6%)	- -	25 (40.3%)	2	30 (48.4%)	4 (6.5%)	-	- -	28 (45.2%	1	27 (43.5%)	- -	- -	- -	35 (56.5%)	5
20. Percentage of reused products and recycled packaging materials	51 (82.3%)	7 (11.3%)	1 (1.6%)	- -	3 (4.8%)	1	56 (90.3%)	2 (3.2%)	-	- -	4 (6.5%)	2	53 (85.4%)	- -	- -	- -	9 (14.5%)	1
21. Initiatives to reduce environmental impacts of products and/or services relating to use of materials and water, emissions, effluents, noise, and/or wastes	18 (29.%)	17 (27.4%)	- -	- -	27 (43.5%)	2	26 (41.9%)	5 (8.1%)	-	- -	31 (50.0%	1	23 (37.1	- -	- -	- -	39 (62.9	5
22. Environmental impacts of transporting products and/or materials used for the organization’s operations and/or employees’ commuting	17 (27.4%)	15 (24.2%)	1 (1.6%)	- -	29 (46.8%)	2	26 (41.9%)	5 (8.1%)	- -	- -	31 (50.0%)	3.5	21 (33.9%)	- -	- -	- -	41 (66.1%)	5
23. Total expenditures of environmental protection	14 (22.6%)	16 (25.8%)	1 (1.6%)	- -	31 (50.0%)	4	24 (38.7%)	6 (9.7%)	-	- -	32 (51.6%)	5	20 (32.3%)	- -	- -	- -	42 (67.7%	5
24. Toxic wastes reductions - chemical wastes, hazard wastes, non-hazard wastes, and/or end-of-life products to minimize landfills and incineration	50 (80.6%)	3 (4.8%)	1 (1.6%)	- -	8 (12.9%)	1	54 (87.1%)	- -	- -	- -	8 (12.9%)	1	51 (82.3)	1 (1.6%)	- -	- -	10 (16.1%)	1
25. Other GHG Emissions - Methane (CH4), PFC, N2O, HFC, and/or SF6	50 (80.6%)	1 (1.6%)	- -	- -	11 (17.7%)	1	51 (82.3.%)	- -	- -	- -	11 (17.7%)	1	47 (75.8%)	1 (1.6%)	- -	- -	14 (22.6%	1
Total						34						40.5						45

Note: this percentage is the proportion of the number above

Table 5-6 Frequencies – social performance indicators

How often does your firm measure indicators below to report either internally or externally? And how often will your firm intend to report in future?

<u>Social performance indicators</u>	Column A Current practices												Column B Future intentions					
	Internal						External											
	Not at all (1)	Monthly(2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median	Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median	Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median
<u>Labour practices and working conditions</u>																		
1. Benefits provided for employees	10 (16.1%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	35 (56.4%)	4	21 (33.9%)	1 (1.6%)	1 (1.6%)	3 (4.8)	36 (58.0%	5	12 19.4%)	3 (4.8%)	9 (14.5%)	1 (1.6%)	37 (59.7%	5
2. Minimum notice period(s) to inform employees regarding organizational changes that could affect them	10 (16.1%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	35 (56.4%)	5	21 (33.9%)	1 (1.6%)	- -	3 (4.8%)	37 (59.7%)	5	11 (17.7.%)	1 (1.6%)	- -	1 (1.6%)	49 (79%)	5
3. Education, training, counselling prevention and risk-control programs to assist employees,	10 (16.1%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	35 (56.4%)	5	20 (32.2%)	2 (3.2%)	- -	3 (4.8%)	37 (59.7%	5	10 (16.1%)	1 (1.6%)	- -	1 (1.6%)	50 (80.6%	5
4. Health and safety topics covered in formal agreements with trade unions	10 (16.1%)	6 (9.7%)	8 (12.9%)	9 (14.5%)	29 (46.8%)	4	21 (33.3%)	1 (1.6%)	- -	3 (4.8%)	37 (59.7%)	5	10 (16.1%)	3 (4.8%)	4 (6.3%)	1 (1.6%)	4 4 (69.8%	5
5. Average hours of training per year per employee by employee categories	10 (16.1%)	10 (16.1%)	4 (6.5%)	9 (14.5%)	29 (46.8%)	4	20 (32.2%)	5 (8.6%)	- -	4 (6.5%)	33 (53.2%	5	10 16.1%)	2 (3.2%)	2 (3.2%)	1 (1.6%)	47 (75.8%)	5
6. Programs for skills management and lifelong learning to develop employees' skills and to update abilities, knowledge, and/or qualification	10 (16.1%)	7 (11.3%)	8 (12.9%)	9 (14.5%)	28 (46.8%	4	21 (33.3%)	1 (1.6%)	- -	3 (4.8%)	37 (59.7%)	5	10 (16.1%)	1 (1.6%)	- -	1 (1.6%)	50 (80.6%	5
7. Percentage of employees receiving a regular performance and career development reviews	12 (19.4%)	8 (12.9%)	4 (6.5%)	9 (14.5%)	29 (46.8%)	4	23 (37.1%)	1 (1.6%)	- -	3 (4.8%)	35 (56.5%)	5	12 (19.4%)	2 (3.2%)	- -	1 (1.6%)	47 (75.8%)	5
8. Ratio of basic salary of males to basic salary of females for each employee category	11 (17.7%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	34 (54.8%)	5	22 (35.5%)	1 (1.6%)	- -	3 (4.8%)	36 (58.1%)	5	11 (17.7%)	1 (4.8%)	- -	1 (1.6%)	49 (79.0%	5
<u>Society</u>																		
9. Nature, scope, and effectiveness of any programs and practices that manage the impacts of operations on communities	10 (16.1%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	35 (55.5%)	5	21 (33.3%)	1 (1.6%)	- -	3 (4.8%)	37 (59.7%)	5	10 (16.1%)	1 (1.6%)	- -	1 (1.6%)	50 (80.6%)	5
10. Percentage of employees trained in organization's failure of policies and procedures	10 (16.1%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	35 (55.5%)	5	21 (33.3%)	1 (1.6%)	- -	2 (3.2%)	38 (61.3%)	5	11 (17.7%)	1 (1.6%)	- -	1 (1.6%)	49 (79.0%)	5
11. Actions taken to respond to incidents of failure to follow policies and procedures	10 (16.1%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	35 (55.5%)	5	21 (33.3%)	1 (1.6%)	- -	3 (4.8%)	37 (59.7%)	5	10 (16.1%)	1 (1.6%)	- -	1 (1.6%)	50 (80.6%	5
12. Whistle blower policy/ hotline in response to incidents of fraud or other inappropriate activities	10 (16.1%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	35 (55.5%)	5	21 (33.3%)	1 (1.6%)	- -	3 (4.8%)	37 (59.7%	5	10 (16.1%)	1 (1.6%)	- -	1 (1.6%)	50 (50.6%	5
Total						**50**						**60**						**60**

Note: this percentage is the proportion of the number above

Table 5-6 Frequencies – social performance indicators (cont.)

How often does your firm measure indicators below to report either internally or externally? And how often will your firm intend to report in future?

Social performance indicators	Column A Current practices – Internal: Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median	Column A Current practices – External: Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly (5)	Median	Column B Future intentions: Not at all (1)	Monthly (2)	Quarterly (3)	Half yearly (4)	Yearly_(5)	Median
Product responsibility																		
13. Total number of legal actions for anti-competitive behaviour, anti-trust, and/or monopoly practices regarding major outcomes of these actions	10 (16.1%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	35 (56.5%)	4	21 (33.8%)	1 (1.6%)	- -	3 (4.8%)	37 (59.7%)	5	10 16.1%)	1 (1.6%)	4 (6.5%)	1 (1.6%)	46 (74.2%	5
14. Total monetary value of fines and/or total number of non-monetary sanctions for non compliance with laws and regulations	15 (24.2%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	30 (48.4%)	4.5	21 (33.8%)	1 (1.6%)	-	3 (4.8%)	37 (59.7%	5	10 (16.1%)	5 (8.1%)	- -	1 (1.6%)	46 (74.2%)	5
15. Life cycle stages in which health and safety impacts of products and services are assessed for improvement	10 (16.1%)	8 (12.9%)	4 (6.5%)	9 (14.5%)	31 (50.0)	4.5	21 (33.8%)	1 (1.6%)	-	3 (4.8%)	37 (59.7%	5	10 16.1%)	1 (1.6%)	4 (6.5%)	1 (1.6%)	46 (74.2%	5
16. Total number of incidents of non-compliance with regulations and voluntary codes concerning health and safety impacts of products during their life cycle	18 (29.0%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	27 (43.5%)	4	21 (33.8%)	1 (1.6%)	-	3 (4.8%)	37 (59.7%	5	10 (16.1%)	6 (9.7%)	- -	1 (1.6%)	44 (71.0%	5
17. Product information required by procedures, and/or percentage of products subject to information requirement	14 (22.5%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	31 (50.0%)	4.5	21 (33.8%)	1 (1.6%)	-	3 (4.8%)	37 (59.7%	5	10 16.1%)	2 (3.2%)	3 (4.8%)	1 (1.6%)	46 (74.2%	5
18. Practices related to customer satisfaction including results of surveys measuring customer satisfaction	16 (25.8%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	29 (46.7%)	4	21 (33.8%)	1 (1.6%)	-	3 (4.8%)	37 (59.7%	5	10 16.1%)	1 (1.6%)	6 (9.5%)	1 (1.6%)	44 (69.8%	5
19. Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, advertising, promotion, and/or sponsorship by type of outcomes	17 (27.4%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	28 (45.1%)	4	28 (45.2%)	1 (1.6%)	-	3 (4.8%)	30 (48.4%	4	10 16.1%)	6 (9.5%)	3 (4.8%)	1 (1.6%)	42 (67.7%	5
20. Total monetary value of fines for non-compliance with laws and regulations concerning the provision and use of products	19 (30.6%)	4 (6.5%)	4 (6.5%)	9 (14.5%)	26 (41.9%)	4	20 (32.2%)	1 (1.6%)	-	3 (4.8%)	38 (61.3%	5	9 4.5%)	2 (3.2%)	7 (11.3%)	1 (1.6%)	42 (67.7%	5
Total						33.5						39						40

Note: this percentage is the proportion of the number above

5.2 Cluster analysis

Cluster analysis was undertaken using hierarchical methods to classify questionnaire items into each group of objects (frequency timeframes—*not at all, monthly, quarterly, half yearly,* and *yearly*). Thus, responses from companies to a set of questionnaires were analysed to seek system characteristics employed by companies to identify environmental and social performance indicators for management decisions and reporting purposes. The analysis procedures were designed to cluster cases (items on questionnaires) into variables (timeframes). Questionnaire items were clustered into each variable while combining clusters with small cluster differences. This approach helps avoid chain samples of observations when similar items fell into its own cluster (Hair et al. 1998). The results of analysis identified which timeframes companies were most likely to employ in their system characteristics of management accounting to identify or measure costs of environment and social impacts.

In addition, as cluster analysis has referred to Q-type factor analysis and is based on classifying groups of objects, the correlations of similarity become more reliable (Hair et al. 1998; Sheskin 2007). Although cluster analysis poses difficulties in modifying a data set in subsequent steps of the classifying process, this method provides an average linkage to create stability when transforming data from one cluster to another cluster (within groups) (Aldenderfer & Blashfield 1984). Average linkage methods have been created to classify data from all individuals of average distance into one cluster and to other clusters (Hair et al. 1998). This enabled the researcher to analyse a large amount of data while avoiding extreme values incurred in single linkage methods. Thus, by applying average linkage methods, all observations (data) were combined into a small number before falling into each cluster (Hair et al. 1998). This study considered that using an average linkage approach helped agglomerate questionnaire items into five factors within groups of observation (not at all, monthly, quarterly, half yearly, and/or yearly. The results of the analysis have been provided in the form of Agglomeration schedules and Dendrogram graphs of companies' current reporting practices of environmental and social performance both internally and externally, as well their intention to report in the future.

5.2.1 Data screening and detecting outliers

To further probe the findings of SR1, SR2 and SR3, cluster analysis method was employed to classify similarity of responses, and data was transformed to identify significant skewness and kurtosis. Data screening and detecting outliers were performed prior to analysis (Tabachnick & Fidell 2007). Data screening and detecting outliers aimed to ensure that the results of data analysis were reliable and trustworthy when investigating sub-research questions. According to Hair et al. (1998), detecting outliers involves examining the distribution of observations, thus seeking outliers falling out of range of the distribution. Detecting outliers involves two different perspectives based on the number of observations—univariate and multivariate outliers (Tabachnick & Fidell 2007). Univariate outliers identify 80 or fewer observations for the distribution exceeding absolute of 2.58. Meanwhile, multivariate outliers examine larger numbers of observations identifying outliers from multivariate assessment with a standard score of 3.29 or greater (Hair et al. 1998). In addition, Tabachnick and Fidell (1996) indicated that the skew value is significant when samples are less than 300 and an absolute value exceeds 2.58. For samples greater than 300, the skew value is also significant when an absolute value exceeds 3.29 (Tabachnick & Fidell 1996).

In this study, data outliers were detected using univariate detection perspective based on the nature of the observations, thus achieving normality for the contribution (Hair et al. 1998). A number of observations (62) were classified into manageable groups before detecting, with any missing values in a survey instrument not included; and remaining missing values were not computed (Hair et al. 1998). The results of normal contributions are separately reported in terms of environmental performance indicators (internal reporting, external reporting, and future intention) and social performance indicators (internal reporting, external reporting, and future intention) (Table 5-7). The distributions are significants when dividing the skew values by the standard error of skewness which are greater than 2.58 (Manning & Munro 2007). The ratio of skew value of environmental performance indicators of internal reporting is 3.04 (-.923/.304), external reporting is 3.35 (.977/.292), and future intention is 2.59 (.786/.304). For social performance indicators, skew values of internal reporting, external reporting, and future intention are also significant (.991/.381 = 2.60), (-1.031/.304 = - 3.39), and (-1.687/.304 = -5.55) respectively.

Table 5-7 Data screening and detecting outliers

	N	Skewness		Kurtosis	
	Statistic	**Statistic**	**Std. Error**	**Statistic**	**Std. Error**
Environmental performance indicators					
– Internal reporting	62	0.923	0.304	1.311	0.599
– External reporting	62	0.977	0.292	1.887	0.573
– Future intention	62	0.786	0.304	4.196	0.599
Social performance indicators					
– Internal reporting	62	0.991	0.381	0.524	0.751
– External reporting	62	-1.031	0.304	-0.569	0.599
– Future intention	62	-1.687	0.304	0.941	0.599
Valid N (listwise)	**62**				

Significant values of data transformations were employed to analyse responses to environmental and social performance indicators in cluster analysis. Companies' responses to environmental performance—internal reporting, external reporting, and future intention—were employed for investigation.

5.2.2 Responses to environmental performance indicators

Responses from 62 companies in the non-service manufacturing sector were received for items on environmental performance indicators. Overall index of environmental performance indicators were ranked in order of *not at all*, *monthly*, *quarterly*, *half yearly*, and *yearly* as numbers and percentages to create a clear picture of the response rates (Table 5-8).

Table 5-8 Overall index of environmental performance indicators

Overall index of environmental indicators						
Time-frames	**CI**	**CE**	**FI**	**CI(%)**	**CE(%)**	**FI(%)**
Yearly	20	22	28	32	35	45
Half yearly	1	0	0	2	0	0
Quarterly	1	0	0	2	0	0
Monthly	13	4	1	21	6	2
Sub Total reporting	**35**	**26**	**29**	**57**	**41**	**46**
Not at all	27	36	33	43	59	53
	62	**62**	**62**	**100%**	**100%**	**100%**

Overall, non-financial performance reporting—both currently and in the future—was summarised by the index of measurement indicators. Based on the indicator measures used in the survey, a number of questionnaire items were analysed to establish at which level a company reports on all indicators adopted by this study from the literature in accordance with Australian and international standards. Analysis results show that companies are currently at the lower ends of scales, but intend to measure costs of environment in the future (Table 5-11). Current reporting practices by companies appear to be biased towards reporting internally (n=35, 57%), with less emphasis on external reporting (n=27, 43%). Thus, having a holistic accounting system that could support future intentions may help companies to more accurately report information on the environment for management decisions and to support environmental performance disclosures (Gadenne & Zaman 2002; Gray et al. 2001)—without substantially increasing reporting costs. To analyse if there were any differences between current practice—internal and external reporting and future intentions to report—the sample was further disaggregated into three components which are detailed below.

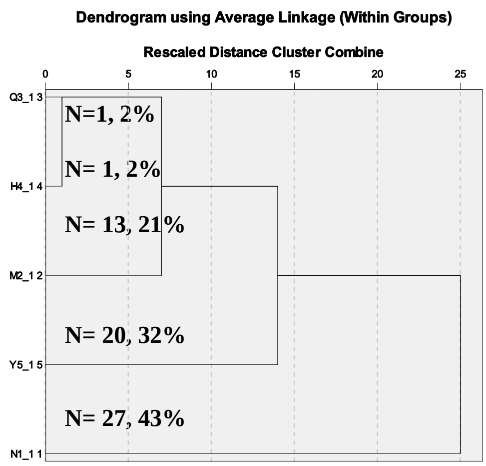
a. Current practice—environment internal reporting: agglomerative method of cluster analysis was used to classify items into five reporting timeframes. Items on the questionnaire were agglomerated into each timeframe as individual clusters—minimizing similarity of a final cluster. Average linkage within groups was employed to identify responses to the items in the questionnaire. The analysis indicates that items on the questionnaire fall into a final cluster, and there is an agglomeration coefficient of 13522.600; for two clusters 7197.833; and for three clusters 3426.667 (Table 5-9).

Table 5-9 Agglomerative results of environment internal reporting

Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	3	4	44.000	0	0	2
2	2	3	3426.667	0	1	3
3	2	5	7197.833	2	0	4
4	1	2	13522.600	0	3	0

The results of analysis are also provided in the form of a Dendrogram graph (Figure 5-1) to obtain a clear visual picture of how similar items in the questionnaire fell into each object. The higher similarity of items in the questionnaire fall into a cluster 'not at all' identified those current practices of companies (n=27, 43%; see overall index, Table 5-11) not currently measuring environmental performance indicators to report internally. Meanwhile, items falling into a cluster 'yearly' (32%), 'monthly' (21%), and 'quarterly' (2%) are recognized as current practices of companies measuring environmental performance indicators to disclose internally. This study further analysed environmental performance indicators for external reporting purposes.



N1= not at all, M2= monthly, Q3=quarterly, H4= half yearly, and Y5= yearly

Figure 5-1 Dendrogram graph of environment internal reporting

b. Current practice—environment external reporting: agglomerative methods were employed to agglomerate items in the questionnaire. The results illustrate that items fall into a final cluster, and there is an agglomeration coefficient of 19253.000; for two clusters 7797.000; and for three clusters 351.333 (Table 5-10). The dendogram graph in Figure 5-2 below provides a clearer result of the analysis.

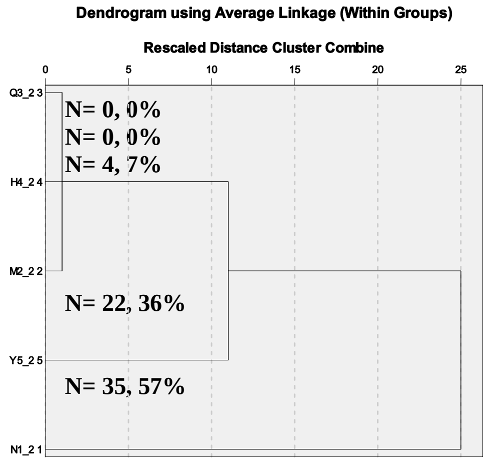
Table 5-10 Agglomerative results of environment external reporting

Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	3	4	.000	0	0	2
2	2	3	351.333	0	1	3
3	2	5	7797.000	2	0	4
4	1	2	19253.000	0	3	0

The dendrogram graph in Figure 5-2 shows the results of similarity of the items falling into each object (frequency timeframes). Items falling into a cluster ‘yearly’ (n=22, 35%) and ‘monthly’ (n=4, 6%) are identified as current practices of companies reporting environmental performance externally. However, a higher similarity of items fall into ‘not at all’ (n= 36, 59%) which indicates that, currently, companies are not measuring environmental performance indicators to report externally; this may be due to their experiencing difficulties in capturing environmental data—because the nature of environmental costs are hidden costs (IFAC 2005) and are complicated to accurately identify or separate from overheads (UNDSD 2001).

Therefore, there appears to be a requirement for companies to change their systems (management accounting systems) to efficiently evaluate reductions in environmental costs and contaminants (Burnett & Hansen 2008; Gale 2006a). Further, this study analyses future intentions of companies in measuring environmental performance indicators for management decisions and reporting purposes and this aspect is discussed next.



N1= not at all, M2= monthly, Q3=quarterly, H4= half yearly, and Y5= yearly

Figure 5-2 Dendrogram graph of environment external reporting

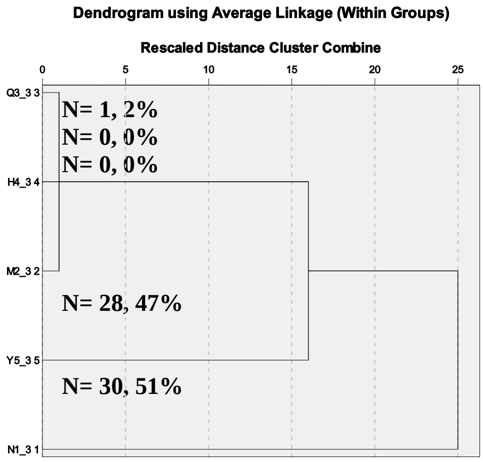
c. Future intentions—environmental performance disclosures: by applying agglomerative cluster analysis methods, the results show an agglomeration coefficient of a final cluster is 22485.400; for two clusters 13941.500; and for three clusters 1.333, respectively (Table 5-11). Clearer results of analysis are provided in the form of a dendogram graph (Figure 5-3).

Table 5-11 Agglomerative results of future intentions – environmental reporting

Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	3	4	.000	0	0	2
2	2	3	1.333	0	1	3
3	2	5	13941.500	2	0	4
4	1	2	22485.400	0	3	0

The dendogram graph above (Figure 5-3) shows higher similarity of items in each cluster of timeframes. Items from the questionnaire fell in a cluster of 'not at all' (n=33, 53%); this indicates that, currently, the majority of companies are not intending to identify environmental costs to support internal management decisions and for reporting purposes in the foreseeable future. Meanwhile, items falling into a cluster 'yearly' (n=28, 45%) and 'monthly' (n=1, 2%) indicate that companies' future intentions may not be dissimilar to current reporting practices.



N1= not at all, M2= monthly, Q3=quarterly, H4= half yearly, and Y5= yearly

Figure 5-3 Dendrogram graph of future intensions - environmental reporting

Accordingly although the results of analysis show higher levels of internal reporting by some firms, a significant percentage of firms do not currently report. This has tentatively been interpreted as companies showing concern about identifying and measuring environmental costs to support disclosures, but experiencing difficulty in capturing these costs as they are hidden among production processes (IFAC 2005; UNDSD 2001). Because of the risk of inaccurately, they may be reluctant to externally disclose performance to stakeholders for fear of providing misleading information.

Companies would need to change their accounting systems to accurately identify and capture environment cost information (Berkel 2003; Gadenne & Zaman 2002). Such a change would allow companies to more effectively measure reductions in production costs, while having the ability to reduce carbon emissions and wastes (Gale 2006a). Therefore, by changing accounting systems, firms could more efficiently evaluate reductions in environmental costs and contaminant such as wastes, emissions, and/or waste disposal, thus reducing negative impacts on the environment and society (Burnett & Hansen 2008; Gale 2006a). The following section describes how this study analysed companies' responses to items on the questionnaire pertaining to social performance indicators.

5.2.3 Responses to social performance indicators

Significant values of data transformations were employed to analyse responses to social performance indicators – internal reporting, external reporting, and future intention. Responses to social performance indicators in the survey were ranked in order of not at all, monthly, quarterly, half yearly, and yearly. The results are provided in the form of numbers and percentages in Table 5-12. These questions were posed to initially ascertain the overall index of social cost identification and measurement that current practices of companies report internally and externally, as well as their intention to disclose in the future.

Table 5-12 Overall index of social performance indicators

Social indicators index						
Time-frames	**CI**	**CE**	**FI**	**CI(%)**	**CE(%)**	**FI(%)**
Yearly	30	36	47	50	58	75
Half yearly	9	3	1	15	5	2
Quarterly	5	1	2	7	2	3
Monthly	6	1	2	9	2	3
Sub total reporting	**50**	**41**	**52**	**81**	**67**	**83**
Not at all	12	21	10	19	33	17
	62	**62**	**62**	**100%**	**100%**	**100%**

Based on the indicator measures used in the survey, ranking timeframes established at which level a company has reported on all indicators adopted by this study from the literature, and in line with Australian and international standards. The results indicate that companies are currently at the higher end of the scale (yearly) in reporting social performance of their organizations. Additionally, companies seem to be highly intent on providing social expenditures to improve reporting on social performance in the future. Companies are currently measuring costs of social impacts and report internally at a higher level than externally. This could be tentatively interpreted as non-service manufacturing companies being significantly concerned about measuring social costs to improve social internal decision-making while supporting social performance disclosures (Gray 2002b, 2006). Further, the sample was analysed to see if there were any differences between current practices and future intention of reporting on social measures.

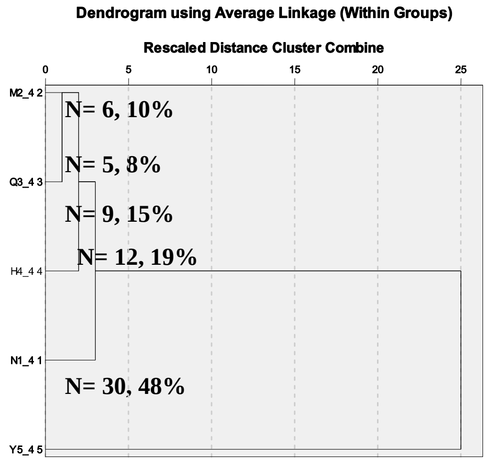
a. Current practice—social internal reporting: an average linkage within group of agglomerative cluster analysis methods was employed to classify items in the questionnaire into five aspects (*not at all, monthly, quarterly, half yearly,* and *yearly*). Responses from current practices of companies provided social data to support sustainability reporting were classified into each cluster (frequency time-frames). The results indicate that an agglomeration coefficient of a final cluster is 4868.400; for two clusters 646.333; and for four clusters 290.667 (Table 5-13).

Table 5-13 Agglomerative results of social internal reporting

Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	2	3	98.000	0	0	2
2	2	4	290.667	1	0	3
3	1	2	646.333	0	2	4
4	1	5	4868.400	3	0	0

This study provides a clear picture of the results in the form of a dendrogram graph (Figure 5-4) which shows that items in the questionnaire fall into a cluster 'yearly', indicating that currently companies (n=30, 50%; see overall index Table 5-12) identify costs of social impacts and report annually. Furthermore, items falling into clusters 'half yearly' (n=9, 15%), 'quarterly' (n=5, 7%), and 'monthly' (n=6, 9%) indicate companies are identifying social costs for management decisions and internal reporting purposes. A small number of items falling into a cluster 'not at all' (n=12, 19%) recognize those companies not intending to identify social data for management decisions and social performance reporting purposes. Additionally, responses of current practices of companies were analysed to establish their social performance disclosures for external reporting.



N1= not at all, M2= monthly, Q3=quarterly, H4= half yearly, and Y5= yearly

Figure 5-4 Dendrogram graph of social internal reporting

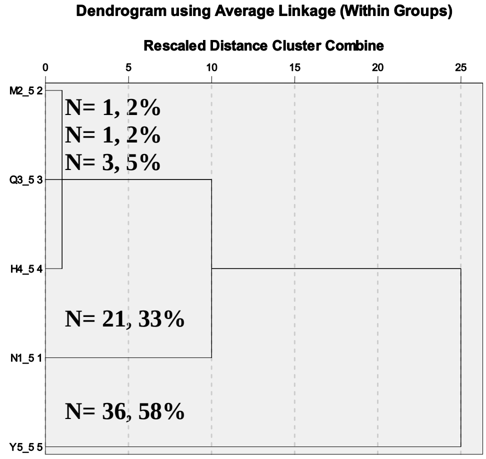
b. Current practice—social external reporting: items in the questionnaire were agglomerated into each object (frequency timeframes). Starting from the bottom, there is an agglomerative coefficient of 10249.800 for one cluster; for two clusters 4044.333; and for four clusters 98.000 (Table 5-14). Thus items on the questionnaire fall into a final cluster identified as 'yearly' (10249.800); for two clusters 'not at all' (4044.333); and for four clusters 'half yearly' (98.000). To create a clearer picture of the results, the dendrogram graph below (Figure 5-5) shows the measurement of similar items in each object of frequency timeframes.

Table 5-14 Agglomerative results of social external reporting

Agglomeration Schedule

Stage	Cluster Combined			Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2	Coefficients	Cluster 1	Cluster 2	
1	2	3	46.000	0	0	2
2	2	4	98.000	1	0	3
3	1	2	4044.333	0	2	4
4	1	5	10249.800	3	0	0

The dendrogram graph above (Figure 5-5) illustrates the questionnaire items that fall into a cluster 'yearly' (n=36, 58%; see overall index table 5-12), 'half yearly' (n=3, 5%), and 'monthly' (n=1, 2%). This results in the majority of companies measuring social expenditures to support external social disclosures, as well as enhancing their social management decisions. A greater number of items fall into a cluster 'not at all' (n=21, 33%), which indicates that, currently, more companies are less likely to disclose social performance to stakeholders and the public than to internal management.



N1= not at all, M2= monthly, Q3=quarterly, H4= half yearly, and Y5= yearly

Figure 5-5 Dendrogram graph of social external reporting

These companies may have been faced with difficulties in cost identification and measurement of social impacts, thus they could not provide cost data to support social disclosures that is sufficiently accurate for external reporting. The companies may need to change their system characteristics (management accounting systems) for social cost identification and measurement to enable them to more appropriately collect social expenditures for improvement in working performance and living standards of employees. Therefore, this study subsequently examined future intentions of companies in measuring social costs for management decisions and reporting purposes.

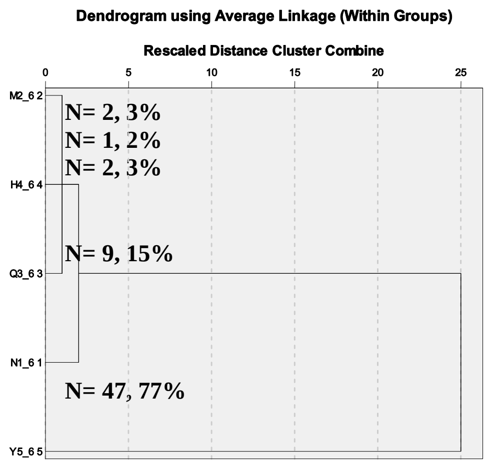
c. Future intentions—social performance disclosures: agglomerative methods of cluster analysis were employed to classify items in the questionnaire into five frequency timeframes. The results of the analysis show that there is an agglomeration coefficient of 15278.600 in a final cluster; for two clusters 839.500; and for three clusters 146.000 (Table 5-15). A dendogram graph (Figure 5-6) provides a clearer picture of the results.

Table 5-15 Agglomerative results of future intensions - social reporting

Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	2	4	78.000	0	0	2
2	2	3	146.000	1	0	3
3	1	2	839.500	0	2	4
4	1	5	15278.600	3	0	0

As shown in the dendrogram graph (Figure 5-6), items fell into a cluster 'yearly' (n=47, 75%) indicating that companies intend to identify costs of social impacts to support management decisions and social performance reporting in the future. In addition, items falling into clusters of 'half yearly' (n=1, 2%), 'quarterly' (n=2, 3%), and 'monthly' (n=2, 3%) indicate that companies are intending to capture costs of social impacts for management decisions and reporting purposes in the future. Furthermore, items falling into a cluster 'not at all' (n=10, 17%) indicate that a small number of companies do not intend to collect social costs in the foreseeable future. These companies appear disinterested in identifying costs of social impacts—possibly because they could create negative impacts on financial outcomes.



N1= not at all, M2= monthly, Q3=quarterly, H4= half yearly, and Y5= yearly

Figure 5-6 Dendrogram graph of future intensions - social reporting

Consequently, current practices of companies indicated that they have placed a high priority on social measures to capture social costs for management decision making and social internal reporting purposes annually. In the meantime, social impact costs were also identified to support social external reporting. Apart from that, current practices of companies have indicated their future intention to identify social expenditures—which is aimed at improving the quality of employees' lives, working performance, and community development to enhance social well-being as a whole. Companies also intend to provide cost information to support social performance disclosures in order to create better relationships with their stakeholders and the public. A summary of the responses to items in questionnaires are provided in Appendix 3. Relative to social reporting, companies are reluctant to report environmental performance to create more accurate results using cluster analysis, this study profiled two and four cluster solutions using K-means cluster to measure levels of significance.

5.3 K-means cluster analysis

The initial aim of this analysis was to seek mean values in final clusters (timeframes) in order to examine where significant differences between cluster groups occur (Manning & Munro 2007). Although descriptive statistics could provide mean values of data analysis, these methods do not examine significant values of cluster differences. Meanwhile, K-means cluster analysis has provided the study with a way to examine significant values of items indicated frequently in each timeframe from hierarchical cluster analysis. K-means cluster analysis has also reported the results in the form of an ANOVA table while providing F-values for each variable to consider significant or non-significant variables that need to be employed for exploratory purposes (Hair et al. 1998). These methods help in maximizing the differences among cases in different clusters—*not at all, monthly, quarterly, half yearly*, and *yearly*. K-means cluster has helped in selecting a final cluster by profiling two- and four-cluster solutions in order to ensure that selected clusters are distinctive (Hair et al. 1998). Thus, K-means cluster analysis methods were considered appropriate for this study to measure mean values of significant differences. The focus of this section was not to interpret the results of the clustering analysis but, rather, to provide the true distinctiveness of variables employed to support the conceptual model of sustainability management accounting system (SMAS). Significance testing of environmental performance disclosures was analysed.

5.3.1 Significance testing of environmental performance disclosures

In this study, profiling both solutions of the clusters (two- and four-clusters) assisted in ensuring that clusters selected were distinctive. Table 5-17 contains the clustering variable profiles for both two- and four-cluster solutions of environmental performance disclosures: internal, external and future intentions. The results indicate that there are two non-significant values of two-cluster differences that are not able to be considered for exploratory purposes (F-value = 1.640, Sig. = 0.214 and F-value = .705, Sig. = 0.410). However, after clustering variables for the four-cluster solution, the increased clusters provide better results for F-values and significant values (Table 5-16).

The results indicate that there is only one non-significant solution clustering from cluster differences (F-value = 0.635, Sig. = 0.601). As a result, the comparison between two and four clusters creates better results of analysis to support this study. Also, the benefits of an increased number of clusters would help the study to maintain distinct groups of objects for exploratory purposes (Hair et al. 1998). This study considered significant values of yearly and monthly in internal reporting, external reporting and future intention as appropriate timeframes for environmental data identification and measurement. The results are utilized to support the SMAS conceptual model.

Table 5-16 Statistical significance of cluster differences - environmental disclosers

ANOVA

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Two-cluster solution						
Environmental - Internal reporting						
Not at all	6715.030	1	35.269	22	190.392	.000
Monthly	472.500	1	21.818	22	21.656	.000
Quarterly	***1.376***	***1***	***.839***	***22***	***1.640***	***.214***
Half yearly	.000	1	.000	22	.	.
Yearly	3891.505	1	20.629	22	188.646	.000
Environmental - External reporting						
Not at all	6297.619	1	21.260	22	296.223	.000
Monthly	141.696	1	1.133	22	125.050	.000
Quarterly	.000	1	.000	22	.	.
Half yearly	.000	1	.000	22	.	.
Yearly	4508.233	1	18.527	22	243.330	.000
Environmental – future intentions						
Not at all	7198.430	1	20.251	22	355.455	.000
Monthly	***.030***	***1***	***.042***	***22***	***.705***	***.410***
Quarterly	.000	1	.000	22	.	.
Half yearly	.000	1	.000	22	.	.
Yearly	7680.476	1	22.039	22	348.495	.000
Four-cluster solution						
Environmental - Internal reporting						
Not at all	2447.819	3	7.375	20	331.908	.000
Monthly	281.000	3	5.475	20	51.324	.000
Quarterly	4.875	3	.260	20	18.720	.000
Half yearly	.000	3	.000	20	.	.
Yearly	1393.375	3	8.260	20	168.681	.000
Environmental - External reporting						
Not at all	2201.000	3	8.117	20	271.170	.000
Monthly	48.083	3	1.119	20	42.980	.000
Quarterly	.000	3	.000	20	.	.
Half yearly	.000	3	.000	20	.	.
Yearly	1590.375	3	7.235	20	219.804	.000
Environmental – future intentions						
Not at all	2459.528	3	13.269	20	185.362	.000
Monthly	***.028***	***3***	***.044***	***20***	***.635***	***.601***
Quarterly	.000	3	.000	20	.	.
Half yearly	.000	3	.000	20	.	.
Yearly	2616.208	3	15.835	20	165.212	.000

5.3.2 Significance testing of social performance disclosures

For social performance disclosures, this study profiled two and four clusters to ensure that clusters selected were distinctive (Hair et al. 1998). Clustering variable profiles were employed to examine social performance reporting that companies have internally and externally disclosed while aiming to report in future. Table 5-17 provides results of clustering variable profiles for both two- and four-cluster solutions. For two-cluster, there are non-significant values of variables that are not able to be employed to support the development of a sustainability management accounting system (SMAS). Thus, an increased number of clusters (five-cluster) was considered to examine variables in order to create well-defined structures of cluster solutions for more variation in relation to clustering profiles (Hair et al. 1998). As a result, clustering variables of social performance disclosures is more statistically significant across the four-cluster groups.

Table 5-17 Statistical significance of cluster differences - social disclosers

ANOVA

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Two-cluster solution						
Social internal reporting						
Not at all	106.667	1	4.741	18	22.500	.000
Monthly	***.067***	***1***	***5.607***	***18***	***.012***	***.914***
Quarterly	***.267***	***1***	***2.252***	***18***	***.118***	***.735***
Half yearly	.000	1	.000	18	.	.
Yearly	106.667	1	6.807	18	15.669	.001
Social external reporting						
Not at all	***5.400***	***1***	***2.822***	***18***	***1.913***	***.184***
Monthly	***.417***	***1***	***.852***	***18***	***.489***	***.493***
Quarterly	***.150***	***1***	***.044***	***18***	***3.375***	***.083***
Half yearly	***.000***	***1***	***.111***	***18***	***.000***	***1.000***
Yearly	***3.750***	***1***	***3.378***	***18***	***1.110***	***.306***
Social, future intentions						
Not at all	***.017***	***1***	***.541***	***18***	***.031***	***.863***
Monthly	15.000	1	2.156	18	6.959	.017
Quarterly	56.067	1	5.096	18	11.001	.004
Half yearly	.000	1	.000	18	.	.
Yearly	132.017	1	5.052	18	26.132	.000
Four-cluster solution						
Social internal reporting						
Not at all	57.959	3	1.133	16	51.169	.000
Monthly	14.897	3	3.519	16	4.233	.022
Quarterly	***4.574***	***3***	***1.692***	***16***	***2.703***	***.080***
Half yearly	.000	3	.000	16	.	.
Yearly	36.974	3	7.392	16	5.002	.012
Social external reporting						
Not at all	16.026	3	.508	16	31.566	.000
Monthly	***.224***	***3***	***.942***	***16***	***.238***	***.868***
Quarterly	.317	3	.000	16	.	.
Half yearly	***.000***	***3***	***.125***	***16***	***.000***	***1.000***
Yearly	14.840	3	1.252	16	11.854	.000
Social, future intentions						
Not at all	1.394	3	.348	16	4.004	.027
Monthly	10.077	3	1.473	16	6.841	.004
Quarterly	22.692	3	4.983	16	4.554	.017
Half yearly	.000	3	.000	16	.	.
Yearly	55.814	3	3.469	16	16.088	.000

By profiling four-cluster variables of significant testing, the number of non-significant values is decreased. There are three non-significant values of cluster variables including quarterly internal social reporting, monthly, and half yearly external social reporting (F value = 2.703, Sig. = 0.080, F value = 0.238, Sig. = 0.868, and F value = 0.000, Sig. = 1.000) (Table 5-19). These variables are not characterized in this study. Meanwhile, significant values of distinctive groups were prepared to support the design of a conceptual model. Thus, for this study, by comparing significant values between two and four clusters it assisted examination in a significant manner across cluster groups. The comparison supports this study to appropriately consider using significant variables to support a benchmarking model in a qualitative study.

Consequently, K-means analysis was considered appropriate for this stage to measure significant values between two and four cluster solution. The comparison for two and four clusters would help in considering significance testing values of differences between cluster centres. Thus, an increased number of clusters would facilitate providing distinct groups of variables to support this exploratory study. In relation to this, profiling two- and four-cluster solution resulted in being able to create mirror images between each other (two and four clusters), thus facilitating this study to reveal significant values from differences clustering. Significant values of yearly (internal and external reporting), monthly and yearly (future intention) were considered suitable timeframes for social cost measurement.

As the results of K-mean cluster analysis are provided in the form of an ANOVA table, significant values (0.05) of environmental performance indicators indicate that the timeframe *monthly* (sig = 0.00) is an appropriate period to capture environmental data for management decision making. Meanwhile, *yearly* (sig. = 0.00) is a significant period for which companies intend to provide environmental data to support internal and external reporting initiatives. For social performance indicators, appropriate timeframes for capturing social impact costs to support internal decision-making is *monthly*, while reporting purposes is *yearly*. In addition, companies indicated their future intention to *monthly* identify and measure environmental and social data (sig. = 0.00 and 0.02) for improvement in decision-making in future. On the other hand, environmental and social data should be disclosed *yearly* in future (sig. = 0.00 and 0.00).

By using the results of significant values of K-mean cluster analysis, this created confidence in this study in identifying appropriate timeframes to analyse best practices companies in the benchmarking model. These timeframes were also employed in a SMAS conceptual model to confidently identify and measure costs of environment and social impacts for management decisions and/or external reporting initiatives. In the following section, the research question and findings are discussed.

5.4 Findings from the research question and sub research-questions

This is an exploratory study with the initial aim of determining system characteristics that should be employed by companies in their sustainability accounting practices and management accounting systems. The investigation is limited to non-service manufacturing companies that are natural resource users and pollution emitters. Increasingly, companies are being required to disclose environmental and social performance to stakeholders and the public. One main research question was posed to determine appropriate environmental and social data identification and measurement to meet the needs of a sustainable organization.

> *What system characteristics could companies employ in designing a SMAS to meet the needs of EMA and SAM practice while adding sustainable value to an organization?*

Overall indices of measurement indicators of environmental and social performance reporting have indicated that current practices of companies in non-service manufacturing sectors identified they report internally and externally to some extent; while looking to create more accurate cost information to disclose in the future (see Appendix 3). A new mechanism of management accounting for environmental and social costs would help in developing enhanced environmental and social management decisions, as well as creating more precise environmental and corporate social responsibility (CSR) reporting. Currently, those companies reporting their environmental and social performance have employed systems of management accounting practices to help in the identification of environmental and social data. Without a holistic system of sustainability accounting, system characteristics of companies capable of providing more realistic costs on which to make decisions on products that are fully costed would be difficult to accomplish.

This study, therefore, employed the system characteristics of current practices of companies to support the development of a benchmarking model. As analysis results of benchmarking were employed to support the development of the conceptual model of sustainability management accounting system (SMAS), it was necessary to enunciate the systems characteristics required to meet the informational needs of sustainable organizations. This information draws on best environmental and social management practices while being consistent with accounting concepts. In order to be able to conceptualise a system, the characteristics should be identified and evaluated so that the most appropriate characteristics are included. To arrive at a set of best practice characteristics, sub-research questions need to be answered as follows.

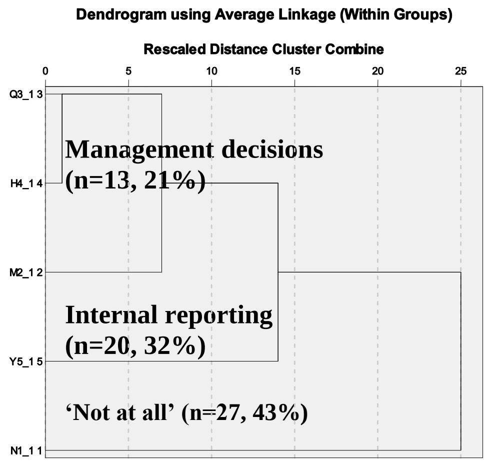
5.4.1 Sub-research question1

To what extent do current accounting systems capture and report environmental costs to support internal decision making for reducing emissions and wastes?

To answer **SR1**, items on the questionnaire falling into a cluster of *yearly*, and *monthly* (internal) reporting were identified as companies (54%) that measured environmental data to support internal management decisions in relation to cost reductions and carbon emissions abatement. As shown in Figure 5-7, companies (n=13, 21%) *monthly* measured environmental data for decision-making purposes. Companies would likely collect environmental data *yearly* to support internal reporting (n=20, 33%) and be used as a management decision strategy for investment decisions on establishing environmental management and/or pollution prevention programs.

Environmental data for management decisions and internal reporting

Internal reporting



N1= not at all, M2= monthly, Q3=quarterly, H4= half yearly, and Y5= yearly

Figure 5-7 Findings of sub-research question 1

Responses to items 4-7 were relevant to the measurement of direct/indirect energy consumption and evaluation of energy saved by process design, conservation, and/or changes in employees' behaviours. Environmental data was employed to support management decisions on measuring reductions in energy consumption and carbon emissions abatement. Companies also provided energy reduction programs/measurements to estimate reductions in indirect energy consumption from use of energy by intensive materials, subcontracted production, transportation, and employee commuting (items 9-11).

This has resulted in companies meeting the requirements of the NGER. Furthermore, responses to items 12-23 measured direct GHG emissions from burning fuel, electricity, heat, and/or steam, chemical processing, transporting materials, products, and/or wastes and indirect GHG emissions from employees commuting and/or business travelling in tonnes of CO_2 equivalent. An initial aim of this measure was to create lower levels of GHG emissions during production in order to meet the emission reduction requirements of the NGER. Thus, system characteristics of current practices of companies could help in identifying and collecting environmental data from production processes and external organizations.

As a consequence, current practices of companies employed system characteristics to measure environmental data from direct/indirect energy consumption in production processes. These companies collected environmental data '*monthly* and *quarterly*' to support internal management decisions in relation to cost reductions and carbon emissions abatement. Energy reduction and emission abatement programs were provided to create energy efficiency while reducing emissions. As a result, companies met energy consumption and GHG emission targets while incorporating environmental data in internal reporting *yearly*. Sub-research question1 **is**, therefore, **answered**.

Nonetheless, those companies that indicated '*not at all*' (n=27, 43%) were looking for a way to identify and measure environmental costs to support management decisions strategies to be more competitive in the marketplace. Therefore, sub-research question2 was posed to examine the need for firms to change to a new holistic system of management accounting practice for internal management decisions and future reporting.

5.4.2 Sub-research question2

How are companies intending to change their accounting systems to meet environment and social internal decision making needs that will support future reporting requirements?

To answer **SR2**, the findings indicate that environmental costs were keenly identified by companies to support external reporting *yearly* (n=22, 35%) while only n=4, 6% measured environmental costs to support decision-making. In addition, the analysis results (n=27, 43% and n=36, 59%) indicate that not all companies provide environmental performance reporting internally and externally, but indicated their future intention to provide environmental disclosures (n= 28, 45% = yearly). Thus, companies currently intend to change their management accounting practices/systems for more accurate cost accounting data of environment to support decision-making monthly and to provide external reporting initiatives yearly (Figure 5-8).

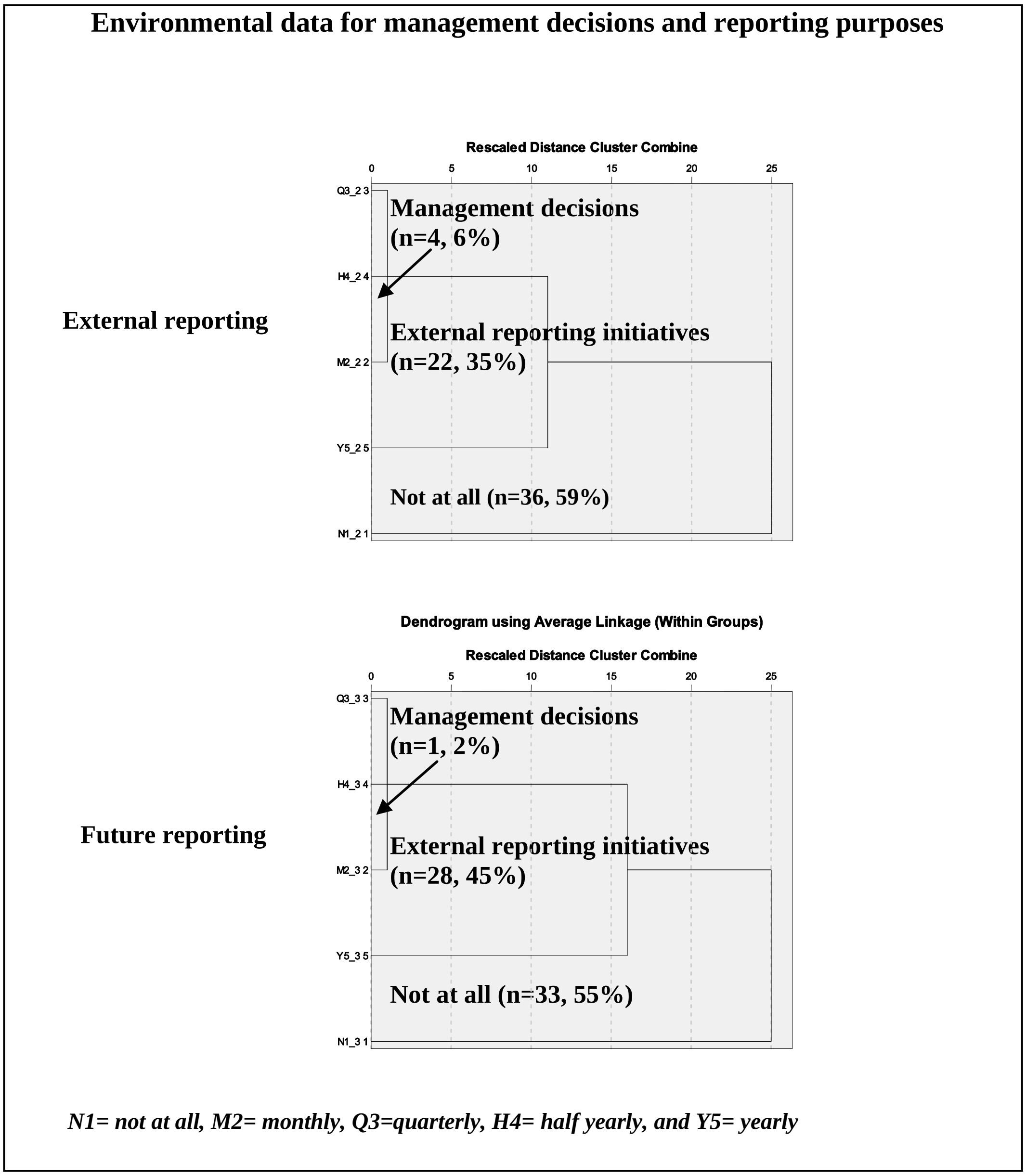


Figure 5-8 Findings of sub-research question 2 - environmental data

Thus, in response to items 4-8 companies would identify direct/indirect energy consumption while measuring the amount of energy saved by process design, conservation, and/or changes in employees' behaviours for future reporting. In doing so, companies would provide an energy reduction program and measurement to minimize energy used per day in production processes. Furthermore, as indicated by responses to items 12-16, companies would calculate direct GHG emissions created from burning fuel, electricity, heat, and/or steam, chemical processing, transporting materials, products, and/or wastes in tonnes of CO_2 equivalent in future reporting.

This includes indirect GHG emissions generated from employees commuting and/or business travel. Companies would also prepare GHG measurement programs and/or methods to measure reductions in GHG emissions created from both internal and external organizations to meet the requirement of the NGER. In relation to this, emissions in tonnes of CFC -11 equivalent of ozone depleting substances would also be measured to support environmental performance disclosures in future.

Companies measured production materials used in production processes to evaluate reductions in GHG emissions. Thus, in changing accounting systems, non-service manufacturing companies would collect cost data of direct/indirect energy usage in production processes to support management decisions on energy reductions and carbon emissions abatement. Energy reduction programs/measurement would need to be implemented to reduce high levels of energy consumption while creating lower carbon emissions. Companies would calculate direct/indirect GHG emissions to avoid negative impacts on environmental and natural patterns.

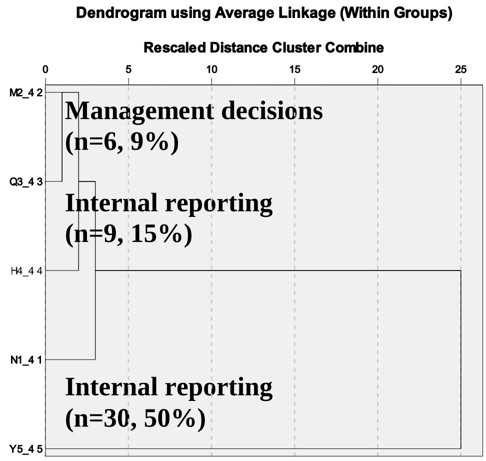
Current practices of companies, in response to items 19 and 21-23, identify total volume of internationally transported, imported, exported, and/or treated hazardous wastes. Initiatives to reduce environmental impacts of products and/or services relating to use of materials and water, emissions, effluents, noise, and/or wastes would be considered in future reporting. In this regard, the environmental impact of transporting products and/or materials used for the organization's operations and/or employees' commuting would be identified to support future disclosures. Companies would also provide environmental expenditures of environmental protection to manage waste disposal and emission treatment, remediation costs, prevention and environmental management costs. Thus, by changing accounting systems, companies could be seen as environmentally aware organizations by taking environmental issues into account. Companies could also capture cost data of environmental aspects to support decision-making on energy reduction and carbon emission abatement.

For social performance, Figure 5-9 shows that current practices of manufacturing companies indicated that social data was collected half yearly (n=9, 15%) and quarterly (n = 6, 9%) to support management decisions and internal reporting. Companies measured social impact costs to provide internal report yearly (n= 30, 50%), thus identifying social expenditures for improvement in the quality of employees, community and social well-being. Companies also indicated that social data was employed to support external disclosures half yearly and yearly (n=3, 5% and n=36, 58%). However, companies (n=21, 33%) were uninterested in identifying social data to disclose externally. This resulted in companies intending to change their management accounting practices for social cost dimensions thus creating more accurate cost accounting data of social impacts. Thus, these companies (n=47, 75%) indicated their future intentions to measure social impact costs to support external reporting initiatives *yearly*.

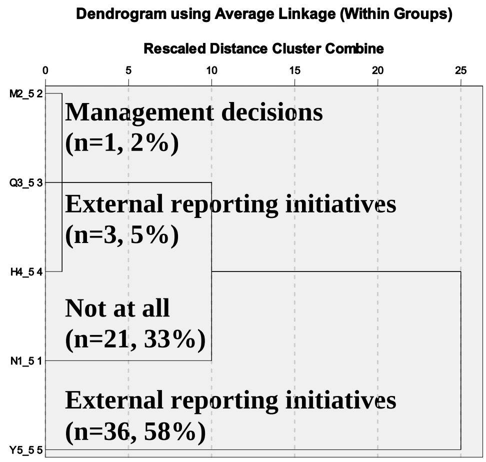
Current practices of companies, in response to items 1-8, are aiming to identify expenditures or funding to support education, training, environmental prevention and risk-control programs to educate employees, their families, and/or community members on serious diseases. In relation to this, health and safety topics covered in formal agreements with trade unions would be employed to support social disclosures, including average hours of training per year per employee by employee categories. Companies would identify programs for management and lifelong learning to develop employees' skills and update abilities, knowledge, and/or qualifications while collecting social data to report in future. Social data would be also identified from a percentage of employees receiving regular performance and career development reviews, as well as ratio of basic salary of males to basic salary of females for each employee category to support social disclosures.

Social data for management decisions and reporting purposes

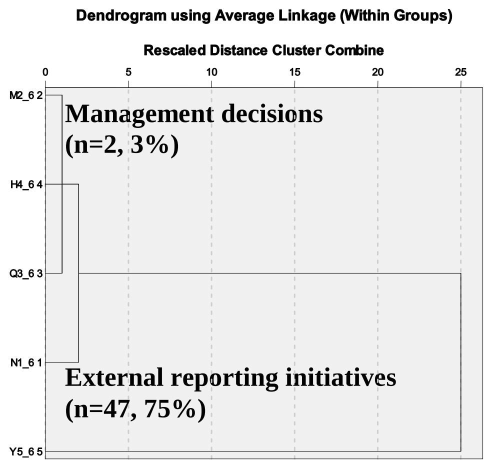
Internal reporting



External reporting



Future reporting



N1= not at all, M2= monthly, Q3=quarterly, H4= half yearly, and Y5= yearly

Figure 5-9 Findings of sub-research question 2 - social data

Furthermore, in response to items 9-14 companies indicated that they would provide nature, scope, and effectiveness of any programs and practices that manage the impacts of operations on communities for disclosure in future, including percentage of employees trained in dealing with failure of policies and procedures. Companies would report actions taken to respond to incidents of failure to follow policies and procedures, as well as whistle-blower policy/hotline in response to incidents of fraud or other inappropriate activities. In relation to this, the total number of legal actions for anti-competitive behaviour, anti-trust, and/or monopoly practices regarding major outcomes of these actions would be also incorporated in social performance disclosures. This would include total monetary value of fines and/or total number of non-monetary sanctions for non-compliance with laws and regulations.

In response to items 15-20, companies indicated they intend to report life cycle stages in which health and safety impacts of products and services are assessed for improvement. The number of incidents of non-compliance with regulations and voluntary codes concerning health and safety impacts of products during their life cycle would be also provided in future reporting. This includes product information required by procedures, and/or percentage of products subject to information requirement. In addition, companies would identify practices related to customer satisfaction, including results of surveys measuring customer satisfaction to support social disclosures in future. In relation to this, incidents of non-compliance with regulations and voluntary codes concerning marketing communications, advertising, promotion, and/or sponsorship by type of outcomes would be incorporated in social disclosures. Companies would also report monetary value of fines for non-compliance with laws and regulations concerning the provision and use of products in future.

The analysis results have shown that current practices of companies aim to provide more accurate environmental and social cost information to incorporate in sustainability reporting, as well as supporting management decisions. Thus, companies need to separately measure and identify environmental and social impact costs from overheads to create more accurate cost information.

Environmental costs should be captured from unit inputs—managing use and flows of material, energy, water, and wastes in production processes (Sendroiu et al. 2006). Wastes and carbon emissions created during producing products need to be identified as environmental costs, including emissions created from transportation, employee commuting, and/or business travel (Gale 2006a; IFAC 2005). Hence, changing management accounting systems/practices for more accurate outcomes could help companies to meet their internal decision-making needs and provide more precise sustainability disclosures. Subsequently, sub-research question 2 **is answered**.

5.4.3 Sub-research question3

To what extent is leading practice in environment and social accounting systems and reporting being adopted by non-service companies in Australia?

Findings of sub-research **question3** were discussed from the overview of cluster analysis results, along with the literature review detailed in chapter 2. The analysis results of SR1 and SR2 were employed, along with benchmarking results, to identify leading practice for economic, environment and social value added adopted by Australian non-service manufacturing companies. The results of SR1 and SR2 indicated that current practices of companies captured environmental costs *monthly* to support internal management decisions on cost savings and carbon emission abatement. Environmental data was also employed to support external reporting initiatives *yearly*, thus disclosing environmental performance to the stakeholders and public. Current practices of companies also measured social costs *monthly* for enhancement of social internal decision-making on cost measurement and identification. Social data disclosed the development of social performance in the form of corporate social responsibility (CSR) reporting *yearly*.

In addition, best practice companies identified in the benchmarking analysis adopted leading practice to support data accuracy needs, internal decision-making efficiency, and sustainable growth. Best practice companies employed an appropriate mechanism of management accounting to successfully identify and measure costs of environment and social impacts. Companies captured costs of environment from both internal and external organizations, as well as providing expenditures for environmental management prevention programs, waste and emissions treatment, and pollution prevention (Gale 2006a). Best practice companies also collected social data from expenditure provided to support employee benefits, education, training, and health and safety programs—including health and safety programs provided to reduce negative impacts on customers, community, and society while using products or services. Companies identified social data from customer satisfaction programs regarding product recalls, product information and/or insurance to fully capture total product costs (Bebbington et al. 2001). Thus, management accounting systems of current practices of companies identified in this study would be recognized as leading practice for environmental and social cost identification and measurement.

It is believed that in Australia, companies which to date have not shown an interest in measuring costs of environmental and social impact costs may indeed intend to change their management accounting practices in order to create more accurate cost information of environment and social impacts. By adopting such an approach, companies would benefit from enhanced internal management decision-making, as well as improving their environmental social performance disclosures (Bartolomeo et al. 2000; Bose 2006; Burritt, Herzig & Tadeo 2009; Gray 2006). Australian manufacturing companies would, thus, be seen as adopters of leading practice in sustainability accounting (Jasch & Stasiškienė 2005). This would assist in successfully measuring, identifying and analysing environmental and social impact costs (Gadenne & Zaman 2002; Gale 2006a). Added benefits include improving organisational environmental and social performance and being regarded as a sustainable organization (Herremans & Herschovis 2006b; James, P. & Bennett 1994). The following section provides definitions of measures to reduce confusion of key terms used, as well as describing the method of measurement of environmental and social costs within this study.

A SMAS designed by this study would help separately identify environmental data from overheads (IFAC 2005; UNDSD 2001) while collecting environmental costs of each production activity. This would create data accuracy for environmental management decisions, thus successfully improving cost efficiency and meeting GHG emissions targets. Cost information is employed to enhance internal management decisions in relation to cost reductions and carbon emissions abatement (Gadenne & Zaman 2002; Gale 2006a). As a result, best practice companies more effectively measured reductions in costs and carbon contaminants while maintaining the balance of environmental and ecological systems to improve long-term social well-being and life on earth. In the meantime, best practice companies provide more accurate cost information on environment and social impacts to incorporate in triple bottom line reporting. Leading practice in environment and social accounting systems and reporting needs to be adopted by Australian non-service manufacturing companies and all polluters.

By adopting leading practice, Australian non-service manufacturing companies would be able to fully cost total products, including environment and social impacts. Environmental and social impact costs could be accurately incorporated into financial disclosures in the form of a triple bottom line (Berkel 2003). Meanwhile, corporate social responsibility (CSR) reporting could be more precisely provided to disclose the development of society, community and public services (Gray et al. 2001; Holland 2004). Companies could become more competitive in the marketplace by promoting themselves as ‘green’ producers and socially-aware organizations (Hubbard 2009)—thus, companies could add sustainable value in the eyes of stakeholders and the public. Therefore, sub-research question 3 **is answered**.

Consequently, the data supports the first sub-research question that *current accounting systems help companies to capture and report environmental costs to support internal decision-making for reducing emissions and wastes.* Similarly, the second sub-research question that *companies are intending to change their accounting systems to meet environment and social internal decision-making needs that will support future reporting requirement* is answered. The third sub-research question relating to the extent to which *Australian manufacturing* *companies adopted leading practice in environment and social accounting system and reporting to more accurately identify and measure environmental and social impact costs for management decisions on cost efficiency inducing environment-friendly and social wellbeing* is answered. A revised conceptual model (Figure 5-10) shows the system characteristics employed by current practices of companies in their environmental and social cost identification and measurement.

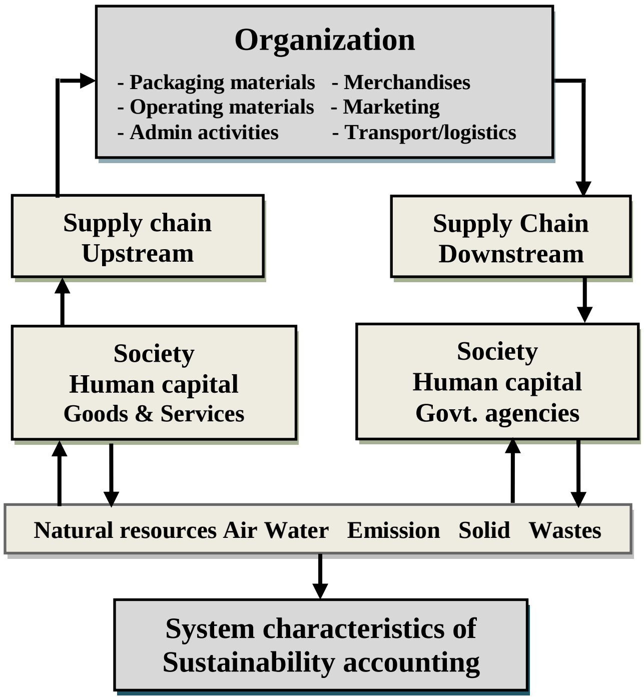


Figure 5-10 A revised conceptual framework for quantitative data - SR1, SR2, and SR3

5.5 Chapter summary

Chapter 5 has reported the results of data analysis from the secondary data (Carbon Disclosure Project) in response to questions in the survey. Descriptive statistic analysis was firstly employed to analyse non-service manufacturing sectors. Further, frequency responses to the items were analysed to provide the percentages of companies' response rates. The results of the analysis have been reported and discussed. The results of hierarchical cluster analysis have then been interpreted as variables of environmental and social performance indicators while clustering into frequency timeframes—*not at all, quarterly, monthly, half yearly*, and *yearly*. K-means analysis was considered appropriate to profile two- and four-cluster in order to compare F values of significance testing from different clusters. The results of the hierarchical cluster analysis were identified to answer the research question, as well as supporting findings of sub research-questions 1, 2, and 3 (see Table 5-18 for a summary of findings of sub-research questions). A summary of measurement procedures of sub-research questions and their source of data collection and instrument is provided in Appendix 5. The following chapter (Chapter 6) reports on analysis results of benchmarking model in qualitative methods.

Table 5-18 A summary of findings of sub-research questions

Research question *RQ1:* What system characteristics could companies employ in designing a SMAS to meet the needs of EMA and SMA practices while adding sustainable value to an organization?

Research question' s findings		Propositions	
Sub research questions	**Areas of measurement and findings**		
SR1: *To what extent do current accounting systems capture and report environmental costs to support internal decision making for reducing emissions and wastes?*	**Current system characteristics or management accounting system** - Environmental data was identified and measured from production processes and external organizations including physical quantities (e.g. materials, energy, water, wastes, and emissions) - Environmental data was used as internal management decision strategies to estimate reductions in cost and carbon contaminants as well as establishing environmental management programs - Cost information of environment was incorporated in financial disclosures to disclose internally and externally	***P1:***	**A designed SMAS conceptual model for sustainable organizations**
SR2: *How are companies intending to change their accounting systems to meet environment and social internal decision making needs that will support future reporting requirements?*	**Environment and social internal decision making** - Changing management accounting systems/practices for environmental identification and measurement would create more accurate cost information -Social data would be more precisely measured from benefits provided to support employee life, working performance, community fulfilment, and social well-being - Cost information would support internal management decisions in relation to cost savings, environmental prevention, community development, as well as supporting reporting purposes.	***P2:***	
SR3: *To what extent is leading practice in environment and social accounting systems and reporting being adopted by non-service manufacturing companies in Australia?*	**Economic, environmental, and social performance** - Cost efficiency – lower levels of energy usage, less carbon emission, decrease in production costs - Environmental friendly – reducing GHG emissions in the air, avoiding natural resources extraction and ecological damage - Social well-being – improving quality of employee life, supporting community benefits, and - Corporate social responsibility – disclosing accurate sustainability reporting - Meeting the requirement of the NGER and GRI	***P3:*** ***P4:***	

CHAPTER 6: QUALITATIVE STUDY

The contribution of this study is the design of a conceptual model of a sustainability management accounting system (SMAS) for environmental and social cost identification and measurement based on exploratory study. The results of an investigation into management accounting best practice for environmental and social data are expected to support the design of a SMAS conceptual model. A SMAS would provide a holistic system of management accounting practice for more accurate cost information on environmental and social impacts. This study seeks to examine fifteen cases selected from different manufacturing sectors to identify management accounting activities in accordance with the research aims outlined in Chapter 1.

Firstly, this chapter provides the background to the case studies and key performance of benchmarked companies to briefly describe the characteristics of management accounting activities of each case. Then, a benchmarking procedure is provided to *define* management accounting practices for environmental and social data identification and measurement in order to *measure* data accuracy of environment and social impacts. This measure is also relevant to the development of internal decision-making on cost savings and GHG emissions reductions to add shareholder value in the eyes of stakeholders and the public. Next, appropriate management accounting practices of cases were *analysed* and compared against international firms (benchmarking companies) to meet best practice. The results of the survey are employed to support the analysis to ensure best practice is achieved. A brief discussion follows on *improving* current management accounting practices by applying a SMAS conceptual model. Finally, a summary of the chapter is presented.

6.1 Case study and key performance of benchmarked companies

Fifteen case studies were selected from fifty-three Australian companies that responded to the Carbon Disclosure Project questionnaire, and purposive sampling methods were adopted to identify those companies meeting the aims of the study. These companies were from manufacturing sectors identified in the survey, namely, five from the petroleum, coal, chemical and associated product manufacturing sector (n=5, 33.3%); followed by three companies from the mining and metal product sector (n=3, 20%) (Table 6-1). Also included were two companies from the food, beverage and tobacco sector (n=2, 13.3%) and two companies from retail trade (excluding motor vehicles and motorcycles; repair of personal and household products) (n=2, 13.3%). In addition, three companies were from the sectors of electricity and gas supply (n=1, 6.7%), construction (n=1, 6.7%), and air transport (n=1, 6.7%). These companies were selected from responses to the Carbon Disclosure Project questionnaire (CDP 2009). Chief accounting officers, chief financial officers and corporate management teams dealing with environmental and social issues participated in the interviews.

Table 6-1 Descriptive statistic results of industry sectors

Descriptive statistic of industry sectors

Manufacturing sectors	**ANZSIC Code**	**Frequency**	**Valid Percent**
Metal and mining product manufacturing	080-091	3	20
Food, beverage, and tobacco manufacturing	121-122	2	13.3
Petroleum, coal, chemical and associate product manufacturing	170-184	5	33.3
Electricity, gas, and water supply	261-292	1	6.7
Construction	301-329	1	6.7
Retail trade of food and repair of personal and household goods	411-412	2	13.3
Air transport	490-500	1	6.7
Total		**15.0**	**100.0**

After obtaining consent for the interviews, the researcher contacted participants to schedule and conduct telephone interviews and tape record the responses. By using multiple cases from different sectors, it assisted in creating a deeper understanding of management accounting practices from various business activities (Yin 1993, 2009) while enriching data collection (Patton 1990). Inductive analysis methods were considered appropriate to conduct the in-depth interviews in order to detect patterns of management accounting practices and system characteristics, along with benchmarking models. Industry sectors were analysed based on whether companies are state-wide (n=7, 46.7%), interstate (n=5, 33.3%), or international (n=3, 20%) (Table 6-2).

Table 6-2 Descriptive statistic of industry sectors and companies' backgrounds

	Frequency	Percent
Industry sector		
State wide	7	46.7
Interstate	5	33.3
International	3	20.0
Total	**15**	**100.0**
Role / position title		
Chief accounting	7	46.7
Management accountant	3	20.0
Sustainable management teams	5	33.3
Total	**15**	**100.0**
Education background		
Accounting	7	46.7
Finance	5	33.3
Economic	1	6.7
Environmental science	2	13.3
Total	**15**	**100.0**
Work experience in accounting		
Less than 1 year	3	20.0
1 to 5 years	2	13.3
6 to 10 years	7	46.7
Up to 10 years	3	20.0
Total	**15**	**100.0**

As shown in Table 6-2, participants' backgrounds were analysed from role/position in the organization which comprised chief accountant (n=7, 46.7%), management accountant (n=3, 20%), and sustainable management teams (n=5, 33.3%). The educational backgrounds of participants were examined from accounting (n=7, 46.7%), finance (n=5, 33.3%), economic (n=1, 6.7%), and environmental science (n=2, 13.3%). In relation to work experience, most participants had 6-10 years work experience in accounting (n=7, 46.7%), followed by up to 10 years (n=3, 20%) and less than 1 year (n=3, 20%). However, for the most part, participants had 1-5 years work experience only (n=2, 13.3%).

This study further analysed participants' work experience in environmental and social accounting through environmental and CSR reporting and the results ranged from 5 years or more (n=5, 33.3%), less than 1 year (n=3, 20%) and 1-3 years (n=3, 20%) (Table 6-3). In addition, this study examined work responsibility in environmental and social issues including providing sustainability reporting (n=5, 33.3%), identifying sustainable costs (n=3, 20%), and supporting community needs (n=2, 13.4%). Lastly, certification/training hours in sustainability accounting was measured from 25 hours (n=2, 13.3%).

Table 6-3 Descriptive statistic results of participants' background

	Frequency	Percent
Work experience in environmental and social accounting through environmental and CSR reporting		
Less than 1 year	3	20.0
1 to 3 years	3	20.0
3 to 5 years	2	13.3
5 years or more	5	33.3
Missing	2	13.3
Total	**15**	**100.0**
Work responsibility in environmental/social issues		
Providing sustainability reporting	5	33.3
Identifying sustainable costs	3	20.0
Supporting community needs	2	13.4
Missing	5	33.3
Total	**15**	**100.0**
Certification/training _____ hours (in sustainability accounting) in last 12 months		
25 hours	2	13.3
Missing	13	86.7
Total	**15**	**100.0**

This study also compared management accounting practices among cases to meet best practice needs, and then evaluated them against international organizations including International Business Machines (IBM), Shell and Toyota. These firms have been successful in creating eco-efficiency and/or cost savings by reducing energy consumption and GHG emissions abatement. A background to the case studies and benchmarked companies are briefly provided to describe companies' interested in measuring use and flows of natural resources to reduce carbon emissions.

6.1.1 Case studies

As case studies were selected from those companies responding to the Carbon Disclosure Project questionnaire and identified as those disclosing sustainability reports to stakeholders and the public, these sources were considered appropriate in disclosing their respective backgrounds. An initial aim of this exercise was to seek the appropriateness and preciseness of environmental and social issues of these case study companies displaying concern with improving environment and society as a whole. This study also sought to establish measurement and use of flows of material, energy, water and waste to reduce lower GHG emissions. This included companies' intent to reduce negative impacts on the environment and society while accurately identifying environmental and social data for management decision-making and reporting purposes. Concise information on company backgrounds and their on-going activities in measuring physical quantities (e.g. material, energy, water, and wastes) to reduce GHG emissions are provided in Appendix 4.

6.1.2 Key environmental and social performance of benchmarked companies

As mentioned above, this study selected three international firms from non-service sectors as benchmarked companies of leading practice. These companies are IBM (computer and business machine manufacturing sector) ANZSIC Code: 242; Royal Dutch Shell (oil and gas extraction sector), ANZSIC Code: 070; and Toyota (motor vehicle and motor vehicle part manufacturing sector), ANZSIC Code: 231. These benchmarked companies have measured use of energy consumption to reduce GHG emissions, as well as providing funding to support community development. These companies have also provided essential programs and methodologies for the development of economic, environmental and social performance. In order to create accurate cost information, environmental and social data has been incorporated in sustainability reporting to support stakeholder demands and the public interest. Although these companies removed large volumes of natural resources, energy and water, they are concerned with taking environmental and social issues into account by reducing negative impacts on the environment and society. These companies appropriately managed use and flows of unit inputs (material, energy, and water) to create lower levels of wastes, emissions and/or waste disposal to avoid harm to ecological systems and all life on Earth.

IBM has significantly managed lower levels of energy usage to support its operating processes (CDP 2009) (Table 6-4). The company saved $310 million in energy costs, while being involved in energy consumption and GHG emissions abatement programs provided by the U.S. Government (IBM 2008b). This resulted in the company being a leading exemplar in creating energy efficiency and environmental management. IBM was also concerned with resources conservation and reduced energy consumption, thus avoiding harm to environmental and ecological systems (CDP 2009). Climate change strategies were created as part of their environmental prevention programs to reduce environmental damage from resources extractions and carbon emissions.

Table 6-4 Key environmental performance - IBM

Key Environmental performance indicators of IBM	Best practice companies for sustainability organization
Company successfully developed energy efficiency while supporting U.S. EPA to create the Energy Starr Computer Program and criteria in 1992.	This program has been recognized and used around the world to help in energy consumption reductions while collecting data sources of energy use into data centres to measure GHG emissions reductions.
IBM also collaborated with the World Resources Institute to develop the GHG Protocol as international accounting tool for quantifying and managing GHG emissions.	The GHG Protocol has been a widely-employed international accounting tool for government and business leaders to create better understanding in using GHG emissions factors for the measurement of GHG emissions in tonnes of CO_2 equivalent.
In 2000, IBM worked with the WWF (World Wildlife Fund) to develop Climate Servers. Climate Servers has become best practices in creating energy efficiency and climate protections	IBM was recognized by WWF as the first generation in Climate Servers program while becoming a technical service provider in developing GHG emission inventories. IBM was also recognized as a comprehensive climate change strategies' organization, as well as successfully managing climate change protections
As IBM was a charter member of U.S. EPA industry-government partnership, IBM has been recognized as a corporate environmental leader by EPA under U.S. EPA Climate Leader Program.	IBM's annual environmental reports have met the comprehensive climate change strategies. This resulted in climate change strategies of IBM being implemented in U.S EPA Climate Leader Program
IBM was a charter member of the World Resources Institute's Green Power Market Development Group established to create cost-competitive green power by aiming to enhance a clean energy future in 2010.	IBM was recognised by WRI's GPMDG as its use of energy and lower level of GHG emissions met the cost-competitive green power in 2009.
In 2003, IBM was a charter member of Chicago Climate Exchange (CCX) to experience measuring GHG emission reductions of market-based cap and tread schemes while volunteering for GHG emissions initiatives.	IBM has successfully measured GHG emissions reductions 16.5 percent which was higher than commitment (4.25%) by the end of 2007. This resulted in GHG emissions in tonnes of CO_2 equivalents being reduced. Company has reported environmental performance disclosures to the Carbon Disclosure Project (CDP) since 2003.

Source: Carbon Disclosure Project (CDP 2009)

Furthermore, key environmental performance of Royal Dutch Shell has led to their recognition as a lower carbon emission firm. Shell is considered a sustainable organization that produces 'green' products to reduce harmful effects on the environment (CDP 2009). The company reduced volumes of CO_2

emissions in production processes while becoming an environmentally-friendly organization in the eyes of stakeholders and the marketplace (CDP 2009). Key environmental performance of Royal Dutch Shell is provided in Table 6-5.

Table 6-5 Key environmental performance - Royal Dutch Shell

Key Environmental performance indicators of Royal Dutch Shell	Best practice companies for sustainability organization
Shell has created cost efficiency from lower energy plans such as converting plants to bio-fuels.	This has helped a company to reduce CO_2 emissions and create cost savings in long-term
Shell has established lower CO_2 sources of energy to reduce lower carbon emission based on road transport vehicles. Company has continued using potential technology to capture large scale CO_2 emissions and storage underground of CO_2 emissions.	This concept has informed government to provide regular frameworks and support to pursue demonstration plans or projects. Shell has created business opportunities and competitive advantages from cost efficiency when reducing CO_2 emissions.
Company has introduced less carbon emission products to the markets while meeting the GHG emission reduction targets since 2008.	This concept has helped costumers to use less energy and reduce CO_2 emissions while inspiring them to realize saving on fuel consumption by changing driving habits. Customers could be able to enhance fuel efficiency and lead to cost savings and resources preservations.
Shell has also created low CO_2 group to take business downstream emissions into account along with carbon management strategy. In the meantime, company has continued working with government, industries, and nongovernmental organizations (NGOs) to support changing energy consumption systems.	Company has invested capital on CO_2 emissions abatement to meet CO_2 emissions reduction targets. Research and development has been conducted tracking CO_2 reductions to help create marketing opportunities.

Source: Carbon Disclosure Project (CDP 2009)

This study selected Toyota to identify its key environmental performance and sustainable development as a benchmark company. This was because Toyota has produced vehicles that significantly consume less fuel to create lower levels of carbon emissions. This company also created energy efficiency in production processes, thus reducing resource extractions and environmental and ecological damage. Table 6-6 shows key environmental performance of Toyota—which this study recognized as a best practice company in reducing energy consumptions and carbon emissions abatement, both from production processes and vehicles, to support market demands.

Table 6-6 Key environmental performance - Toyota Motor

Key Environmental performance indicators of Toyota Motor	Best practice companies for sustainability organization
Response to fuel efficiency: Toyota developed Fuel Efficiency Standard Program to reduce fuel consumption in all types of vehicles produced by company. This program has helped company to meet fuel consumption efficiency in 2010.	Toyota has been known as a special supervisor on environmental global warming issues in Japan, USA, and European countries. In addition, the chairman of Toyota was a member of the Comprehensive Energy and Resource Research Committee established by the Ministry of Economy in Japan. Moreover, Toyota's vice- chairman has actively worked on environmental and climate change issues as a member of Competitiveness-Nippon.
Green taxation systems: Toyota created carbon tax incentive for high fuel consumption and lower emission cars in many countries. In Germany, for example, company has introduced vehicle taxation systems based on lower volumes of CO_2 emissions while making all efforts to take responsibility for environmental protection and natural resource extraction.	This concept was set as company's policy to appropriately deal with environmental and climate issues. As a result, company was recognized as an environmentally-friendly organization and quality product design in the eyes of stakeholder and Toyota cars users around the world.
Response to exhaust gas: Toyota introduced Exhaust Emissions Standards in Japan, 2005. Toyota has produced large volumes of vehicle that meet the Exhaust Emissions Standards needs – low exhaust gas vehicles and less exhaust emission. Company has redesigned vehicles and production processes thus meeting Exhaust Emission Standards needs of total production.	Toyota also made major changes in vehicle design to reduce particulate matter (PM) and nitrous oxides (NOx). This was a major challenge in reducing carbon emission from diesel engines. However, company significantly met the requirements of Exhaust Emissions Standards by reducing lower NOx and PM.
Response to energy efficiency: Toyota introduced alternative fuel consumption in production processes while promoting environmentally-friendly vehicles and intensive reduction in vehicle fuel consumption around the world.	In many countries, company introduced less energy consumption models that were compatible with Ethanol10, 20, and 85. Company working forward to actively introduce vehicles that are running on ethanol mixed and/or ethanol standalone fuels.

Source: Carbon Disclosure Project (CDP 2009)

To meet the needs of sustainable organizations, this study further identified key social performance of international firms to analyse best practice companies. Table 6-7 provides key social performance of benchmark companies, beginning with International Business Machines which provided essential programs to fulfil community development, including English reading skills and supporting business knowledge and skills for future careers (IBM 2008b). IBM also supported coaching and training programs to improve their business management skills, while adding value to their social and economic performance.

Table 6-7 Key social performance - IBM

Key Social performance indicators of IBM	Best practice companies for sustainability organization
In 2006, IBM generated Reading Companion Grant Program to develop students' English reading skills, as well as creating students' interest in reading.	Reading Companion Grant Program helped development of students' reading and pronunciation skills in Mexico. This has supported students in being more confident in computer skills and literacy.
In 2008, IBM incorporated Service Science Management and Engineering (SSME) education into national curriculum in Egypt, Malaysia, Philippines, and Vietnam. SSME has combined business management skills relating to social and technology development to enhance working performance in developing countries.	SSME was recognized as the strongest contributor to maintaining the development of economic performance. This was because SSME has provided students with a new learning pattern to improve higher knowledge and skills to be ready in future careers. After initially launching scheme in seven countries, SSME now in 50 countries offering courses and degrees with 250 universities.
In 2009, IBM joined World Community Grid and Childhood Cancer supporting research to complete a new World Community Grid project in two years.	This World Community Grid project discovered global issues to help improvement in clean energy, reducing world hunger, preventing dengue fever and the H1N1 and HIV/AIDS viruses.

Source: corporate social responsibility (IBM 2008a)

In addition, the social performance of Royal Dutch Shell identified by this study was relevant to costs/expenditure that the company provided to improve local communities and support supplier development programs. These programs helped local communities set up small businesses, while creating careers for those in local communities where the company operates. Funding by Shell to support health and safety programs for employees during working hours aimed to improve the quality of employees' lives and their living standards. Subsequently, these programs reduced negative impacts on society and local communities within which the company operates. Thus, sustainability development by Shell resulted in the company being recognized as a socially-aware organization creating value to local communities and social well-being (Shell 2009) (Table 6-8).

Table 6-8 Key social performance - Royal Dutch Shell

Key Social performance indicators of Royal Dutch Shell	Best practice companies for sustainability organization
Shell developed local supply chain and community by helping local suppliers set up business and sell Shell's products and services in Canada, Oman, and Russia, in 2005.	By supporting local communities and suppliers, Shell significantly reached its sustainability goals. Company has brought significant value to local community by helping local suppliers to support energy demands.
Company worked with local contractors to hire local employees while providing business coaching and training programs to develop working performance.	These programs not only helped local businesses to reach their business goals, but also to improve knowledge and skills of local employees.
In 2005, company also supported female-owned businesses in USA and provided economic empowerment programs in South Africa. The purposes of these programs were to help local communities in low and medium income countries to own businesses.	Shell created value to local community thus giving greater opportunities for minorities and women. This helps in reducing unemployment rates in areas where the company operates.
Currently, Shell launched sustainability programs health, safety, security, environmental and social performance (HSSE & SP) to reduce injury rate during working hours. This program mainly helped development of communities in areas where the company operates.	HSSE & SP supported community development by providing road safety programs supporting government regulations in Vietnam. In 2008, the rates of motorcycle deaths were considerably reduced in Vietnam. In 2009, company records show lower rates of injury and death.

Source: Royal Dutch Shell's sustainability report (Shell 2009)

Furthermore, the social performance and sustainable development of Toyota Motor Australia is provided in Table 6-9. This study considered the social development of Toyota as a key performance of social development including cash donations and funding provided to enhance the quality of local communities and their living standards. Social development programs were identified from sport sponsorships, education, environment, and community services. This supported the company to create local management strategies throughout their business practices and production systems (Toyota 2009). Connecting community programs assisted Toyota in creating great relationships with local artists and local business activities in the areas in which the company operates (Toyota 2009). These programs significantly improved the local economy and social well-being.

Table 6-9 Key social performance - Toyota Motor

Key Social performance indicators of Toyota Motor	Best practice companies for sustainability organization
Toyota has supported the Australian community by providing employee and dealership participation programs for local community development. This local community program has included sport, environment and community services.	Toyota's local community development program was used by London Benchmarking Group (LBG) to identify best practice in supporting community and society.
Community investment project is also relevant to Conservation Volunteers Australia program that aims to provide transport and safety gear for volunteers from the company. This program has focused on environmental management and protection for local community in surrounding areas.	These programs have supported Toyota in building greater relationships with the local community and created long-term sustainable benefits to reduce negative impacts on society and the environment.
This program was identified as the company's contribution to community thus sponsoring National Tree Day programs, Victorian bush fire donations, Toyota Good For Footy, Toyota Cup, and Fraser Island Annual Clean Up Weekend and Fishing Expo.	Toyota has played a significant role in developing quality of life of young local communities and their living standards. This has helped the company to promote sustainable organizations in the eyes of the public and the marketplace.

Source: Toyota's sustainability report (Toyota 2009)

6.1.3 Key performance indicators of NGER and GRI

As management accounting best practices of cases were examined to support the development of a SMAS conceptual model (study's contribution), environmental and social performance indicators required by the NGER were based on investigation into energy consumption and GHE emission abatement. This included management accounting systems/practices employed by cases for the measurement of energy reduction and GHG emissions abatement. In order to meet best practice for environmental performance, the study aimed to ensure that companies (case studies) have decreased total volumes of energy usage while meeting GHG emission reductions targets. For key performance indicators of GRI, environmental and social performance, the cases were compared against performance indicators required by the GRI to meet the needs of best practice companies. Environmental and social performance indicators provided by companies to support sustainability reporting are expected to meet the requirements of the Global Reporting Initiative (GRI).

Key performance indicators required by the NGER are drawn from measurement tools and procedures for capturing total volumes of energy consumption and reductions in GHG emissions from energy and emissions in production processes. The reporting systems of the NGER include facility thresholds—GHG emissions in tonnes of CO_2 equivalents, energy production and energy consumption. Thus, to meet standards of best practice companies, cases needed to provide environmental reports incorporating GHG emissions and energy data from all sources of facilities. Each facility must be under the control of operations and must be involved in the controlling corporation and its member group (Department of Climate Change 2009). Table 6-10 provides key performance indicators required by the NGER used by this study.

Table 6-10 Key requirements of measuring GHG emissions and energy consumption

Key Requirements of the National Greenhouse Emission Reporting	
Key requirement	**Regulations of fuels and energy consumption**
Identify sources of GHG emission in tonnes of CO_2 equivalents	GHG emission created from burning fossil fuel to produce products and transports of products GHG emission created from operating processes including natural gas consumption Fugitive GHG emission from transporting purposes Wastes generated in production processes
Energy consumption and production	Measuring total volume of solid fossil fuels and coal based products Identifying use of fuels derided from recycled materials Capturing primary solid biomass fuels, fossil fuels, natural gas for combustion, oil, petroleum, bio fuels, petrochemical feedstock, and energy products
Energy consumption for transport of products	GHG emission must be measured at the state where vehicles are filled up. Energy consumption
Measurement tools/ methods of GHG emissions and energy consumption	There are four methods provided by the NGER – default methods using along with the National Greenhouse Accounting (NGA) – a facility-specific method applying along with industry sampling and Australian and/or international standards listed in the determination or equivalent for analysis – a facility-specific method using Australian or international standards listed in the Determination or equivalent standard for both sampling and analysis of fuels and raw materials – direct monitoring of emission systems, on either a continuous or a periodic basis
The measurement of incidental sources of GHG emissions	The measurement tools/methods can be selected by firms to identify GHG emissions and energy by sources and energy types

Source: Department of Climate Change (2009, p. 41-43)

This study identified key performance indicators of environment and community (social impacts) required by GRI to analyse best practice companies along with the key performance of the NGER. Key environmental performance indicators of GRI were identified by measuring total levels of energy consumption and water usage in production processes. This included the measurement of direct/indirect emissions, wastes and/or disposal wastes from production processes, and transport of products/materials, as well as emissions from business travel. Meanwhile, key social performance indicators include community support and sponsorships such as providing expenditure to support community development programs. Thus, to meet the criterion of a best practice company, cases should incorporate environmental and social data in their sustainability reporting, thus disclosing development of environmental and social performance to stakeholders and the public (Berkel 2003). Table 6-11 provides key performance indicators of environment and community required by GRI.

Table 6-11 Key environmental and social performance indicators of GRI

Key performance indicators of Global Reporting Initiative (GRI) requirements			
Environmental performance		**Social performance**	
Indicator		**Indicator**	
Energy	Measuring direct/indirect energy consumptions from primary sources	Community	Identifying community development/support program to bring benefits to community where a company operates
	Measuring energy saved and improvement in energy efficiency		
	Providing energy efficiency program and/or renewable energy plan		Providing community healthcare and safety programs to prevent serious diseases, to reduce negative impacts on environment and ecological system that affect local community in surrounding areas
	Identifying energy reduction targets		
Emissions	Measuring total direct/indirect energy in tonnes of CO_2 equivalents		
	Measuring other sources of GHG emissions in tonnes of CO_2 equivalents		
	Providing GHG emission reductions plan/projects		Providing voluntary programs including employees' time, donation, training, educational facilities, and/or other associated benefits relating to a company operating to develop economic efficiency and create careers for local community
Water	Measuring total volume of water used by sources		
	Identify percentage and total volumes of reused water		
Waste	Measuring total volume of wastes, disposal wastes, hazardous, and or other significant spills		

Source : Society Performance Indicators (GRI 2010a) and Environment Performance Indicators (GRI 2010b).

6.2 Benchmarking procedure

In examining best practice companies, this study used a benchmarking model adopting DMAIC improvement cycle process of Lean Six Sigma as an appropriate measurement tool for qualitative data analysis (discussed in chapter 4). The benchmarking model aims to examine the appropriateness of environmental and social cost identification and measurement in meeting the needs of best practice companies. This benchmarking model includes *Define, Measure, Analyse, Improve,* and *Control*. Nonetheless, the *control* process was outside the scope of the study and was not undertaken as the SMAS conceptual model was not implemented. Thus, this study considered *control* as unnecessary.

6.2.1 Define (D)

This study began with defining management accounting practices and systems of fifteen cases to detect accounting patterns in measuring, identifying and capturing costs of environment and social impacts that could meet best practice needs. Companies could appropriately measure and identify environmental and social data before allocating to cost centres of each production activity (Jasch 2009). Environmental and social data could be separately captured from overheads to create more accurate accounting information for management decisions and reporting purposes (IFAC 2005). Companies could successfully manage use and flows of unit inputs (material, energy, water, and wastes) to estimate reductions in costs and carbon contaminants (Gale 2006a). Also, social costs could be measured and controlled to reduce negative impacts on society, employees and the environment (Gray & Bebbington 2001; Mook, Richmond & Quarter 2003). As a consequence, companies would be able to provide more accurate cost information to support reporting for internal decision-making and enhanced external disclosure initiatives (Gadenne & Zaman 2002). Thus, companies could meet their reporting obligations on energy consumption and emission abatement to the NGER and GRI. Proposition1 was posed to examine management accounting practices and systems characteristics employed for environmental and social cost identification and measurement.

> ***P1:*** *Best practice companies identify costs of environment and social impacts, as well as measuring reductions of contaminants to reduce negative impacts on humans, society, employees and the environment.*

To answer **Proposition 1**, this study defined current management accounting practices and systems of cases that could provide companies with a way to successfully improve environmental and social performance—thus ensuring sustainable organizations. Interviews conducted with fifteen participants sought to establish appropriate management accounting practices employed for cost identification and measurement of environment and social impacts. Companies appear to be in the early stages of environmental and social cost dimensions, thus only recently disclosing sustainability reporting to stakeholders and the public. There were different sources and types of management accounting relating to environmental and social systems employed by the fifteen cases and these are listed in Table 6-12.

Table 6-12 Sources/type of environmental and social systems and motivation of cost measurement

	Frequency	Percent
Sources of environmental and social system		
Bought off the shelf	3	20.0
Developed internally from scratch	7	46.7
Modified system	4	26.7
Missing system	1	6.6
Total	**15**	**100.0**
Types of environmental and social system		
Separate/ standalone system	6	40.0
Integrating system with financial/ management accounting	8	53.3
Missing system	1	6.7
Total	**15**	**100.0**
Motivated company to capture environmental and social data for sustainability reporting		
NGER and/or GRI	8	53.3
Missing System	7	46.7
Total	**15**	**100.0**
Board initiated	13	86.7
Missing System	2	13.3
Total	**15**	**100.0**
Corporate social responsibility initiative	15	100.0
Missing System	0	0
Total	**15**	**100.0**

Table 6-13 shows that systems were bought off the shelf (n=3, 20%), developed internally from scratch (n=7, 46.7%), or modified (n=4, 26.7%). Types of environmental and social systems were separate/standalone systems (n=6, 40%) and integrated systems with financial/management accounting (n=8, 53.3%). This study also analysed motivation of companies to capture environmental and social data for sustainability reporting in line with NGER/GRI requirements (n=8, 53.3%), or board initiated (n=13, 56.7%). Companies captured environmental and social data to comply with corporate social responsibility (CSR) reporting systems (n=15, 100%).

This study found that cases reported environmental data yearly (n=7, 46%), monthly (n=6, 40%), and half yearly (n=1, 6.7%). For social cost, these cases reported yearly (n=8, 53.3%) and monthly (n=6, 40%) (Table 6-13).

Table 6-13 Environmental and social cost reporting frequency

Descriptive statistic of environmental and social cost identification		
	Frequency	**Percent**
Environmental cost identification		
Yearly	7	46.7
Half yearly	1	6.7
Monthly	6	40.0
Missing	1	6.6
Total	**15**	**100.0**
Social cost identification		
Yearly	8	53.3
Monthly	6	40.0
Missing	1	6.7
Total	**15**	**100.0**

This study further tabulated management accounting practices for environmental and social data to define cost identification and measurement of fifteen cases (Table 6-14). This was to identify those that implemented management accounting of environmental and social systems for environmental and social cost identification and measurement. The table also shows that cases captured costs of physical quantities such as energy consumptions, while environmental data was collected from costs/expenditure provided for environmental management and energy reduction programs. Companies also measured social expenditures provided to support community development, including benefits and services for local communities in surrounding areas. Meanwhile, companies indicated that environmental and social data was not separated from overheads.

Table 6-14 Defining management accounting practices/systems

Case	Implementing environmental and social systems to capture costs of environment and social impacts					
	Costs of physical quantities e.g. materials, energy, water, waste, and/or emissions	**Other sources of**				**Separating cost from overheads**
		Environmental data	**Timeframe**	**Social data**	**Timeframe**	
1	In process of capturing energy consumption in production sites	Expecting to capture cost of environmental management and prevention	-	Expecting to support community development	-	No
2	Capturing physical quantities from total volumes of energy types used in production processes	Environmental management and prevention	Monthly	Health insurance and external study assistance support	Monthly	No
3	Invoices of energy, water, and waste consumption	Costs associated with environmental management projects	Monthly	Local and community support	Monthly	No
4	Levels of energy and fuel consumption in producing sites	Costs associated with energy reduction activities	Yearly	Community skill scholarships e.g. training, educational facilities and career development. Road safety programs for local community.	Yearly	No
5	Levels of energy and water consumption in production processes	Costs provided for future GHG emissions reductions and environmental management	Monthly	Community development, respective local economy	Monthly	No
6	All relevant resource use (electricity, gas, fuel, etc) and waste generation data from direct download, as flat file, from existing systems.	Cost provided to support carbon emission projects	Yearly	Cash donation, donation in kind and hours	Yearly	No
7	Amount of electricity, gas, diesel, petrol, water consumption.	Environmental data on the sub-sites	Yearly	Community support and employees' time/ donation	Yearly	No
8	Utility bill data and fuel data, flight service provider, and applying the emissions factor associated with the energy source or fuel types	Expenditures provided to support agricultural impacts of raw material growth	Yearly	Political donations, community sponsorship and support, obesity and other social issues	Yearly	No
9	Use of liquid transport fuels	Cost of customer emissions reductions	Yearly	Administrative funding for overseas travel	Yearly	No
10	Levels of ground fuel consumption including petrol, diesel, and unleaded	Cost of environmental awareness programs	Monthly	Employment benefit programs	Monthly	No
11	Amount of diesel and fuel used in production processes	Cost provided to support greenhouse gas activities and energy conservation plan projects	Monthly	Community sponsorships, training and educational facilities or health services to bring benefits to communities	Monthly	No
12	Energy consumption invoices	Other GHG emissions is expected to capture in future	Monthly	-	Monthly	No
13	Amount of energy consumption	Cost of energy provided to support customer services	Yearly	Community development	Yearly	No
14	Amount of raw material used in the manufacture of aluminium.	Costs to explore opportunities to reduce direct emissions and improve energy efficiency	Half yearly	Sustainable community development	Yearly	No
15	Electricity purchased, natural gas, LPG, both industrial and transport, diesel, both industrial and transport, and coal.	Cost provided to support energy conservation projects	Yearly	Supporting Red Cross, cash donation to support local community and employee donation in kind of materials to maintain community benefits	Yearly	No

Furthermore, management accounting practices for measuring GHG emissions of these fifteen cases were tabulated to define calculation of carbon emissions from main sources and other sources that met NGER/GRI requirement/regulation. This study analysed GHG emissions in tonnes of CO_2 equivalent of cases from increase (n=9, 60%) and decrease (n=5, 33.3%) (Table 6-15).

Table 6-15 Descriptive statistic of GHG emissions in tonnes of CO_2 equivalent

	Frequency	**Percent**
GHG emissions in tonnes of CO_2 equivalent		
Increase	9.0	60.0
Decrease	5.0	33.3
Missing	1.0	6.7
Total	**15.0**	**100.0**

This study further tabulated measurement tools and methods employed by case studies in their environmental and social cost identification and measurement. Table 6-16 illustrates measurement tools and methods indicated by the fifteen cases employed to measure use and flows of natural resources (material, energy, water, and wastes) and to calculate GHG emissions in tonnes of CO_2 equivalent. Total volumes of GHG emissions were collected from main sources, including energy consumptions in production processes, employees' business travel, and transport of products by air, road, and rail as other sources of GHG emissions. Companies also employed cost accounting data to reduce levels of GHG emissions and energy usage in production processes.

Consequently, management accounting practices for environmental and social systems of the fifteen cases helped in the identification and measurement of environmental and social costs. Companies measured environmental costs from internal and external organizations, while identifying costs of physical aspects including material, energy, water, and wastes and unit outputs (e.g. emissions, wastes, disposal wastes) to estimate reductions in costs and carbon contaminants. Social data was collected from expenditure associated with community development and support. Companies measured reductions in GHG emission reductions, while providing social expenditures to improve society and community development.

Table 6-16 Defining measurement of GHG emissions

Case#	Calculating GHG emission in tonnes of CO_2 equivalents from		GHG emissions reductions that meet requirements of the NGER and/or GRI		
	Main sources of GHG emissions	**Other sources of GHG emissions**	**Measurement tool/methodologies**	**Measurement procedures**	**GHG emission**
1	In progress	In progress	In progress	Not yet reported	-
2	Company expects to use turnover as base to measure associated direct and indirect GHG emissions	- None - Company will capture employee air travels in future	National Greenhouse Accounting (NGA) factors along with Global Warming Potential calculation	Using NGA emissions factors as internal mythologies to measure GHG emissions	Decrease
3	Volume of fuel consumption and quantity of electricity used in production processes	Employee and business travel and transport of products	NGER measurement and technical guidelines	Using emission factors to measure reductions in energy consumption and GHG emissions	Increase
4	Volume of energy consumption of all major production activities of company	Business air travel emissions, taxi travel emissions, vehicles	WRI/WBCSD Greenhouse Gas Protocol	Using emissions factors and default factors to calculate GHG emissions from business air travel. Taxi travel is calculated based on financial records., and vehicle provided for employees	Decrease
5	Energy and water usages in production processes	Business air travel	Using developed spreadsheets along with national greenhouse accounting factors to measure CO_2 equivalent	Using spread sheets along with national greenhouse accounting factors to measure CO_2 equivalent. Carbon emission factors are employed to measure GHG emissions reduction	Increase
6	All relevant energy consumption including natural gas, electricity, fuel etc.	Employee business air travel	NGER Green Accounts Factors and in house calculation tool	Using NGER emissions factors to measure main sources of GHG emissions reductions as well as measuring all flights and distances travelled by employees	Decrease
7	All types of energy consumptions including natural gas, electricity, diesel	-	Kyoto protocol guideline is used to calculate GHG emissions along with NGER measurement as base	Measuring CO_2 has come through to natural gas consumptions and GHG emission for motor vehicle	Increase
8	Transport of raw material suppled to beverage manufacturing plants by air, road, and rails	Use of cold drink equipment (e.g. coolers, vending machine, and post –mix)	NGER Measurement Technical Guidelines	Using emissions to measure sources of GHG emission from distribution/transporting Energy factors are used to measure electricity and refrigerant leakages for GHG emission reductions	Increase

Table 6-16 Defining measurement of GHG emissions (cont.)

Case#	Calculating GHG emission in tonnes of CO_2 equivalents from		GHG emissions reductions that meet requirement of the NGER and/or GRI		
	Main sources of GHG emissions	**Other sources of GHG emissions**	**Measurement tool**	**Measurement procedures**	**GHG emission**
9	Energy used in production processes and liquid transport fuels	Emission associated with transport of products	Australian Greenhouse Office Factors and Methods Workbook	Using GHG emission factors to measure GHG emissions in tonnes of CO_2 equivalents based on the volumes for which a company paid for business activities	Increase
10	Ground fuel combustions, nature gas, and electricity	Employees' business travel	NGA emission factors	NGA emission factor is used to measure motor gasoline (petrol) or diesel (automotive diesel oil) as well as energy consumption from natural gas and electricity. This includes GHG emissions from employee business travel	Increase
11	Transport, stationary and mobile sources, emission defaults in production processes as well as industry	Commercial airline flights, employee business travel, downstream consumption of products, particularly coal and petroleum products.	NGER Greenhouse Emissions Calculation Methodologies	NGER emission factor is used to measure CO_2 from stationary combustion, GHG emission from, and production of aluminium, as well as emissions from commercial employee flights	Increase
12	Stationary energy	-	NGA factors and NGER measurement determination (2008)	NGA emission factor is used to measures GHG emissions in tonnes of CO_2-e from manufacturing energy NGER emission factor is used to measure GHG emissions created from supply chain, as expected to capture in future	Increase
13	Merchant energy, upstream gas, operating processes (offices)	Business air travel	NGER act 2007 and NGER measurement determination (2008)	NGER emission factor is used to measures GHG emissions in tonnes of CO_2-e from merchant energy (e.g. natural gas power, hydro, and solar/diesel generation), upstream gas, and corporate. NGER emission factor measures GHG emissions from business travel by air using domestic travels and other facilities provided for staff	Increase
14	Fuel combustion and facilities used in producing processes of aluminium	Domestic and international air travel	WRI emission factors	WRI emission factor is employed to measure CO_2 emission from use of fuel in facilities and production of aluminium including the measurement of CO_2 emission from business travel	Decrease
15	Electricity, natural gas, LPG, diesel, cold and other alternative fuel used in production processes	Air travel and diesel associated with transport of building materials	NGER measurement determinant (2008) Emission intensity based on revenue Metric tonnes of CO_2-e based on AU$ turnover	NGER emission factor measures CO_2, NH_4, and N_2O in tonnes of CO_2 equivalent. Invoice dates and numbers are calculated GHG emissions using GHG emission factor as base	Decrease

This shows that **Proposition1,** *best practice companies identify costs of environment and social impacts, as well as measuring reductions in contaminants to reduce negative impacts on humans, society, employees and the environment,* **is answered**. This study further measured management accounting practices for environmental and social cost identification and measurement among cases to meet best practice needs. The following section provides results of the benchmarking analysis within cases.

6.2.2 Measure (M)

The measurement processes were made to properly compare data accuracy, meet the requirements of the NGER and/or GRI, and create a sustainable organization. Interview contents were tabulated into a metric table using a key driver for a particular aspect(Coers et al. 2001) of the study for analysis. Existing management accounting practices of fifteen cases were examined for similarity, difference and/or appropriateness in measuring, identifying and analysing environmental and social data. This aimed to seek accuracy of data employed to enhance management decisions on cost reductions and GHG emissions abatement (Gale 2006a; IFAC 2005). In addition, cost accounting data needs to be accurate when used to support sustainability reporting (Gray 2006). Fifteen cases were tabulated using chronological order concept to put information into different arrays under headings provided (Yin 2009). The outstanding environmental and social systems of each case had to meet the needs of data accuracy, energy reductions and GHG emissions abatement required by NGER and/or GRI, and sustainable organizations (Table 6-17).

The results show that cases (cases#5, 8, 9, 10, 11, 12, and 13) developed management accounting systems internally from scratch for capturing environmental and social data. The systems were integrated with existing financial/management accounting systems to help capture costs of environment and social impacts. However, the systems did not help in measuring reductions in energy consumption and did not meet GHG emissions targets required by the NGER/GRI.

Table 6-17 Measurement of management accounting best practice companies

Measurement of management accounting best practice companies among cases

Env. and social system	Types of system		Implementation of environmental and social systems					Data accuracy					
			To capture costs of			To measure GHG emissions		To enhance management decisions for			To support sustainability Reporting		
Sources of system	**Separate/ standalone**	**Integrated system**	**Physical quantities**	**Env. data**	**Social data**	**Main sources**	**Other sources**	**Energy efficiency**	**GHG emission reduction**		**Env. reporting**	**Social reporting**	**Reporting year**
Bought off	Case#2	-	Case#2	Case#2	Case#2	Case#2	-	**Case#2**	**Case#2**	**Decrease**	***Case#2**	***Case#2**	2007-2009
the shelf	-	Case#6	Case#6	Case#6	Case#6	Case#6	Case#6	**Case#6**	**Case#6**	**Decrease**	****Case#6**	****Case#6**	2007-2009
	Case#7		Case#7	Case#7	Case#7	Case#7	-	-	-	Increase	Case#7	Case#7	2006-2009
Developed	Case#5	-	Case#5	Case#5	Case#5	Case#5	Case#5	Case#5	Case#5	Increase	*Case#5	*Case#5	2007-2009
internally		Case#8	Case#8	Case#8	Case#8	Case#8	Case#8	Case#8	Case#8	Increase	**Case#8	**Case#8	2008-2009
from scratch		Case#9	Case#9	Case#9	Case#9	Case#9	Case#9	-	-	Increase	Case#9	Case#9	2007-2009
		Case#10	Case#10	Case#10	Case#10	Case#10	Case#10	Case#10	Case#10	Increase	*Case#10	*Case#10	2007-2009
		Case#11	Case#11	Case#11	Case#11	Case#11	Case#11	Case#11	Case#11	Increase	*Case#11	*Case#11	2007-2009
		Case#12	Case#12	Case#12	-	Case#12	Case#12	Case#12	Case#12	Increase	*Case#12	-	2007-2009
		Case#13	Case#13	Case#13	Case#13	Case#13	Case#13	Case#13	Case#13	Increase	**Case#13	**Case#13	2008-2009
Modified	Case#3	-	Case#3	Case#3	Case#3	Case#3	Case#3	Case#3	Case#3	Increase	*Case#3	*Case#3	2006-2009
system	Case#4	-	Case#4	Case#4	-	Case#4	Case#4	**Case#4**	**Case#4**	**Decrease**	****Case#4**	-	2007-2009
based on	Case#14	-	Case#14	Case#14	Case#14	Case#14	Case#14	**Case#14**	**Case#14**	**Decrease**	*****Case#14**	****Case#14**	2007-2009
exiting financial/ management accounting		Case#15	Case#15	Case#15	Case#15	Case#15	Case#15	**Case#15**	**Case#15**	**Decrease**	****Case#15**	****Case#15**	2007-2009

Although environmental data of case#2, 6 and 8 are slightly inaccurate and in improvement process of data accuracy, social data of these cases is at accurate level
Bold cases were considered to analyse management accounting best practice compared against international firms (benchmarking companies)
*A company has captured environmental and social data **monthly** to support sustainability reporting
A company has captured environmental and social data **yearly to support sustainability reporting
*** A company has captured environmental and social data **half yearly** to support sustainability reporting

Meanwhile, case#7 bought a stand-alone system of management accounting off-the-shelf to help in the identification and measurement of environment and social impacts. Case#3 modified management accounting systems based on an existing financial/management accounting system for environmental and social cost identification and measurement. Although the system has helped in creating data accuracy, the company could not measure reductions in total volumes of energy usage and experienced difficulties in estimating GHG emission abatement. Thus, the company did not meet the GHG emission reduction required by the NGER/GRI.

In contrast, cases meeting data accuracy measured total volume of energy usage and decreased GHG emissions in tonnes of CO_2 equivalent (n=5, 33.3% - case#2, 4, 6, 14, and 15) and employed accounting data of environment (use and flow resources such energy) to create energy efficiency while having the ability to estimate reductions in GHG emissions. These companies met energy reduction and GHG emissions abatement targets; and employed different sources and types of management accounting for environmental systems to collect costs of physical quantities (e.g. material, energy, water and/or wastes). The systems provided companies with a way to identify and capture environmental and social data to create management decision strategies for reporting purposes. Case#2, for example, bought separate management accounting systems off-the-shelf to collect environmental and social data. The company created accurate cost accounting data to estimate reductions in energy consumption and GHG emissions, thus meeting the requirements of the NGER and GRI. In addition, Case#6 also bought management accounting systems/software off-the-shelf to integrate with existing financial/management accounting methods. An integrated system helped in the identification and measurement of environmental and social data while having the ability to create energy efficiency and meet GHG reductions targets.

On the other hand, case#4 and case#14 modified standalone systems based on existing financial/management accounting to help in the cost identification and measurement of environment and social impacts. Environmental and social data was captured accurately to support internal management decisions to create energy efficiency and reductions in GHG emissions, thus meeting the requirements of the NGER and GRI.

In the meantime, case#15 modified integrated systems with financial/management accounting practices for environmental and social cost identification and measurement. As the systems were modified based on existing financial/management accounting, this provided the company with a way to create data accuracy for enhancement of decision-making and support external disclosures. The company decreased total volumes of GHG emissions by measuring energy reductions in production processes. As a result, the company created energy efficiency and met carbon emissions reductions as obliged by the NGER and/or GRI.

Consequently, case#2, 4, 6, 14, and 15 were identified as best practice companies employing environmental data to enhance internal management decisions on cost efficiency and GHG emissions reductions. Companies were able to reduce negative impacts on the environment and society, thus adding shareholder value in the eyes of stakeholders and the public. These cases were further compared against benchmarked companies to meet the needs of best practices of environmental and social data identification and measurement.

6.2.3 Analyse (A)

This study analysed environmental and social data of cases that met accurate levels to compare against environmental and social data of benchmark companies (international firms IBM, Royal Dutch Shell, and Toyota Motor). An initial aim of this analysis was to evaluate best practice organizations in developing environmental and social performance. The analysis *firstly* examined the accuracy of environmental and social data which the cases captured from internal and external organizations. *Secondly*, to meet best practice, cases employed accurate data to enhance internal decision-making, as well as supporting sustainability disclosures. Environmental costs and physical aspects (e.g. material, energy, water, and/or wastes) were captured to estimate reductions in energy consumption, as well as creating lower levels of GHG emissions in production processes. Best practice companies are able to create energy efficiency and carbon emission abatement to improve financial/economic performance—as well as developing environmental and social performance, which is of significant concern to stakeholders and the public. In relation to this, social costs needed to be collected from expenditures provided for community development plans/projects. *Finally*, environmental and social costs needed to be incorporated in financial disclosures (such as preparing sustainably reporting) to add sustainable value. The analysis commenced with comparing data accuracy of cases and benchmarking companies. Proposition2 was addressed to examine data accuracy of environmental and social impact costs that companies created to enhance internal management decisions and support sustainability reporting.

> ***P2:*** *Best practice companies more accurately provide environmental and social costs information for internal decision-making and to support external reporting disclosures.*

Data accuracy

To answer **Proposition 2**, this study considered appropriate management accounting systems and practices employed to collect environmental and social data from internal and external sources to meet data accuracy. Expenditure for improvement in environment and society should be correctly identified and separated before allocating into each production activity to fully cost (Bebbington et al. 2001). This creates accurate data for companies to use in management decision strategies for the development of economic performance (cost reductions, cost savings and/or resource efficiency) when supporting company disclosures. According to the requirements of the NGER (Department of Climate Change 2009), data accuracy refers to minimizing uncertainties in measuring GHG emissions to meet 95% accuracy levels. Thus, uncertain measures of total levels of GHG emissions need to be minimized as much as possible to meet confident levels of true volumes.

For social data, expenditure/funding provided to bring benefits to the community must be captured from community development programs/projects. Invoices for any payments regarding the programs/projects must be collected to create more accurate data to utilize and enhance internal management decisions (Hazilla & Kopp 1990). To meet data accuracy needs, environmental and social impact costs need to be separated from overhead accounts (IFAC 2005) and allocated to a single production activity where theses costs are consumed (Cãpusneanu 2008). Cost information of environment and social impacts should independently appeared in financial reporting under environmental costs (Gadenne & Zaman 2002) and social impact costs (Gray 2006). Table 6-21 reports overall index of benchmarked companies and cases (best practising companies) in identifying and measuring environmental and social impact costs. The table also identifies case studies unable to meet best practice companies.

Overall, management accounting practices of benchmarked firms and best practice companies was summarized by the index of environmental and social cost identification and measurement. Based on indicator measures used in the survey, benchmarked firms identified environmental and social data for decision-making and reporting purpose at higher levels—69%, 67%, and 64%, respectively. For best practice companies, the maximum cost identification and measurement was case#2 at 71% who captured environmental and social data for management decisions and reporting purposes, followed by 35%, 33,%, and 31% of case#6, 15, and 4. Although, case#14 was at the lowest scale, it did significantly meet the needs of data accuracy for management decisions and external reporting initiatives. On the other hand, details of cases not meeting best practice needs are provided in Table 6-18.

For the cases meeting the needs of best practice companies, applied stand-alone systems were modified from existing management accounting practice in kind of spreadsheets to provide those companies with a way of creating data accuracy. The systems capture costs of physical quantities (e.g. material, energy, water and/or wastes) and calculate direct/indirect GHG emissions within the production processes and external to the organization appropriately.

Table 6-18 Overall index of environmental and social cost measurement

Overall index of cost identification and measurement			
	Environmental cost (%)	**Social cost (%)**	**Total (%)**
Benchmarked company			
IBM	**36**	**33**	**69**
Royal Dutch Shell	**31**	**33**	**64**
Toyota Motor	**33**	**34**	**67**
	Environmental cost (%)	**Social cost (%)**	**Total (%)**
Best practice company			
Case#2	38	33	71
Case#4	15	16	31
Case#6	19	16	35
Case#14	15	15	30
Case#15	13	20	33
	Environmental cost (%)	**Social cost (%)**	**Total (%)**
Case study			
Case#1	9	4	13
Case#3	10	6	16
Case#5	10	9	19
Case#7	10	16	26
Case#8	12	16	28
Case#9	10	16	26
Case#10	8	6	14
Case#11	8	6	14
Case#12	9	7	16
Case#13	14	14	28

Companies measured costs of environment and social impacts to support environmental and social performance disclosures. Data collected from materials and energy consumption using emission default factors was employed to calculate direct/indirect GHG emissions in tonnes of CO_2 equivalents. Direct/indirect GHG emissions were captured from energy consumption as main sources used to support production processes. Companies also identified employee and business travel by air and land as other sources of GHG emissions created from external business activities. Participants described processes/methods of capturing environmental and social data as follows:

> **Case#2:** 'We used standalone system along with NGA emissions factors for GHG calculation to measure energy consumptions that are broken down by energy type. We identified total volumes of energy consumption by energy type from each production process as main sources of GHG emissions. Although we do not capture other sources of GHG emissions from associated activities of employee and business travels ant GHG emission, we are planning to capture in future. We provided budgets for energy and GHG emission reductions programs. This included less water consumption and waste generation projects. We also provide financial supports for health insurance and external study for local community where a company operates'. [Participant was a management accountant.]

Case#4: 'We modified separate system and applied default and specific factors along with WRI/WBCSD Greenhouse Gas Protocol for GHG emissions calculation to measure energy consumptions from all major sources of production activities. We identified total volumes of energy consumptions of all major production activities. We captured other sources of GHG emissions created from business air travel emissions, taxi travel emissions, vehicles. We provided renewable energy projects to reduce direct energy consumption throughout GHG emission reduction in future. Our company provided funding to support scholarship programs for 20 local communities in central southern Queensland'. [Participant was a chief accounting officer.]

Case#6: 'We created in-house inventory calculation tool and employed all relevant emission factors and methodologies from NGER to measure GHG emissions to measure energy and fuel consumption. We identified total volumes of GHG emissions from all sources of energy consumptions (main sources) and employee business travel by air (other sources of GHG emissions). We provided GHG emission reduction projects to estimate reductions in GHG emissions in tonnes of CO_2 equivalent. We provided cash donation and time donation to support community development'. [Participant was a chief accounting officer.]

Case#14: 'We modified a separate system while applying WRI emission factors for GHG calculation to measure amount of raw material used in manufacturing aluminium metal[6]. GHG emissions were collected from all types of fuel consumptions and facilities used in producing processes of aluminium, as main sources. GHG emissions were also collected from other sources – domestic and internal national air travel. We provided costs to explore possible opportunities to reduce lower levels of energy consumptions and GHG emissions. We provided social expenditures to support sustainable community development programs. This has been set as a policy to support stakeholders' demands for community needs'. [Participant was a chief accounting officer.]

Case#15: We used in-house calculation along with National Greenhouse and Energy Reporting (NGER) measurement to measure electricity, natural gas, LPG, diesel, and coal. We calculated GHG emissions from all sources of energy consumptions in production processes and other sources including business air travel and diesel used for transport of building materials[7]. We provided energy efficiency programs to create carbon emission efficiency. We also provided community development expenses, cash, and material donation to re-build harming local community'.[Participant was a chief accounting officer.]

Companies modified management accounting systems separately from scratch, while using in-house spreadsheets to collect environmental and social data from internal and external organizations. Energy consumption and raw material (case#14) were measured to identify reductions in costs and carbon contaminants. Case#14 described the process of creating data accuracy of environment for materials used in production processes. In the meantime, GHG emissions were collected from the main source (total volume of energy usage) and other sources including transport of materials. This resulted in companies appropriately

[6] Case#14 is only company in five best practice firms that identified total volume of materials used in producing process to estimate reductions in energy consumptions and emissions abatement.
[7] Case#15 was identified as a best practice company that captured other sources of GHG emissions from diesel used for transport of building materials.

identifying costs/expenditures in relation to the development of environmental performance.

Accurate accounting data was employed for management decision-making and to incorporate into companies' disclosures to support demands of stakeholders and the public. In addition, companies collected environmental expenditure to support energy reduction and GHG emissions abatement programs. This included capital invested in exploring potential opportunities to reduce use of energy and lower the level of GHG emissions in production processes. Furthermore, a matrix comparison in Table 6-19 shows that that best practice companies met data accuracy needs **(Yes)** in creating accounting data of environment and social impacts.

Table 6-19 Results of a matrix comparison of data accuracy

Firm	Data accuracy					
	Calculating GHG emission in tonnes of CO_2-e				Capturing other sources of	
	Calculation tool/ measurement	Cost of physical quantities	Capturing GHG emissions from		Env. impacts	Social impacts – community development for
			Main sources	Other sources		
BC#1	In-house spread sheets	Energy	Total volumes of energy in production processes	Employee business travel, commuting,	Energy reduction projects	Education, training, healthcare and safety, and serious diseases
BC#2	A modified system within company	Energy	Total volumes of energy in production processes and transports	Employee business travel - air	Low CO_2 projects	Supporting social issues and community services
BC#3	In-house calculation worksheets	Energy	Total volumes of energy in production processes	Employee business travel – air, road, rail	Environ-mental prevention and energy saving projects	Services for and road safety for local community
Case#2	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Case#4	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Case#6	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Case#14	**Yes**	Raw material	**Yes**	**Yes**	**Yes**	**Yes**
Case#15	**Yes**	**Yes**	**Yes**	**Yes** and transport of materials	**Yes**	**Yes**

BC#1= IBM, BC2= Royal Dutch Shell, and BC#3= Toyota Motor
Yes = cases met best practising company needs

Companies were also concerned with demands of stakeholders on the development of social well-being by supporting community needs and providing benefits for local communities. Social issues were taken into account by companies in providing social data to support corporate social responsibility reporting. Companies identified social data from expenditures in the form of cash donations and time spent by employees in supporting local community development where community development is a company policy. Expenditure provided to support education and training programs for the development of working performance and future careers of the local community were also collected as social data. In this action, companies created spreadsheets of modified systems to collect social data, as well as capturing costs of environment.

At this stage, this study also referred to the results of survey analysis of K-mean cluster (chapter 5) which examined significant testing values of environmental and social performance indicators. The testing values of environmental performance indicators illustrated that capturing environmental data monthly and yearly were significant (see Table 5-17). This helps companies to create more accurate data for enhancement of management decisions when collecting data monthly; and to precisely provide sustainability reporting when capturing data yearly. Meanwhile, for social performance indicators, the results of testing values show that collecting social data yearly was significant (see Table 5-18) to incorporate in financial reporting. Companies preferred measuring social costs yearly for management decisions and reporting purposes.

Consequently, this study considered that cases meeting best practice companies identified and measured environmental and social costs monthly (case#2) and yearly (case#4, 6, 14, and 15) to create data accuracy for management decisions and to support external reporting initiatives. Environmental and social data collected monthly and yearly helped companies to successfully measure reductions in costs and carbon contaminants. Companies created eco-efficiency by reducing total volumes of energy usage, as well as decreasing the level of GHG emissions from operational activities. Companies created internal energy cost savings by using environmental data to lead decision-making on providing energy efficiency programs. Accurate environmental costs were also employed to support decision-making on environmental management and prevention programs to control GHG emission and waste in production processes. Thus, this study further analysed internal management decisions of cases to establish where decision-making of cases meets best practice needs.

Internal management decisions

Internal management decisions on environmental and social cost identification and measurement of cases were compared against the development of decision-making of benchmark companies. Internal management decisions of cases should successfully enhance cost savings; create energy efficiency, and measure carbon emission abatement—thus meeting best practice. Accurate data identified from the preceding analysis should be used in management decision strategies to estimate future production costs (Gadenne & Zaman 2002). For instance, environmental costs should support environmental management decisions in relation to energy reductions and carbon emission abatement (ACCA 1995; IFAC 2005). Meanwhile, social data should be utilized to enhance social management decisions in relation to providing costs/expenditure for community development and support (Gray 2002a). Thus, accurate data of environment and social impacts should provide companies with a way to make well-informed decisions on cost savings while measuring costs/expenditures to reduce negative impacts on the environment, the community, and society as a whole (Gray & Bebbington 2001; Jasch 2009). Participants described effective decision-making using accurate accounting data of environment and social impacts as follows:

> **Case#2:** 'We met the target of 30% energy reductions by introducing fuel switching to reduce use of energy. We also met reduction in GHG emissions targets. We reduce costs of environmental performance by creating lower carbon emissions and reduced energy consumptions. We identified social expenditures to support health insurance and external study has been identified as social costs for community development'. [Participant was a management accountant]

> **Case#4:** 'We reduced lower energy consumption 10% while identifying to save more energy in production processes. We reduced total volumes of GHG emissions by 15%. We will be reduced more in future. We provided environmental management programs to help creating energy efficiency and GHG emissions reductions. We identified social costs to support community skill scholarship programs for local community'. [Participant was a chief accounting officer]

Case#6: 'We met energy efficiency targets – reducing energy used; reducing costs of natural gas; using renewable energy. We also met GHG emission reduction targets by 25% in 2008, and 30% in 2006 and saved costs of transport – reducing costs of carbon emissions projects. This resulted in environmental costs provided to support the projects were decreased. We provided cash donation and expenditures paid for staffs who donate time for community development'. [Participant was a chief accounting officer]

Case#14: 'We had ability to reduce total volumes of energy usage from use of renewable energy. Total volumes of GHG emissions were decreased in 2008 by 4% approximately. We collected environmental costs from energy and emissions reductions projects to create carbon intensities. We measured social costs from expenditures provided to develop as sustainable community identifying from stakeholders' and public's interests' [Participant was a chief accounting officer]

Case#15: 'We reduced total volumes of energy consumption with 722,000 GP per year. We also reduced GHG emissions more than 75,000 tonnes of CO_2 equivalent per annum. We identified environmental costs to achieve energy consumption and emissions targets. We measured social expenditures to support Red Cross, community benefits and materials to renovate areas and facilities damage from business operations from social cost information collected in previous years.' [Participant was a chief accounting officer]

Furthermore, table 6-20 provides a matrix for comparing internal management decisions on cost savings and measurement of environmental and social costs among cases and benchmark companies. The results illustrate that companies met **(Yes)** best practice needs in enhancing internal management decisions on cost saving in relation to energy reductions and GHG emissions abatement and environmental and social cost identification and measurement. Companies measured total volumes of energy usage in production processes while providing energy reduction programs to create energy efficiency. Total volumes of energy usage were estimated to reduce levels of GHG emissions in production processes and external sources of emissions. Energy consumptions were identified to capture all sources of GHG emissions in tonnes of CO_2 equivalents in order to estimate reductions yearly. Companies successfully created cost saving by reducing total volume of energy consumptions and having the ability to estimate reductions in GHG emissions.

Table 6-20 Results of a matrix comparison of internal management decisions

Internal management decisions				
Firm	**Cost savings**		**Measurement**	
	Energy efficiency	**GHG emission reductions**	**Env. cost**	**Social cost**
BC#1	Energy reduction world record	Low GHG emission world record	Costs of energy reduction projects	Community development and supports
BC#2	Improvement in energy reductions	Less GHG emission from reducing energy usage	Costs of energy efficiency and research projects	Community development and services
BC#3	Using renewable energy for energy reductions targets	Decrease in GHG emissions from improving business performance	Cost of environmental management plans and projects	Community support and funding
Case#2	**Yes**	**Yes**	**Yes**	**Yes**
Case#4	**Yes**	**Yes**	**Yes**	**Yes**
Case#6	**Yes**	**Yes**	**Yes**	**Yes**
Case#14	**Yes**	**Yes**	**Yes**	**Yes**
Case#15	**Yes**	**Yes**	**Yes**	**Yes**

BC#1= IBM, BC2= Royal Dutch Shell, and BC#3= Toyota Motor
Yes = cases met best practising company needs

Environmental costs were identified from environmental management programs, energy reduction projects, measurement of carbon emission intensity and/or pollution prevention plans/projects. Social data was collected from expenditure provided to support community development programs and funding or cash donation for community benefits. Consequently, companies **(case#2, 4, 6, 14, and 15)** employed data accuracy to enhance environmental and social management decisions in relation to cost identification and measurement, thus ensuring their goal as a sustainable development organization is achieved. In relation to this, sustainable development of cases was compared against benchmark companies to discover best practice companies when adding sustainable value to shareholders.

Sustainable organization

To meet sustainable organization needs, best practice companies aim to create value to economic performance by reducing resources (material, energy, and water) used in production processes to build long-term profits and value-driven businesses (Bebbington 2007b; Taplin, Bent & Aeron-Thomas 2006). Sustainable firms need to disclose their sustainable development performance relating to economic, society, and environment aspects in the form of triple bottom line to support stakeholder and public concerns (Berkel 2003). Environmental and social issues are taken into account to create a positive impact on environmental and ecological systems while improving the quality of society and local communities in which companies operate (Gray & Bebbington 2001). Thus, to meet the criterion of a sustainable organization as identified by this study, companies (cases) must employ environmentally harmless practices and provide social development plans/projects to successfully deal with environmental and social issues (Epstein 2008; Epstein & Roy 2001). In discussion with participants of the study it was suggested that details of sustainability reporting be provided on company websites and comments in this regard include:

> **Case#2:** 'We have invested costs in Energy & Water Efficiency Program to create energy and water efficiency while meeting GHG emissions abatement. We also identified reductions in carbon emissions from other associated business activities including transports office buildings, and/or IT. This is to reduce affected sources of energy and to reduce negative impacts of environment by emitting low carbon emission in the air. We have provided healthcare and safety insurances for local community and external study assistance support to create better quality of life and their future careers. We shared experiences with the NGER as well as other government's legislation in relation to measurement of energy reductions and GHG emission calculation procedures. We also engaged with Australian government by volunteering energy reductions and GHG emissions abatement actions under the CPRS policy'. [Participant was a management accountant]

> **Case#4:** 'As we have met the energy and carbon emission targets, we become a leader in green markets that resulted in our company creates greater opportunities in economic performance. We invested capital in low- and zero-emission generation to produce low energy and less carbon offsets products for home and business markets. We sought lower carbon and green products to improve environmental performance thus creating ecological efficiency as green organization. We reduced significant percentage of energy consumptions and total volumes of GHG emissions in tonnes of CO_2 equivalents. We have been concerned with producing green and low carbon products to create energy efficiency and low carbon offset. This has resulted in our company became a market leader and met sustainable organization needs'. [Participant was a chief accounting officer].

> **Case#6:** 'We met cost saving targets of water and energy usages. All financial aspects of our company were considered from cost savings and benefits from reductions in energy and water consumptions. We designed green stores and construction to reduce lower amounts of energy and water usages. This included measuring lower levels of GHG emission in the air. We met the energy and water savings targets while making commitments to add value as a sustainable company. Our company provided cash donation and donation in kind of hour to support community development. We became a leader in Australian food manufacturing industry thus having had a positive reputation as a green producer that has met sustainable targets. We created financial

performance while becoming more efficient in cost savings, reducing lower volumes of energy and water usages'. [Participant was a chief accounting officer].

Case#14: 'We created energy efficiency and extensive savings in GHG emissions thus reducing direct/indirect carbon emissions. This resulted in our company achieved cost saving targets such reducing lower volumes of energy consumption and emissions reductions. We improved negative impacts on environment by reducing a significant percentage of GHG emission reductions per year while using lower volumes of energy to create lower levels of carbon emission in each production process. We create social investment policy by establishing community framework to support community needs. We also established stakeholder engagement programs by identifying stakeholders' interests to support sustainable community development and continued improvement in environmental resources management while effectively deal with environmental and social issues. Our company has established environmental and social policies and programs to reduce business risks while creating positive reputations in marketplaces'. [Participant was a chief accounting officer].

Case#15: 'We undertook energy reduction programs to meet energy reductions and GHG emissions abatement targets. We have met economic performance targets by reducing carbon emissions 410,000 tonnes over two years and saving 722,000 GJ energy consumption in 2008. We are expecting to save more volumes of energy consumption in future to achieve environmental management targets such releasing lower carbon emissions in the air. Our environmental management plans are involved in measuring use of energy, water, emissions, waste generation and recycling. Our company aimed to reduce negative impacts of environment and ecological systems. We also donated funds for the official Red Cross together with dollar-for-dollar from employee donation to support Victoria bushfires. We managed in 50% cash and 50% material to renovate surface land, affected communities, and/or ecological system damaged from business activities. As we are a large user and polluter, we are a benchmark participant in the Greenhouse Gas Abatement Scheme of NSW government'. [Participant was a chief accounting officer].

Table 6-21 illustrates that cases met (**Yes**) the needs of best practice companies in creating sustainable organizations. Companies invested capital on energy reduction programs/projects to estimate use and flow of physical quantities—material, energy, water, and/or wastes—in production of goods. In doing so, companies create opportunities to estimate reductions in carbon emissions and wastes while meeting environmental management performance targets. Companies created lower carbon emissions and wastes to reduce negative impacts on the environment in order to sustain environmental and ecological systems for all life on Earth. For social management performance, companies supported community development needs by donating cash and employees' time to bring benefits to local communities where companies operate.

Table 6-21 Results of a matrix comparison of sustainable organizations

Firm	Sustainable organization			
	An enhancement of			Adding sustainable value to shareholders
	Economic performance	Environmental performance	Social performance	
BC#1	Costs savings of energy	Reductions in GHG emissions to avoid environmental damage	Improving community and support society	Continue improvement in economic, environment and social performance
BC#2	Costs savings by using renewable energy	Creating lower emissions to reduce negative impacts on environment	Providing community services to improve quality of community life and safety	Supporting stakeholders' concerns about the development of economic, environment and social performance
BC#3	Cost savings of energy and production costs	Creating lower emissions to reduce negative impacts on environment	Sponsoring community and bring benefits to local community and society	Promoting environmental and social aware organization while improving economic performance in long-term
Case#2	**Yes**	**Yes**	**Yes**	**Yes**
Case#4	**Yes**	**Yes**	**Yes**	**Yes**
Case#6	**Yes**	**Yes**	**Yes**	**Yes**
Case#14	**Yes**	**Yes**	**Yes**	**Yes**
Case#15	**Yes**	**Yes**	**Yes**	**Yes**

BC#1= IBM, BC2= Royal Dutch Shell, and BC#3= Toyota Motor
Yes = cases met best practising company needs

Cases meeting best practice continued their improvement in environmental and natural patterns, as well as developing quality of community life and living standards (Table 6-22). Leading companies aimed to take environmental and social issues into account as they are of significant concern to stakeholders and the public. Companies promoted themselves as sustainable organizations to create positive reputations as environment-friendly and socially-aware organizations. As a result, companies added sustainable value while creating better opportunities in the marketplace. A matrix comparison of sustainable organization of cases and benchmark companies aimed to establish where those cases have met the requirements of the NGER and GRI. This study identified key requirements of the NGER limiting energy reductions and carbon emissions abatement—measuring total volumes of energy usage in production processes and other sources and calculating direct/indirect GHG emissions in tonnes of CO_2 equivalent from all sources; and using lower volumes of energy consumptions while reducing GHG emissions in tonnes of CO_2 equivalent. The results in Table 6-25 identify cases that have met the requirements of the NGER.

Table 6-22 Analysis results of the NGER requirements

Regulations of fuels and energy consumption of the NGER					
Key requirement	**Case#2**	**Case#4**	**Case#6**	**Case#14**	**Case#15**
Identify sources of GHG emission in tonnes of CO_2 equivalents	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Energy consumption and production	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Energy consumption for transport of products	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Measurement tools/methods of GHG emissions and energy consumption	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
The measurement of incidental sources of GHG emissions	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Energy reductions and carbon emission abatement	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Yes = cases met best practising company needs

For GRI requirements, this study selected limited relevant key environmental and social performance indicators to analyse management accounting of best practice companies (cases). The limitation of key environmental performance consisted of measuring direct/indirect energy, direct/indirect emissions, total volume of water usage and total volume of wastes created from production processes.

Table 6-23 illustrates that best practice companies met (**Yes**) requirements of the GRI in measuring direct/indirect energy consumptions when estimating reductions in use of energy. Companies calculated total volumes of direct/indirect GHG emissions in tonnes of CO_2 equivalent toward evaluating reductions in carbon contaminates. Companies measured total volume of water while measuring reused water to preserve water consumption. In addition, total volume of waste was collected from all sources of production activities to measure reduction in waste and disposal waste from future production.

For social performance, best practice companies met (**Yes**) the needs of social development performance indicators required by GRI. Companies supported community development by providing healthcare and safety, education and training programs, and other community services. Companies donated in-kind cash and time to bring benefits to local communities in areas where companies operate. Consequently, best practice companies are concerned with environmental prevention and the development of social well-being, thus ensuring their sustainability is achieved. The results of benchmarking analysis were employed to support the design of the conceptual model of a sustainability management accounting system (SMAS).

Table 6-23 Analysis results of the GRI requirements

Key performance indicators of Global Reporting Initiative (GRI) requirements						
Environmental performance Indicator		**Case#2**	**Case#4**	**Case#6**	**Case#14**	**Case#15**
Energy	Measuring direct/indirect energy consumptions from primary sources	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Measuring energy saved and improvement in energy efficiency	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Providing energy efficiency program and/or renewable energy plan	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Identifying energy reduction targets	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Emissions	Measuring total direct/indirect energy in tonnes of CO_2 equivalents	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Measuring other sources of GHG emissions in tonnes of CO_2 equivalents	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Providing GHG emission reductions plan/ projects	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Water	Measuring total volume of water used by sources	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Identify percentage and total volumes of reused water	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Waste	Measuring total volume of wastes, disposal wastes, hazardous, and or other significant spills	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Social performance Indicator						
Community	Identifying community development/ support program to bring benefits to community where a company operates	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Providing community healthcare and safety programs to prevent serious diseases, to reduce negative impacts on environment and ecological system that affect local community in surrounding areas	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Providing voluntary programs including employees' time/donation, training, educational facilities, and/or other associated benefits relating to a company operating to develop economic efficiency and create careers for local community	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Yes = cases met best practising company needs

Consequently, best practice companies create accurate cost accounting data of environment and social impacts to support internal decision-making on cost savings and to comply with external reporting requirements such as NGER and/or GRI. Environmental costs were employed to create eco-efficiency and environmental performance development, thus adding shareholder value as sustainable organizations (see Table 6-21). In the meantime, social data was used to lead decision-making on identifying social expenditure for improvement in quality of employees, the community and society as a whole. However, these costs were identified as overheads when disclosing sustainable performance of organizations. For that reason, the priority of environmental and social cost identification and measurement is to support management decisions on operational outcomes—where, in the past, these costs have been somewhat inaccurate in financial disclosures. Thus **Proposition2,** *best practice companies more accurately provide environmental and social cost information for internal decision-making and to support external reporting disclosures* **is incompletely answered.** This study, therefore, designed a SMAS conceptual model that would help in separately identifying cost information of environment and social impacts from overheads—thus improving management accounting practices/systems of firms. Figure 6-1 shows the links within the conceptual framework of qualitative study supported by the data.

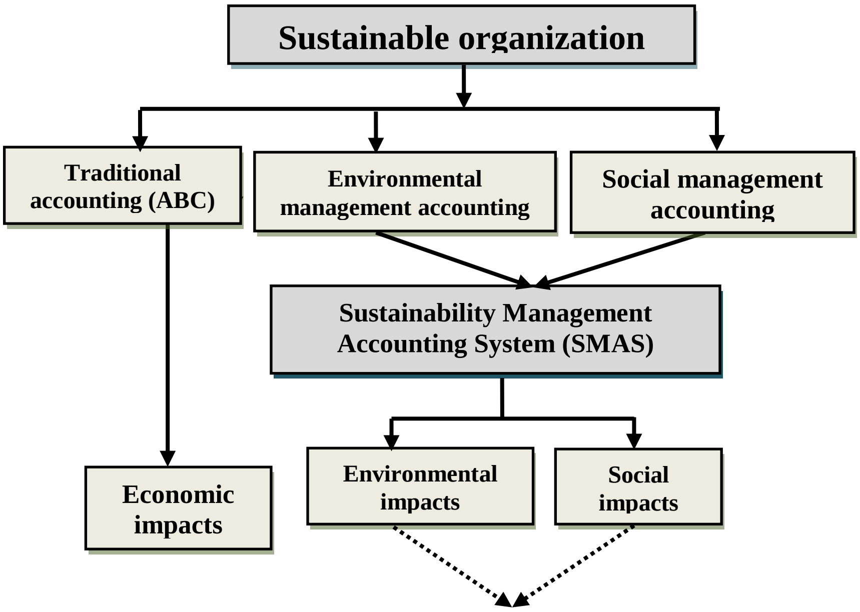


Figure 6-1 A revised conceptual framework for a SMAS - P1 and P2

Accordingly, the data supports the first proposition that *best practice companies identify costs of environment and social impacts, as well as measuring reductions in contaminants to reduce negative impacts on humans, society, employees and the environment* **is answered**. In contrast, the data supports the second proposition that *best practice companies provide more accurate environmental and social cost information for internal decision-making and to support external reporting disclosures* **is incompletely answered.** Companies captured environmental and social impact costs from production processes and external organizations to support external reporting initiatives. Companies more likely disclosed the development of economic, environmental, and social performance to add shareholder value. However companies collected environmental and social costs as overheads, due to experiencing difficulty in cost identification and measurement. Companies therefore tended to change effective management accounting practices to help in identifying, measuring and analysing cost of environment and social impacts.

6.2.4 Improve (I)

A SMAS conceptual model aimed to improve current management accounting practices and systems to more accurately create cost accounting data on environment and social impacts. A SMAS would help separately identify and measure environmental and social costs from overheads while collecting as standalone costs in external reporting initiatives. In doing so, companies would be able to enhance management decisions on cost savings and GHG emission abatement. Proposition3 was addressed to examine a SMAS conceptual model that would help improve environmental and social cost identification and measurement for management decisions and reporting purposes.

> ***P3.*** *A SMAS provides best practice companies with an enhanced environmental and social costs management system to improve internal decision-making and to support stakeholders' and public concerns.*

A SMAS conceptual model would be a new mechanism of management accounting practice to provide companies with a way of creating data accuracy of environmental and social impacts to answer **Proposition 3**. A SMAS is designed to *monthly* collect environmental data from internal and external organizations while separating overheads to assign to single production activities. This would help in creating more accurate environmental data for internal management decisions on use and flow of physical quantities (e.g. material, energy, water, wastes and/or emissions) captured from internal and external organizations. A SMAS conceptual model would provide companies with a way to improve cost efficiency and identify where savings in energy cost could be made. Companies could be more successful in reducing levels of GHG emissions in tonnes of CO_2 equivalent. A SMAS would significantly help improve the measurement, identification and collection of environmental and social data to meet data accuracy needs. Environmental data would be identified *yearly* to support external reporting, thus adding sustainable value as a 'green' producer in the marketplace.

For social data, a designed SMAS would separately identify expenditure provided for social and community development from overheads before allocating to a cost centre (single product costs). Social data would be captured *monthly* from all sources relating to costs, expenditure, funding, and/or donation in kind of cash and employees' time in supporting social management decisions. This also includes all sources of business activities and social management programs that companies provide to bring benefits to employees, society and the community as a whole. A SMAS would *yearly* identify social impact costs to incorporate in external reporting initiatives for disclosure and to create better relationships with stakeholders and the public. Thus, by implementing a SMAS, companies could provide development of economic, social and environmental performance in financial reporting to create shareholder value in the eyes of stakeholders and the public. This would appropriately answer to **Proposition 3** (and discussed further in Chapter 7)**.**

> ***P4.*** *A SMAS provides best practice companies with a mechanism to add value in economic, social and environment areas of performance.*

To answer **Proposition 4**, a designed SMAS could enable best practice companies to apply sustainability accounting concepts to continue improvement in environmental and social costs identification and measurement. A SMAS would improve environmental and social costs allocation, thus fully costing products and providing a new management accounting mechanism for sustainable organizations. Companies would successfully manage environmental and social costs to enhance society and the environment while creating eco-efficiency—via internal energy cost savings and less GHG emission. Accurate environmental and social data would be incorporated in sustainability reporting by developing internal reporting and tracking systems. A SMAS would provide companies with a way to add sustainable value and preserve natural and environmental systems in the long-term. Companies would be able to externally report their progress in using less energy and emissions abatement to the NGER and meet the requirements of GRI sustainability reporting guidelines. The following chapter, Chapter 7, will further discuss improvement processes in the design of a SMAS conceptual model to answer both **Proposition 3** and **4**. Figure 6-2 shows the conceptual framework for a SMAS

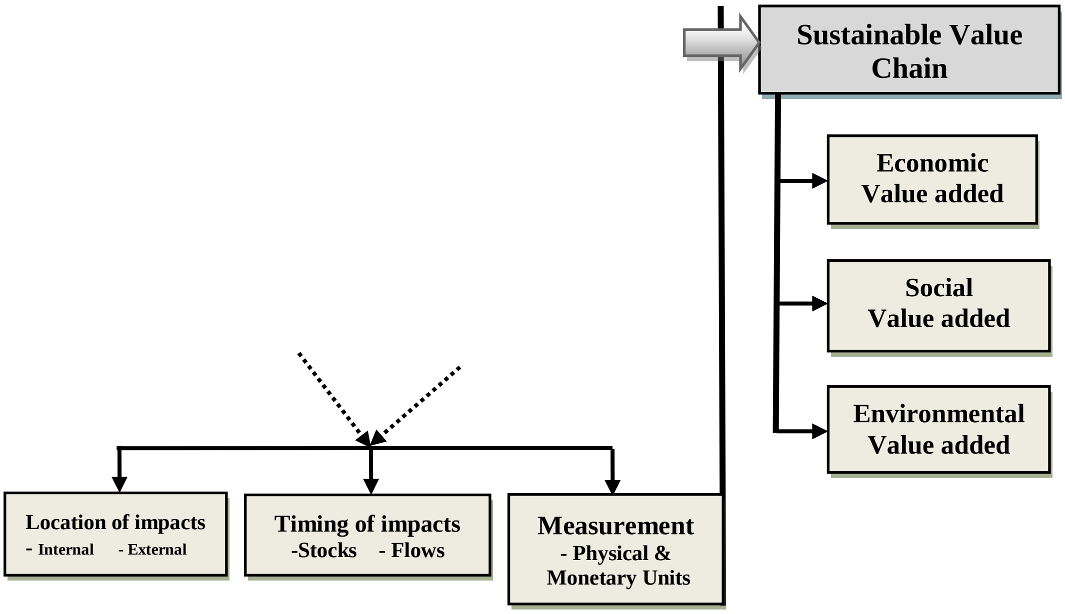


Figure 6-2 A revised conceptual framework for a SMAS – P3 and P4

6.3 Chapter summary

This chapter reports the results of benchmarking analysis defining management accounting systems/practices of cases for comparison and benchmarking against international firms. Case study backgrounds and key environmental and social performance of benchmarked companies were briefly provided to introduce management accounting practices of cases and benchmarked firms. Management accounting practices of fifteen cases were defined to detect environmental and social cost identification and measurement before benchmarking among cases. There were five cases (case#2, 4, 6, 14, and15) that met the criterion of best practice company to compare against international firms (IBM, Shell and Toyota). Best practice companies were also compared for their environmental and social performance with key environmental and social performance indicators required by the NGER and GRI. This aimed to meet best practice needs for sustainable organizations in creating data accuracy of environment and social impacts to enhance internal management decisions and to support external reporting initiatives. A summary of findings of qualitative study to answer **Propositions** is provided in Table 6-24. Furthermore, a summary of proposition findings and their sources of data collection and instrument is provided in Appendix 6. The results of best practice companies employed to support the design of a SMAS conceptual model is discussed further in chapter 7.

Table 6-24 A summary of findings of propositions

Proposition findings	
Propositions	**Areas of measurement and findings**
P1: *Best practice companies identify costs of environment and social impacts as well as measuring reductions in contaminants to reduce negative impacts on humans, society, employees and the environment.*	Companies developed management accounting systems for environmental and social data identification and measurement. The systems have been integrated with existing financial/management accounting to help in capturing environmental and social data in production processes and external organizations. Companies bought management accounting for environmental and social data off the shelf and created data of environment and social impacts, as well as measuring reductions in energy consumptions to meet GHG emissions targets. Companies measured social expenditures to improve the quality of employee and local community thus reducing negative impacts on environment and society.
P2: *Best practice companies more accurately provide environmental and social cost information for internal decision-making and to support external reporting disclosures*	Environmental and social data of cases was considered at accurate levels by cases. Companies captured total volumes of physical quantities (material, energy, water, and wastes) to create cost efficiency while identifying environmental and social data precisely. Environmental costs were collected from internal organizations (unit inputs in production processes such as material, energy, water, and wastes) and external organizations (e.g. transport of products, business travel, and/or environmental management and preventions. Meanwhile, social data was collected from expenditures provided for community development and support. Also expenditures spent on improvement in quality of local community and their living standards were captured including donation in kind of employees' time to bring benefits to local community in surrounding areas. However, these costs were identified as overheads.
P3. *A SMAS provides best practice companies with an enhanced environmental and social costs management system to improve internal decision-making and to support stakeholders' and public concerns*	A SMAS employs *environmental management accounting (EMA)* practices to help in identifying, analysing, and measuring environmental costs from internal and external organizations. All expenditures reflecting from unit inputs (material purchase value of wastes and emissions and/or processing costs of wastes and emissions), product output (e.g. product in processes, product design), and non-product outputs (e.g. emissions, wastes, and waste disposal), prevention and environmental management costs, and recycled wastes and materials. *Social management accounting (SMA)* in a SMAS assists companies to measure social costs from expenditures provided to support the development of society and community including funding provided for social management programs and community development. Costs of product responsibility provided for research and product development, marketing communication, and/or health and safety of lifelong using. *Activity based costing (ABC)* application is used for cost allocation and analysis. Environmental and social data is allocated to single production activity where the costs are consumed. ABC helps in cost analysis using accurate cost accounting data to lead decision-making on costs reductions and carbon contaminants
P4. *A SMAS provides best practice companies with a mechanism to add value in economic, social, and environment areas of performance*	A SMAS creates environmental and social data more accurately to represent in sustainability performance disclosures. Companies report their development of economic, environmental, and social performance using more accurately environmental and social data to support stakeholders, and public's demands. Environmental and social costs are collected as actual costs of environment and social impacts then assigning to single production activity. These costs are tracked accurately in financial reporting. A SMAS provides companies with sustainable development strategies to more accurately generate cost information for business decision-making. A SMAS support companies to ensure that every environmental and social data is measured and allocated to single production activity thus fully costing products. Environmental and social data is tracked in financial disclosures thus developing tracking and reporting systems.

CHAPTER 7: DESIGN OF A SMAS CONCEPTUAL MODEL

Having reported the analysis results of quantitative and qualitative components in previous chapters, chapter 7 now provides a discussion of the results employed to support the design of the SMAS conceptual model. The chapter begins with an overview of the purpose of the study. Major findings are then discussed to arrive at the holistic SMAS conceptual model is. Next the design of the SMAS conceptual model is discussed in terms of environmental and social cost identification and measurement. Finally, the chapter concludes with a summary of the results.

7.1 Purpose and major findings of study

7.1.1 Purpose of the study

This study's purpose is to design a conceptual model for a sustainability management accounting system (SMAS) to more accurately account for environment and social impact costs by Australian non-service sectors, particularly manufacturing. The SMAS create a new form of accounting system by separately identifying and measuring environmental and social data from overheads while fully costing products for internal management decision-making and reporting purposes. A number of previous studies (e.g. Bennett, Bouma & Wolteres 2002; Berkel 2003; Gadenne & Zaman 2002; Gale 2006a; IFAC 2005) suggested that environmental management accounting (EMA) should be introduced to companies to help in the identification and measurement of environmental costs. This would not only create more accurate cost accounting data of the environment, but also help with making environmental and social internal decisions on cost reductions and carbon emission abatement (Jasch & Stasiškienė 2005). More accurate environmental cost accounting data would provide better sustainable development disclosures when reporting on environmental efficiency and supporting stakeholders' interests (Berkel 2003).

In addition, social management accounting (SMA) should be introduced as a new mechanism in management accounting systems for more precise cost accounting data for social disclosures. Limited literature (Gray 2002a, 2002b; Tinker & Gray 2003) suggests that social management accounting (SMA) could help companies to enhance internal management decision making in relation to investing capital for the development of society's well-being. Companies would be able to create more accurate social performance disclosures to stakeholders and the public.

Nevertheless, it is unclear from the literature what the appropriate characteristics of a holistic system are. Based on the literature, a theoretical framework was developed building on the concept of social and environmental management accounting that identifies the theoretical characteristics required in the SMAS, but these were expected to be incomplete. Furthermore, incorporation of environmental and social costs into a management accounting system has not been widely accepted by manufacturing industries and has not been fully exploited to date (Gadenne & Zaman 2002; Gale 2006a; Hubbard 2009), which needed to be ratified by this study. Therefore, the SMAS conceptual model designed by this study aims to contribute to theory and practice since previous studies have not developed a holistic model of sustainability management accounting practice.

7.1.2 Summary of major findings

System characteristics for environmental and social data

The results of the study indicate that companies (quantitative results) measure environmental data to support *internal management decisions* on energy reductions and emission abatement (See Figure 5-7, Chapter 5). Companies employed system characteristics to *monthly* and *quarterly* manage use and flows of natural resources (material, energy, and water) in order to possibly measure cost reductions of unit inputs, including physical quantities, wastes, emissions, and/or disposal wastes (IFAC 2005). Their systems also measured total volumes of direct/indirect energy consumption while calculating volumes of energy saved by process design, conservation and/or changes in employees' behaviours.

This study found that companies incorporated system characteristics as part of their management accounting tools to identify and measure environmental data in the form of quantities (for example, tonnage, mega-litres, kilowatts, and CO_2 equivalents). Companies captured total volume of production materials, total volume of spills including oil, fuel, wastes and/or chemical, and total volume of internationally transported, imported, exported and/or treated hazardous wastes. This included total volume of waste in tonnes by disposal methods—composting, reuse, recycling, recover, incinerations, landfill, and deep injection—to estimate reductions in total volume of waste and GHG emissions in tonnes of CO_2 equivalent. Companies also measured environmental costs from total expenditure of environmental protection, including waste disposal and emission treatment, remediation costs, prevention and environmental management.

Nevertheless, companies that indicated *'not at all'*, in other words, they did not collect specific environmental data, might be faced with difficulties in measuring reductions in carbon contaminants (see Figure 5-7, Chapter 5). As companies are in the early stages of developing an understanding of cost identification and measurement of environmental impacts, companies may be unaware of the extent or scope of environmental costs (Epstein 2006). Meanwhile, social costs are seemingly ignored by some respondent companies in capturing social data for management decision making and supporting social disclosures (Gray et al. 2001). As a result, companies may be unable to identify or track these costs accurately in their financial reporting (Epstein 2006) and/or sustainability disclosures to support concerns of stakeholders and the public (Berkel 2003). Thus the study looked at current practices which could change over time. To deal with any anticipated change, companies were asked if it was their intention to change their management accounting practices for to capture data on environment and social impacts. Thus the study looked at current practices which could change over time. To deal with any anticipated change, companies were asked if it was their intention to change their management accounting practices for to capture data on environment and social impacts. Sub-research question2 addressed future intentions of firms to incorporate new management accounting practices for better management decision making and future sustainability reporting.

The results of the study show that companies are intending to change their management accounting practices/systems to *yearly* identify and measure *environmental data* reporting *externally* in the future (see Figure 5-8, Chapter 5). In addition to what they are currently capturing, companies are intending to change their accounting systems to collect data on non-production outputs such as environmental impact of transporting products including energy use (e.g. oil, kerosene, fuel, and/or electricity), emissions (e.g. GHG emission, NO_x, SO_x, other air emissions), effluents (e.g. different kinds of chemicals), wastes (e.g. different types of packaging materials), noise, and spills (e.g. spills of chemicals, oils, and/or fuels). Companies are also intending to provide initiatives for direct and indirect energy efficiency, as well as capturing environmental costs from recycling wastes in production processes. Furthermore, by changing their management accounting practice/systems companies would be able to collect environmental data required by the GRI that impacts on biodiversity, habitats (protected or restored), and total water discharge.

Companies plan to change their management accounting practices/systems to collect social data from sources of expenditure on community development, local community support/benefits, educational facilities and career development programs provided to improve community skills and knowledge. By changing accounting systems, social data would be appropriately collected from donation in kind of cash and employees' time, donation in kind of materials to maintain community benefits, and road safety programs to bring benefits to local communities where companies operate. Companies would also be able to capture social data from administrative funding for overseas travel, sustainable community development programs, political donations, and other social issues related to corporate social responsibility.

Thus, by changing management accounting systems/practices, companies could more accurately create environmental and social data in the future for management decisions on cost efficiency and reporting purposes. Companies could achieve best practice companies by identifying, capturing and analysing costs of environment and social impacts. Environmental and social data may be able to meet internal decision-making needs and may be used to create more precise sustainability disclosures. Thus this study posed sub-research question3 to examine a new mechanism of management accounting systems/practices for environmental and social data to meet best practice needs.

This study found that best practice in environment and social accounting systems and reporting has been adopted by best practice companies (e.g. cases#2, 4, 6, 14, and 15) to identify and measure costs of environment and social impacts. Companies created environmental and social data to meet accuracy levels for environmental management decisions, thus successfully improving cost efficiency and meeting GHG emissions targets. Best practice companies captured environment costs from both internal and external organizations, as well as providing expenditure for environmental management prevention programs, wastes and emissions treatment, and pollution prevention. In doing so, companies created data accuracy for environmental management decisions, thus successfully improving cost efficiency and meeting GHG emissions targets.

For social performance, best practice companies provided social expenditure to support employee benefits, education, training, and health and safety programs. Health and safety programs were provided to improve positive impacts on customers, the community, and society while using products or services. This included customer satisfaction programs regarding product recalls, product information, and/or products assessed for improvement. In doing so, best practice companies accurately created cost information of environment and social impacts to incorporate into triple bottom line reporting and enhance internal management decision-making. As a result, best practice companies more effectively measured reductions in costs and carbon contaminants and maintain the balance of environmental and ecological systems to improve social well-being and life on earth.

Consequently, by adopting leading practice, Australian non-service companies fully cost total products including environment and social impacts. The major findings from analyses to answer sub-research questions were employed to support the development of the SMAS conceptual model including management accounting best practices of cases. Thus, this study further investigated management accounting best practice using a benchmarking model to compare management accounting practices between case companies and internationally recognised best practice organizations in environment and social reporting. Propositions were posed to examine management accounting best practice of Australian organizations in relation to environmental and social cost identification and measurement.

Management accounting best practice for sustainable organization

Results of the study indicate that best practice companies *monthly* identified environmental data for internal management decisions on cost reductions and carbon emissions abatement. To capture data required, companies purchased accounting programs/systems off-the-shelf to integrate with their existing financial/management accounting systems. Companies modified separate accounting systems to record environmental and social data based on existing financial/management accounting practice. The systems helped in the cost identification and measurement of environment and social impacts and in creating energy efficiency and GHG emissions abatement. Best practice companies identified and measured environmental costs from internal (production processes) and external organizations relating including unit inputs—wastes and emissions treatment costs and non-production outputs—material purchase value of waste and emissions, environmental revenues (e.g. reused material or wastes), processing costs of wastes and emissions, and environmental prevention and management costs. The results are consistent with the survey wherein best practice companies attempted to identify and measure environmental data from internal and external organizations while managing use and flow of resources (material, energy, water and/or wastes) in production processes. Companies captured physical quantities from total volumes of energy types and amount of raw material used in production processes, including all relevant resource of energy usage (electricity, gas, fuel, etc). Total volumes of direct/indirect energy usages and amounts of raw materials used in production processes were identified to estimate reductions in energy consumptions and GHG emissions.

GHG emissions were captured from main sources of business activities including fuel combustion and facilities used in production processes, electricity, natural gas, LPG, diesel, coal and other alternative fuel used in production processes. In the meantime, best practice companies captured GHG emission from other sources—external business activities such as employee and business travel by air, land, and water. Emission default factors of the National Greenhouse and Energy Reporting (NGER) were used, along with modified systems separated from existing financial/management accounting practices to calculate direct/indirect GHG emissions in tonnes of CO_2 equivalents. This measure helps best practice companies to create data accuracy when using environmental costs for management decisions and reporting purposes. This would support that companies have an ethical and moral obligation to reduce negative impacts on the environment and communities; and create values-driven businesses and long-term profitably while improving environmental and economic performance.

Companies employed emission factor guidelines of NGER, NGA and/or WRI/WBCSD[8] to measure GHG emissions in tonnes of CO_2 equivalent based on revenue/turnover. Total volumes of GHG emissions were measured from main sources (e.g. energy consumptions in production processes) and other sources such as business travel and transport of products/materials by air, road and rail. Meanwhile, expenditures incurred to support environmental management and pollution prevention programs were also collected *monthly* as environmental data. Environmental data was used to measure reductions in energy consumption and GHG emissions abatement, so that companies could meet energy consumption and GHG emissions targets required by the NGER and/or GRI. These findings confirm the results of the survey.

[8] NGER = National Greenhouse and Energy Reporting, NGA = National Greenhouse Accounts, WRI = World Resources Institute, and WBCSD = World Business Council for Sustainable Development

For social data, results from cases' analysis are also consistent with the survey which show that best practise companies collected social costs *monthly* from expenditure provided to support community development and to create benefits for local communities in which companies operate. Social data was also captured from social management programs established to support healthcare and safety, education and career development to improve local conditions. Social data was relevant to expenditure on community development and all services provided to support community benefits. Donation in kind of cash and employees' time in supporting local community development were identified as social data. Social data also included education and training programs for better working performance and future careers of the local community. Best practice companies also measured social expenditure provided to maintain community benefits, including community skill scholarships/training, educational facilities and career development. Other community services were also provided to bring benefits to the community including health insurance and safety programs and external study assistance. Other social issues relating to sustainable community development would also be identified as social costs. Social data was employed for social decision-making when capturing social expenditure for community development and establishing social management programs to provide benefits to communities and society. Companies externally disclose social performance of organizations in thus adding value as a sustainable organization in the eyes of stakeholders and the marketplace.

It appears that companies collected costs of environment and social impacts to support internal management decisions. Accounting data of environment was used as a management decision strategy for eco-efficiency and GHG emissions abatement. Companies aimed to achieve sustainable development targets thus providing sustainability reporting to address the demands of stakeholders and the public. Companies also tended to disclose the development of economic, environmental and social performance to add shareholder value. Companies reduced cost of emissions permits, energy and raw material costs through emission reduction initiatives. Companies managed demand of products/materials and benefited from the anticipated shift to more energy efficient building design and opportunities to develop new products. Best practice companies also intended to create potential sustainability development introducing a new form of business activity, in particular to establish timber plantations that provide a carbon offset and saleable product in the future. This initiative would create long-term benefits to the environment and society as a whole.

Nevertheless, results from the study indicate that environmental and social data was not separately identified from overheads when allocating to single production activities. This was because accounting systems for environmental and social data integrated/modified with existing financial/management accounting systems treated these costs as overheads. In addition, stand-alone systems modified from existing management accounting practice in kind of spreadsheets were not able to separately identify environmental and social data from overheads. This resulted in environmental and social costs being hidden among production processes (IFAC 2005; UNDSD 2001), while tracking reporting systems could not be developed (Gadenne & Zaman 2002; Gray 2006). Companies could not precisely disclose actual costs of environment and social impacts, thus, internal management decisions for sustainable development organizations might not be achieved. Companies did not accurately identify environmental and social data in developing tracking and reporting systems. Environmental and social data seemed to be identified as overheads, which creates imprecise financial disclosure when disclosing in the form of triple bottom line. This study, therefore, designs the SMAS conceptual model to help in cost identification and measurement of environment and social impacts discussed below.

7.2 Designed SMAS conceptual model

The SMAS is designed as a new mechanism of management accounting practice for environmental and social cost identification and measurement based on sustainability accounting concepts. In the SMAS, environmental and social characteristics identified from the findings are based on GRI and NGER requirements, as well as adding additional characteristics of ACCA (1995). The SMAS provide companies with a way to externally report their progress in using less energy and emissions abatement to the NGER and meet the requirements of GRI sustainability reporting guidelines.

7.2.1 Environmental characteristics in SMAS

As environmental costs have been historically hidden among production and service processes (IFAC 2005), most companies were unable to factually identify them as environmental costs. These costs were therefore allocate to overhead accounts (Epstein 2006). This study provides system characteristics to capture environmental costs identify and which would be incorporated into SMAS for the manufacturing business. In the SMAS, environmental costs are captured *daily* from unit inputs— cost of physical quantities (e.g. materials, energy, air, and water and unit outputs)—and production processes (e.g. packaging materials, product in process, product design. The SMAS also collects environmental costs from non-production outputs including solid wastes, emissions, waste disposal, and/or waste created from producing products (Gale 2006a). In the meantime, environmental prevention and management programs, including penalties/fines, are collected as environmental costs (IFAC 2005). Shallow ecology perspective indicates that measuring environmental costs creates the ability to better manage use and flows of unit inputs (material, energy and water) by using more accurate costs of environment as a management decision strategy (Devall & Sessions 1985).

The SMAS captures GHG emissions in tonnes of CO_2 equivalent relying on emission factor guidelines of NGER, NGA and WRI/WBCSD. Sources of payments/bills paid for energy consumptions in production processes are transferred to total volume of GHG emissions[9]. The SMAS measures total volume of GHG emissions measured from main sources (e.g. energy consumptions in production processes) and other sources such as business travel and transport of products/materials by air, road and rail. In doing so, companies are able to evaluate reductions in GHG emissions in tonnes of CO_2 equivalent thus meeting the requirement of NGER/GRI. Thus, by implementing the SMAS, companies are

[9] The results of benchmarking model, chapter6

able to captures GHG emissions from main sources to measure reductions in energy consumptions thus creating less emission in production processes. Companies effectively manage use and flows of natural resources (material, energy, water) while creating energy efficiency and having the ability to meet GHG emission reduction targets.

In the SMAS, environmental prevention and management programs, including penalties/fines, carbon tax, waste treatment costs, are collected as environmental costs (IFAC 2005). The SMAS tracks these costs to initially recognize them as environment-related costs that are involved in sources of expendture provided to reduce negative impacts on the environment. This includes environmental costs from internal and external organizations—production processes, employee and bussiness transport, environmental and pollution prevention management (IFAC 2005). Table 7-1 provides environmental characteristics identified and measured by the companies in a survey and their adding characteristics based on the NGER/GRI requirements. Nonetheless, there is no adding characteristic of environmental costs from best practice companies and international benchmarking firms. Moreover, the SMAS also collects environmental data from all invoices/bills for any payments[10] relating to the potential hidden costs. The table provides missing environmental characteristics based on ACCA (1995, p. 9) that companies have naturally identified as overheads.

Allocation keys of environmental costs attributed to cost centres and products are recommended by Jasch (2009, p. 116) including 'volume of emissions or waste treated, relative cost of treating, and direct costs of material inputs, treatment and/or projects'. Schaltegger and Burritt (2000) claim that allocation keys of environmental cost drivers are based on knowledge of a particular business, business activity, and/or appropriate management and accounting judgement. Schaltegger and Burritt identifies four allocation keys of environmental costs that are widely discussed – 'the volume of materials, emissions, and waste treated – the toxicity of emission and waste treated – the environmental impact added, and – the induced costs associated with treating different kinds of materials and

[10] The results of benchmarking model, chapter6

emission treated' (Schaltegger & Burritt 2000, p 136). Thus, the choice of appropriate allocation keys in the SMAS are based on volume of emissions or waste treated, cost of treating, and direct costs of material inputs, treatment and/or projects. Thus the choice of allocation keys (driver for activity allocation) in the SMAS is a matter of business activity and management and accounting judgment.

Table 7-1 Environmental characteristics captured by the SMAS

Environmental characteristic	**Quantity and Equivalents**		**Driver for Activity Allocation to Products (example)**
	Quantity[11] **(unit of measure)**	**Environmental impact measure**	
Current practices			
<u>Unit inputs</u> :			
Direct materials:			
Raw materials	Metric tonne	CO_2 – equivalent	Cost of treating[12]
Associated process materials	Metric tonne	CO_2 – equivalent	"
Semi-manufactured goods or parts	Metric tonne	CO_2 – equivalent	"
Non-renewable materials:			
Minerals	Metric tonne	CO_2 – equivalent	"
Metals	Metric tonne	CO_2 – equivalent	"
Oil	Gallon/Litre/barrel	CO_2 – equivalent	"
Gas,	Cubic feet/metre	CO_2 – equivalent	"
Coal	Metric tonne	CO_2 – equivalent	"
Recycled materials	Metric tonne	CO_2 – equivalent	"
Direct energy			"
Direct non-renewable energy sources:			
Coal	Metric tonne	CO_2 – equivalent	"
Natural gas	Cubic feet/metre	CO_2 – equivalent	"
Fuel	Metric tonne/Gallon/barrel	CO_2 – equivalent	"
Direct renewable energy:			"
Biofuel	Metric tonne/Gallon/barrel	CO_2 – equivalent	"
Ethanol	"	CO_2 – equivalent	"
Hydrogen	Megawatt-hour	CO_2 – equivalent	"
Indirect energy:			"
Electricity	Megawatt-hour	CO_2 – equivalent	"
Heating and cooling	Megawatt-hour	CO_2 – equivalent	"
Steam	Megawatt-hour	CO_2 – equivalent	"
Nuclear energy	Megawatt-hour	CO_2 – equivalent	"
Other forms of imported energy	Megawatt-hour	CO_2 – equivalent	"
Solar	Megawatt-hour	CO_2 – equivalent	"
Geothermal	Megawatt-hour	CO_2 – equivalent	"
Hydro energy	Megawatt-hour	CO_2 – equivalent	"
Wind	Megawatt-hour	CO_2 – equivalent	"
Biomass based intermediate energy	Megawatt-hour	CO_2 – equivalent	"

[11] Quantity (unit of measure) is based on GRI requirement (GRI 2006, 2010a).
[12] Cost of treating means emissions, wastes, and/or toxic waste created from producing product need to be allocated to that product (Jasch 2009)

Table 7-1 Environmental characteristics captured by the SMAS (cont.)

Environmental characteristic	Quantity and Equivalents		Driver for Activity Allocation to Products (example)
	Quantity (unit of measure)	Environmental impact measure	
Unit inputs (cont.)			
Hydrogen based intermediate energy	Megawatt-hour	CO_2 – equivalent	"
Water:			
Surface water	Cubic metre / Kilolitre	CO_2 – equivalent	Cost of treating
Ground water	Cubic metre / Kilolitre	CO_2 – equivalent	"
Rain water	Cubic metre / Kilolitre	Kilolitres	Volume of waste water
Waste water	Cubic metre / Kilolitre	Kilolitres	"
Municipal water suppliers	Cubic metre / Kilolitre	Kilolitres	"
Reused water:			
Wastewater recycled	Cubic metre / Kilolitre	Kilolitres (saved)	"
Production processes			
Recycled packaging materials	Percentage of input materials	CO_2 – equivalent (saved)	Direct costs of material inputs
Reused products	Percentage of input materials	CO_2 – equivalent (saved)	"
Product in processes	Percentage of usage	CO_2 – equivalent	"
Energy conservation programs	Percentage of outputs	CO_2 – equivalent	"
Initiatives to reduce GHG emission programs	Dollars	CO_2 – equivalent	Direct costs of projects
Environmental protection expenditures	Dollars	Dollars	"
Environmental management programs	Dollars	Dollars	"
Initiatives to provide direct energy efficiency	Dollars		Direct costs of treatment or projects
Initiatives to provide indirect energy efficiency	Dollars		"
Non-production outputs Direct GHG emission:			
Carbon Dioxide (CO_2)	Metric tonne	CO_2 – equivalent	Volume of emissions
Methane (CH4),	Metric tonne	CO_2 – equivalent	"
Nitrous Oxide (N_2O)	Metric tonne	CO_2 – equivalent	"
Hydrofluorocarbons HFCs	Metric tonne	CO_2 – equivalent	"
Perfluorocarbons PFCs	Metric tonne	CO_2 – equivalent	"
Hydrofluoroethers (HFEs)	Metric tonne	CO_2 – equivalent	"
Indirect GHG emission:			
Transporting	Weight/Kilometre	CO_2 – equivalent	"
Employee commuting	Weight/Kilometre	CO_2 – equivalent	"
Business travel	Kilometre	CO_2 – equivalent	"
Wastes:			
Hazardous wastes:			
Composting	Metric tonne	CO_2 – equivalent	Volume of wastes
Reuse	Metric tonne	CO_2 – equivalent	"
Recycled	Metric tonne	CO_2 – equivalent	"
Recovery	Metric tonne	CO_2 – equivalent	"
Incineration	Metric tonne	CO_2 – equivalent	"
Landfill	Metric tonne	CO_2 – equivalent	"
Deep well injection	Metric tonne	CO_2 – equivalent	"

Table 7-1 Environmental characteristics captured by the SMAS (cont.)

Environmental characteristic	Quantity and Equivalents		Driver for Activity Allocation to Products (example)
	Quantity (unit of measure)	Environmental impact measure	
Wastes (cont.) :			
On-site storage	Metric tonne	CO_2 – equivalent	"
Other that specified by firms	Metric tonne	CO_2 – equivalent	"
Non-hazardous wastes	Metric tonne	CO_2 – equivalent	Volume of wastes
Solid wastes	Metric tonne	CO_2 – equivalent	"
Current practices			
Non-production outputs (Cont.)			
Wastes:			
Liquid wastes	Metric tonne	CO_2 – equivalent	Volume of wastes
Disposal wastes	Metric tonne	CO_2 – equivalent	"
Toxic wastes	Metric tonne	CO_2 – equivalent	"
Air emission:			
Carbon monoxide	Site specific or default data	CO_2 – equivalent	Volume of emissions
Nitrogen oxides	Site specific or default data	CO_2 – equivalent	"
Oxides of nitrogen	Site specific or default data	CO_2 – equivalent	"
Other air emissions indentified in regulations	Site specific or default data	CO_2 – equivalent	"
Emissions of ozone-depleting substances:			
Emissions (production + imports – exports of substances	Metric tonne	CFC -11 equivalent	"
Production (Substances produced – Substances destroyed by technology)	Metric tonne	CFC -11 equivalent	"
Material spills:			"
Chemical	Metric tonne	CO_2 – equivalent	"
Oil	Gallon/Litre/barrel	CO_2 – equivalent	"
Fuel	Gallon/Litre/barrel	CO_2 – equivalent	"
Spill of wastes	Metric tonne	CO_2 – equivalent	"
Others	Metric tonne	CO_2 – equivalent	"
Air emission:			"
Carbon monoxide	Site specific or default data	CO_2 – equivalent	"
Nitrogen oxides	Site specific or default data	CO_2 – equivalent	"
Oxides of nitrogen	Site specific or default data	CO_2 – equivalent	"
Other air emissions indentified in regulations	Site specific or default data	CO_2 – equivalent	"
Emissions of ozone-depleting substances:			"
Emissions (production + imports – exports of substances	Metric tonne	CFC -11 equivalent	"
Material spills:			
Production (Substances produced – Substances destroyed by technology)	Metric tonne	CFC -11 equivalent	"
Additional characteristics based on NGER/GRI			
Non-production outputs			
Recycling wastes	Metric tonne	CO_2 – equivalent (saved)	Volume of wastes

Table 7-1 Environmental characteristics captured by the SMAS (cont.)

Environmental characteristic	Quantity and Equivalents		Driver for Activity Allocation to Products (example)
	Quantity (unit of measure)	Environmental impact measure	
Additional characteristics based on NGER/GRI **(Cont.)**			
Non-production outputs			
Environmental fines and regulations	Dollars		Direct costs of treatment or projects
Location and size of land owned that impacts on biodiversity	Sq Kilometres		Direct costs of treatment or projects
Habitats protected or restored	Sq Kilometres		"
Total water discharge by quality and destination	Cubic metre / Kilolitre	CO_2 – equivalent	"
Environmental impacts of transporting products:			
Energy use (e.g. oil, kerosene, Fuel, and/or electricity)	Identify environmental impacts from transportation	CO_2 – equivalent	"
Emissions (e.g. GHG emission, NO_x, SO_x, other air emissions)	"	CO_2 – equivalent	"
Effluents (e.g. different kinds of chemicals)	"	CO_2 – equivalent	"
Wastes (e.g. different types of packaging materials)	"	CO_2 – equivalent	"
Noise	"	CO_2 – equivalent	"
Spills (e.g. spills of chemicals, oils, and/or fuels)	"	CO_2 – equivalent	"
Additional characteristics based on ACCA (1995)			
Regulation:			
Notification	Dollars		Direct costs of treatment or projects
Monitor/testing	Dollars		"
Studies/modelling	Dollars		"
Recordkeeping	Dollars		"
Plans	Dollars		"
Training	Dollars		"
Inspections	Dollars		"
Manifesting	Dollars		"
Labelling	Dollars		"
Preparedness	Dollars		"
Protective equipment	Dollars		"
Medical surveillance	Dollars		"
Environmental insurance	Dollars		"
Additional characteristics based on ACCA (1995)			
Regulation:			
Financial assurance	Dollars		"
Spill response	Dollars		"
Stormwater management	Dollars		"
Upfront:			
Permitting	Dollars		Direct costs of treatment or projects
Site studies	Dollars		"

Table 7-1 Environmental characteristics captured by the SMAS (cont.)

Environmental characteristic	Quantity and Equivalents		Driver for Activity Allocation to Products (example)
	Quantity (unit of measure)	Environmental impact measure	
Upfront (cont.):			
Site preparation	Dollars		Direct costs of treatment or projects
Engineering and procurement	Dollars		"
Installation	Dollars		"
Additional characteristics based on ACCA (1995)			
Back-End:			
Closure/decommissioning	Dollars		Direct costs of treatment or projects
Post-closure care	Dollars		"
Site survey	Dollars		"
Voluntary:			
Community relation/outreach	Dollars		"
Monitoring /testing	Dollars		"
Training	Dollars		"
Audits	Dollars		"
Quality suppliers	Dollars		"
Reports (e.g., annual environmental reports)	Dollars		"
Insurance	Dollars		"
Feasibility studies	Dollars		"
Environmental studies	Dollars		"
Research and development	Dollars		"
Financial support to environmental groups/researchers	Dollars		"
Contingent costs:			
Future compliance costs	Dollars		"
Response to future releases	Dollars		"
Property damage	Dollars		"
Personal injury damage	Dollars		"
Natural resources damages	Dollars		"
Economic loss damages	Dollars		"
Image and relationship costs:			
Corporate image	Dollars		"
Relationship with customers	Dollars		"
Relationship with investors	Dollars		"
Relationship with insurers	Dollars		"
Relationship with professional staff	Dollars		"
Image and relationship costs:			
Relationship with workers	Dollars		"
Relationship with suppliers	Dollars		"
Relationship with lenders	Dollars		"
Relationship with host communities	Dollars		"
Relationship with regulators	Dollars		"

Environmental characteristics identified from the results of the study support the design of SMAS that environmental data is captured from unit inputs, production processes, and non-production outputs to create more accurate environment accounting data. These costs are also separately identified from overheads before allocating to each production activity where they are considered necessary. Key allocation of environmental costs in the table below refers to direct costs of treatment and/or projects (Jasch 2009). Figure 7-1 shows an example of environmental cost allocation in the SMAS adopted from Schaltegger and Burritt (2000); Turney (1996).

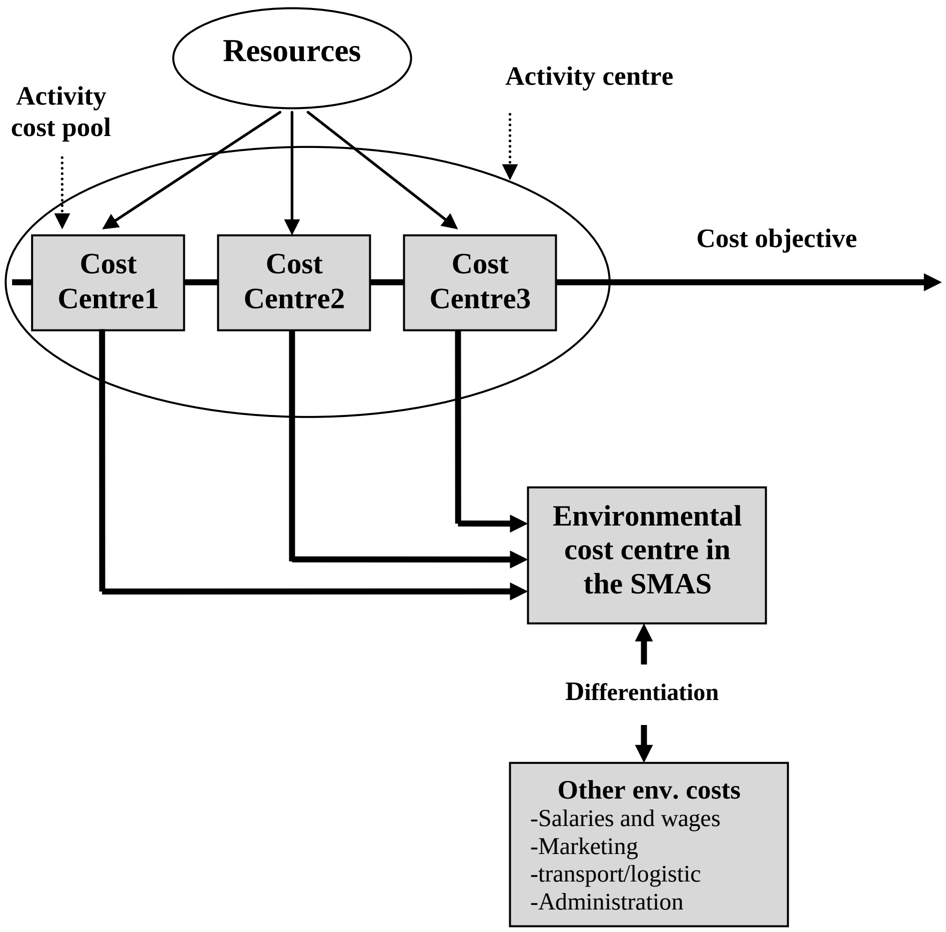


Figure 7-1 An example of environmental costs allocation in the SMAS

The SMAS separately identifies and captures environmental costs from unit inputs, production processes and non-product outputs from overheads, then allocates them to a single production activity where these costs are consumed based on cost allocation and cost centre of ABC approach (Jasch 2009; Schaltegger & Burritt 2000). Environmental costs are directly allocated to the activity where possible relative to costs of treating, volumes of emissions and wastes, and direct costs of material inputs, treatment, and/or projects (Jasch 2009). For example, wastes and/or emissions created from producing product are directly assigned to that product based on weight of product and/or volume of non-production output (Jasch 2009). In the meantime, quantities (units of measure), values (physical units × input price), and costs (e.g. materials, energy, water, and/or wastes) in the SMAS are attributed to the respective material flows (Jasch 2009). Companies effectively manage use and flows of physical units in production processes thus reducing levels of use of materials, energy, water, and wastes, and creating lower volumes of emissions and wastes (Schaltegger & Burritt 2000).

By adopting the SMAS, companies would have the ability to create more accurate environmental information to effectively support management decisions at the boardroom level. As environmental costs are rapidly increasing and negatively impact on economic performance (Epstein 2006), the SMAS assists enhanced environmental management decision-making on cost savings and GHG emission abatement for sustainable firms. Environmental data identified by the SMAS would assist in disclosure of physical and monetary information in relation to use and flows of resources, environmental management, and waste and emission abatement (IFAC 2005) and, in turn, support stakeholders' interests and the related concerns of society (Maak & Pless 2006). Shallow ecology perspective indicates that measuring environmental costs and carbon emissions in production processes would help companies to develop economic performance and environmental efficiency (Buechler 1993; Devall 1988; Seager 1993; Seed et al. 1988). The measurement of environmental costs from use of natural resources would assist management in controlling production costs (Devall & Sessions 1985; Jacob 1994). Thus, the SMAS facilitates companies to enhance corporate sustainability while adding shareholder value and creating better business opportunities in the marketplace (Carbon Trust 2005; EPA Victoria 2007). This study designed the SMAS conceptual model using social management accounting

(SMA) practices to further collect social data, thus fully costing products for management decisions and sustainability reporting *yearly*[13].

7.2.3 Social characteristics in SMAS

In a design of the SMAS, social management accounting (SMA) is employed to create more accurate social data for social internal management decisions and social disclosure purposes. Social costs are *daily* collected from expenditure provided for improvement in the quality of employee life, employee benefits, and other social responsibility divided into three categories[14]. The SMAS captured social costs from unit inputs related to quality of employee life such as working conditions, education and training, and healthcare and safety. Social costs are identified within production processes relating to employee benefits—employees' decision-making, over-time, working hours, bonuses, rewards, and other special offers. The SMAS captures more sources of expenditures spent on business activities and/or social management programs that companies provide to support employee benefits. Furthermore, social costs are measured from unit outputs – poor performance due to working conditions, employee absenteeism, sick/business leave, maternity leave, vacations/holidays, resignations and/or lay-offs. In this category, social costs include product responsibility such as customer satisfaction, customer health and safety, products recalls, community services, social welfare, employee self-development programs, research and product development, and compulsory cost of government policies.

The SMAS measures social impacts from more sources of social expenditures relating to costs, funding, and/or donation in kind of cash and employees' time in supporting social management decisions. According to Marx, capitalists need to develop society and/or social structures to significantly improve the quality of labourers and/or workers (Corlett 1998; Wolff 1999). This would create

[13] Significant values of K-mean cluster show monthly = 0.00, and yearly = 0.00 identifying and measuring environmental costs to support management decisions and reporting purposes (see Chapter 5)
[14] The results of benchmarking model, chapter 6

sustainable value when products were produced at efficient levels and could find a ready market to increase incomes (Marx 1981; Yee et al. 2008).

In the SMAS, social costs are also captured from expenditures spent on community development and all services provided to support community benefits including donation in kind of cash and employees' time in supporting local community development were identified as social data. Social data is collected from costs of education and training programs provided to support better working performance and future careers of the local community. In addition, more sources of social investment are measured as social costs including benefits, including community skill scholarships/training, educational facilities and career development. Apart from that, the SMAS identifies social costs health insurance and safety programs and external study assistance that bring benefits to the local community. In relation to this, other social issues relating to sustainable community development are also recognized as social costs by the SMAS. Social impact costs in the SMAS are incorporated in corporate social responsibility (CSR) reporting disclosing to create better relationships with stakeholders and the public.

Table 7-2 shows social characteristics collected by companies based on the analysis results of the survey and best practice firms. Companies surveyed capture social data from more sources of expenditure on social development. Missing social characteristics based on best practice companies are provided in Table 7-2. However, there are no additional characteristics of social impacts captured by international benchmarking companies.

Table 7-2 Social characteristics captured by the SMAS

Current practices:	Social characteristics
Unit inputs	Benefits provided for employees:
	Life insurance
	Health care
	Disability/invalidity coverage
	Maternity/paternity leave
	Retirement prevision
	Stock ownerships
	Transportation
	Special leaves
	Bonus programs
	Costs of education and training programs
	Counselling prevention and risk-control programs
	Healthcare and safety programs
	Skills management and lifelong learning programs to develop employees' skills and knowledge
	Average hours of training per year per employee:
	Vocational training and instruction
	Costs of educational leave
	Costs of training or education pursued externally
	Costs of training on specific topics
	Programs for skills management and lifelong learning:
	Pre-retirement planning
	Retraining for those intending to continue working
	Severance pay
	Job placement services
	Assistance (e.g. training, counselling) on transitioning on a non-working life
Production processes	Employees receiving a regular performance and career development reviews
	Minimum notice period(s) regarding operational changes
	Actions taken to respond to incidents of failure to follow policies and procedures
	Whistle blower policy/ hotline in response to incidents of fraud or other inappropriate activities
Unit outputs	Ratio of basic salary of males to basic salary of females for each employee category
	Programs and practices that manage the impacts of operations on communities:
	Community health and safety
	Involuntary resettlement , physical and economic displacement, and livelihood restoration
	Local culture, gender, indigenous peoples, and cultural heritage
	Legal actions for anti-competitive behaviour, anti-trust, and/or monopoly practices regarding major outcomes of these actions
	Fines and regulations of non-monetary sanctions for non compliance with laws and regulations
	Life cycle stages in which health and safety impacts of products and services are assessed for improvement

Table 7-2 Social characteristics captured by the SMAS (cont.)

Current practices:	Social characteristics
Unit outputs	Incidents of non-compliance with regulations and voluntary codes concerning health and safety impacts of products during their life cycle
	Ratio of basic salary of males to basic salary of females for each employee category
	Programs and practices that manage the impacts of operations on communities:
	Community health and safety
	Involuntary resettlement , physical and economic displacement, and livelihood restoration
	Local culture, gender, indigenous peoples, and cultural heritage
	Legal actions for anti-competitive behaviour, anti-trust, and/or monopoly practices regarding major outcomes of these actions
	Fines and regulations of non-monetary sanctions for non compliance with laws and regulations
	Life cycle stages in which health and safety impacts of products and services are assessed for improvement
	Incidents of non-compliance with regulations and voluntary codes concerning health and safety impacts of products during their life cycle
	Fines/Penalty
	Warning
	Voluntary codes
	Product information required by procedures, and/or percentage of products subject to information requirement
	Practices related to customer satisfaction:
	Fines/Penalty
	Warning
	Voluntary codes
	Incidents of non-compliance with regulations and voluntary codes concerning marketing communications, advertising, promotion, and/or sponsorship by type of outcomes
	Products are banned in certain markets
	Stakeholder questions or public debate
	Total monetary value of fines and or regulations concerning the provision and use of products
	Fines/Penalty
	Warning
	Voluntary codes
Additional characteristics identified from Australian best practices	
Unit inputs	Administrative funding for overseas travel
	Sustainable community development programs
	Expenditures provided to support community development
	Local and community supports/benefits
	Community skill scholarships e.g. training, educational facilities and career development.
Unit outputs	Road safety programs for local community.
	Respective local economy
	Cash donation,
	Donation in kind and hours e.g. employees' time/donation
	Political donations Obesity and other social issues
	Supporting Red Cross,
	Donation in kind of materials to maintain community benefits

The SMAS *daily* identify social impact costs from internal and external organizations, thus providing benefits to society and communities where companies operate. Companies collect social data from expenditure/funding provided to enhance the quality of employee life, community, and general social well-being. The SMAS supports companies to be more concerned with taking social issues into account by reducing negative impacts on society and local community where companies operate[15]. Social data are also employed to incorporate in social performance disclosures in order to support stakeholder demands and public interests (Gray & Bebbington 2001).

As the SMAS applies an ABC approach to help in cost allocation and analysis, social impacts costs are individually identified from overheads before allocating to fully cost products necessary for each production activity. Social characteristics in the tables above indicate that social data is captured from unit inputs, production processes, and unit outputs to create more accurate accounting data on social impacts. Social costs are allocated to a single production activity where they are considered as emanating from each production. The SMAS identifies allocation key for social impact costs based on costs of social development or community investment attributing to the production activity and to the respective costs centre and/or cost drivers (Jasch 2009). For example, social expenditures spent on improvement in the quality of employees' work environment in producing product are directly allocated to that product. In addition, donations in kind of cash and employees' time are also allocated to products produced by those specific employees. Figure 7-2 provides an example of social cost allocation in the SMAS adopted from Schaltegger and Burritt (2000); Turney (1996).

[15] The results of best practice companies in benchmarking model

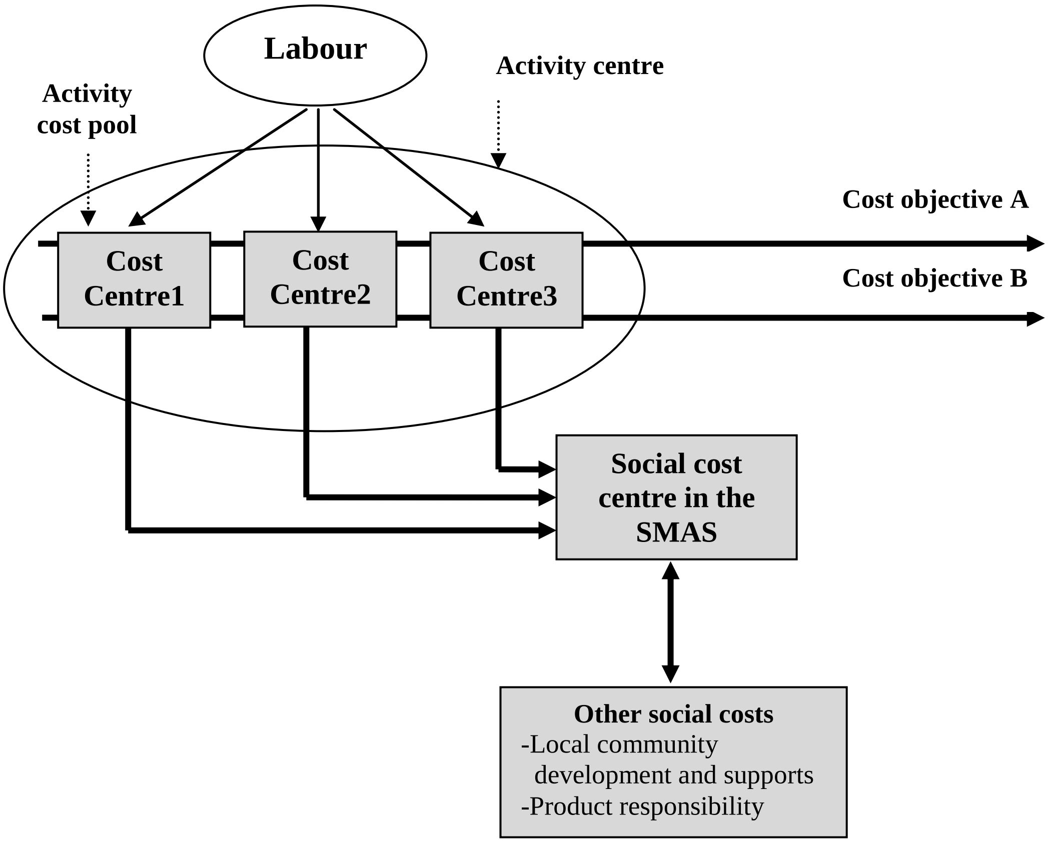


Figure 7-2 An example of social costs allocation in the SMAS

The SMAS creates more accurate cost information on social impacts for companies to enhance investment decisions, thus providing social expenditure to develop quality of employee life, employee benefits, and social well-being as a whole (Mook, Richmond & Quarter 2003). More accurate accounting data is incorporated in corporate social responsibility (CSR) reporting disclosures to address concerns of stakeholders and the public (Gray 2006; Gray et al. 2001).

To summarise the system characteristics for the SMAS, environmental and social data captured based on the results of the study support the SMAS conceptual model to create more accurate cost accounting information on environment and social impacts. The SMAS would eventually replace management accounting systems (MASs) because it captures economic, environmental, and social performance indicators. In addition, the SMAS separately identifies environmental and social impact costs from overheads, thus applying ABC application to help in cost allocation and analysis where these costs are considered necessary for each production activity (Jasch 2009). Environmental and social costs in the SMAS are attributed to cost centres and allocated to products thus tracking and tracing theses costs to appropriate cost objectives. The SMAS captures environmental and social data that international and local companies are not reporting but which SMAS could precisely report. Companies would be collecting data required by the GRI and NGER.

Thus, companies fully cost products, including environmental and social expenditures, to enhance management decision-making and to support external reporting initiatives. More accurate cost information of environment and social impacts are employed to incorporate in sustainability reporting thus developing tracking and reporting systems (Gadenne & Zaman 2002). Companies become better competitors in marketplaces when providing voluntary disclosures based on the requirements of NGER and/or GRI measurement experience which, in turn, creates improved strategic management decisions on energy consumption and emission abatement. Based on *stakeholder power,* the SMAS support companies in taking environmental and social issues into account while heeding ethical and moral obligations of business management activities (Freeman 1994; Ullmann 1985). Thus, in the SMAS, stakeholders' interests are firstly considered in accountability of management decisions to shareholders when providing more accurate cost information to support decision-making and external reporting initiatives.

The SMAS provides companies with a new management accounting practice to create more accurate cost accounting data of environment and social impacts in order to address stakeholders' and the public's interests, based on *stakeholder posture* (Ullmann 1985) thus supporting their perspective on improving the environment and society (Cormier, Gordon & Magnan 2004). The SMAS, therefore, create trustworthiness and reliability from the viewpoint of stakeholders which, in turn, would lead to enhanced organisational decision-making on investments in long-term. Companies are more aware of harmful impacts on the environment and society and, thus, improve their operational outcomes – creating *eco-efficiency* both immediately and in the future (Buchholz & Rosenthal 2004).

Companies become more concerned with preserving natural resources and reducing environmental damage—and promoting themselves as 'green' organizations (Carbon Trust 2005; EPA Victoria 2007). Companies would, therefore, create positive reputations—thus adding sustainable values to the economy, environment, and society in the long-term. Companies more precisely provide sustainability reporting in disclosing the development of economic, environmental and social performance to stakeholders and the public thus ensuring their sustainability is achieved.

7.5 Chapter summary

Chapter7 has discussed the design of the SMAS conceptual model for more accurate cost information of environment and social impacts. The purpose of the study and major findings have discussed and reiterated the importance and the study aspects, as well as clarifying aspects and motivation of the study. Major findings of quantitative and qualitative components have been identified based on the literature review relating to system characteristics for environmental and social cost identification and measurement employed to support management accounting best practices in benchmarking analysis and the SMAS conceptual model. This chapter has also discussed the designed SMAS conceptual model divided into three components—an application of activity based costing (ABC) approach; environmental management accounting (EMA); and social management accounting (SMA). Additionally, accounting practices of the SMAS conceptual model have also been justified, such as introducing a new accounting mechanism of management accounting to the manufacturing environment and to society. The relationships among sub-research questions, propositions, and analysis results within a theoretical framework for the SMAS conceptual model are summarised (see Appendix 7). Finally, a chapter summary is provided. Concluding remarks to the research, including contribution to the literature and practice, limitation of the study, and recommendations for future research are provided in Chapter 8.

CHAPTER 8: CONCLUSION, CONTRIBUTIONS, LIMITATIONS, AND FUTURE RESEARCH

Chapter 8 concludes the thesis and aims, firstly, to provide a summary of the major findings. It then presents the contribution of the study to the literature and implications of the findings to the practice of accounting by non-service manufacturing companies in Australia and New Zealand Subsequently, a discussion on the limitations of the study is provided, followed by suggestions for future research and concluding remarks.

8.1 Conclusions from the study

This study is exploratory study that examines system characteristics of 53 Australian and 9 New Zealander companies employed in their environmental and social cost identification and measurement to support the design of a new management accounting mechanism. The study designs the sustainability management accounting system (SMAS) conceptual model as a holistic system to help create more accurate cost information of environment and social impacts. Thus the survey results are utilized to identify where appropriate system characteristics of Australian companies employed in their environmental and social cost identification and measurement.

Apparently, companies in secondary data are in the early stage of developing their understanding of how to accurately identify and measure environmental and social impact costs in production processes and external organizations. Companies typically captured environmental data from different directions including costs reflecting unit inputs (e.g. material, energy, water and/or wastes), unit outputs (e.g. emissions, wastes, disposal wastes), and environmental management costs. Meanwhile, social data was collected from expenditures paid on improvement in the quality of life of employee, society, and community. The priority in collecting environmental and social data was to report internally and externally. Nonetheless, as environmental and social impact costs are not simple to accurately identify while they have been hidden among production processes, companies were seemingly having difficulty to create accurate data of environment and social impacts. They therefore indicated '*not at all'* in their response did not identify or measure environmental and social costs for management decisions or reporting purposes. Companies may be faced with difficulties in identifying and measuring environmental and social costs due to these costs being treated as overheads by traditional management accounting (IFAC 2005). Companies may need to change their management accounting practices/systems to create more accurate cost accounting data. Companies then indicated their intention to capture environmental and social data in the future.

Thus, by changing to a new management mechanism for environmental and social cost identification and measurement, companies would meet best practice needs, thus fully costing products for enhancement of internal management decisions and external reporting initiatives. Companies would more accurately identify and measure internal and external environmental costs—unit inputs, product outputs, and expenditure—provided to support environmental management prevention programs, wastes and emissions treatment, and pollution prevention (Gale 2006a). Meanwhile, social costs would be captured from more sources of social expenditures to support internal decision-making on cost measurement and provide corporate social responsibility (CSR) reporting. Companies would be involved in improving three areas of performance—economic, environment, and social well-being—by engaging sustainability accounting concepts to achieve sustainable value in the long-term (Bradbury & Clair 1999).

This study further investigated management accounting best practice of environmental and social cost identification and measurement from fifteen case studies by conducting in-depth interviews with selected chief accounting officers, financial controllers and sustainable management teams. The results were consistent with the survey results. The following major findings are worth noting.

1). *Cost identification and measurement:* best practice companies identified environmental costs from internal and external organizations including physical quantities (e.g. material, energy and water) measured against unit outputs such as emissions and wastes. Companies also identified environmental costs from expenditure on environmental management programs, pollution prevention and/or waste treatment costs. In addition, fines and/or government regulations were also recognized as environmental costs. Figure 8-1 provides summary of environmental costs into three categories.

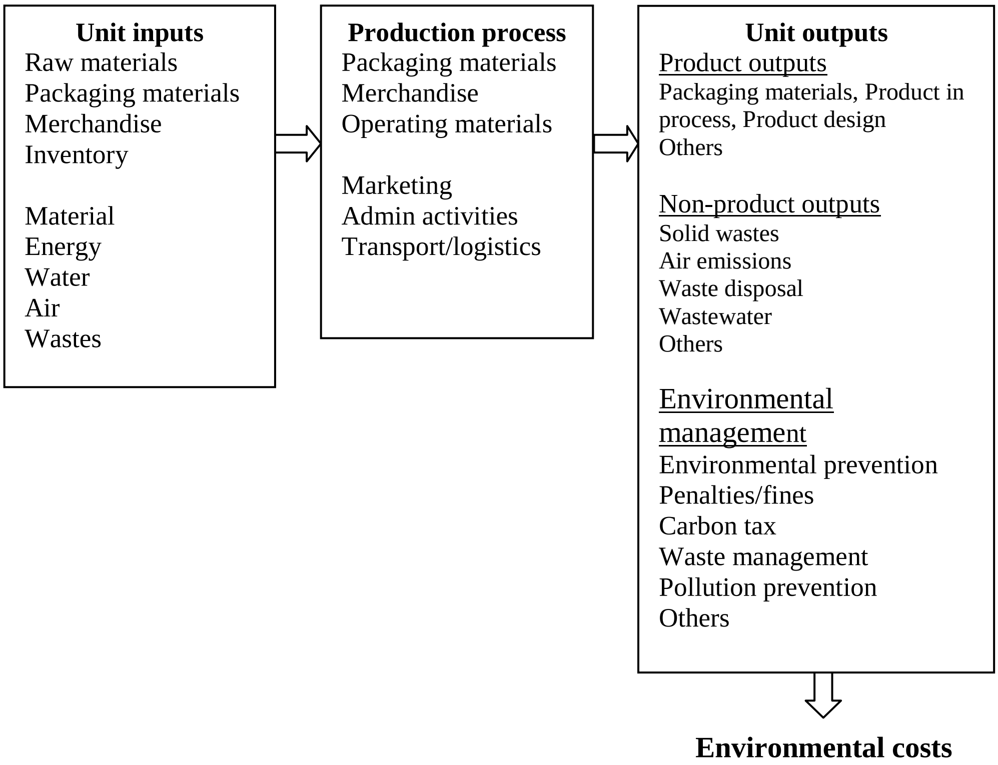


Figure 8-1 Environmental costs in the SMAS conceptual model

For social costs, best practice companies identified expenditure on social and community development, including funding provided to enhance quality of employee life, working performance and living standards. Donations in kind of cash and employee time that bring benefits to local communities where companies operate were also identified as social costs. This is also consistent with survey results. Figure 8-2 summarises social costs into three categories identified by the SMAS conceptual model.

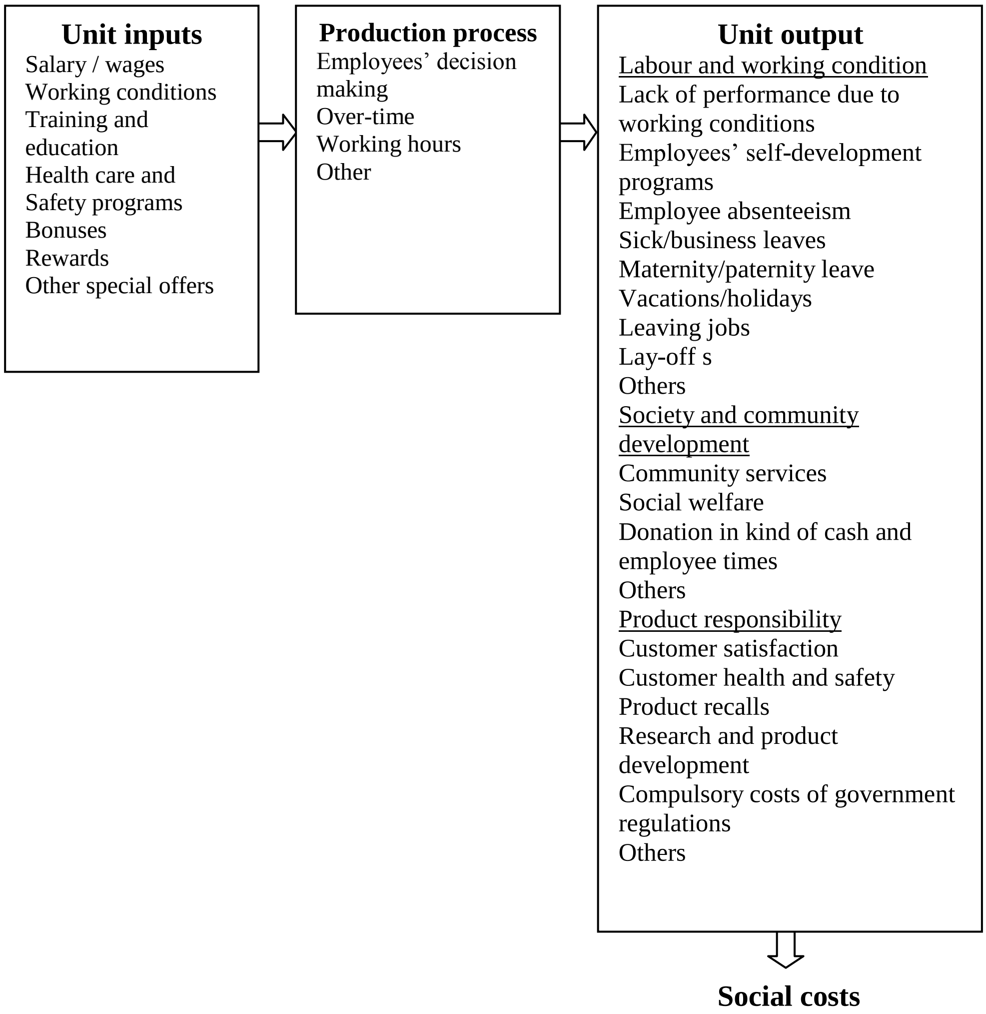


Figure 8-2 Social costs in the SMAS conceptual model

2). *Internal management decisions:* best practice companies employed environmental data for internal decision-making on cost savings and GHG emission reductions. Environmental data was used to support environmental management programs, to estimate alternative energy consumption, and to measure reductions in carbon emissions and waste. As a result, best practice companies were able to meet energy efficiency and GHG emission targets by using less energy and generating lower levels of emissions and waste to comply with the requirements of the NGER/GRI. Companies also employed more accurate social data to support social management decisions when identifying social expenditures to bring benefits to local communities. Social data supported management decisions on cost measurement to address concerns of stakeholders and society and to improve the quality of employees' lives, work performance, and living standards. By providing more accurate data, best practice companies were able to create eco-efficiency, along with improvements in environmental and social performance requisite in a sustainable organization.

3). *Sustainable organization*: best practice companies aimed to meet the conditions of a sustainable organization by attempting to identify environmental and social impact costs for decision-making and reporting purpose. Companies engaged in board-initiated and corporate social responsibility initiatives, thus taking environmental and social issues into account. Companies attempted to address stakeholder and societal concerns by providing sustainability reporting and disclosure on economic, environmental, and social performance to add shareholder value as a sustainable firm. Nevertheless, environmental and social data created by best practice companies did not separately identify these aspects from overheads. Environmental and social data was allocated to overheads based on existing management accounting practices (traditional accounting).

4). *Holistic system*: the SMAS conceptual model designed by this provides companies with a way to separately identify and measure environmental and social data from overhead accounts. The SMAS was designed to integrate with existing accounting system that provides Australian companies with a way to systematically capture environmental and social data from source documents (transactions). The modified spreadsheet systems currently used as a stand-alone system from existing management accounting systems do not individually capture environmental and social data efficiently. This results in environmental and social data being treated as overheads. The holistic approach in the design of SMAS helps create more accurate cost accounting data of environment and social impacts to enhance internal decision-making on cost savings and GHG emissions abatement. The SMAS conceptual model is the main contribution of the study to the literature and to practice. The major findings from answering sub-research questions and propositions are summarized below (Table 8-1).

Table 8-1 Summary of sub-research questions and propositions

	Results of the study
SR1: To what extent do current accounting systems capture and report environmental costs to support internal decision making for reducing emissions and wastes?	Answered
SR2: How are companies intending to change their accounting systems to meet environment and social internal decision making needs that will support future reporting requirements?	Answered
SR3: To what extent is leading practice in environment and social accounting systems and reporting being adopted by non-service manufacturing companies in Australia?	Answered
P1: Best practice companies identify costs of environment and social impacts as well as measuring reductions in contaminants to reduce negative impacts on humans, society, employees and the environment.	Answered
P2: Best practice companies more accurately provide environmental and social cost information for internal decision-making and to support external reporting disclosures	Incompletely answered
P3. A SMAS provides best practice companies with an enhanced environmental and social costs management system to improve internal decision-making and to support stakeholders' and public concerns	Answered
P4. A SMAS provides best practice companies with a mechanism to add value in economic, social, and environment areas of performance	Answered

Table 8-1 has identified a summary of sub-research questions and propositions answered by the major findings. Sub-research questions are completely answered from the results of secondary data in quantitative study. Proposition1, 3, and 4 are answered from the results of benchmarking model; best practice companies identify environmental and social impact costs to support decision-making and external reporting purposes. However, cost information is inaccurately allocated to overheads. This resulted in proposition2 not being answered completely. The following section provides contributions of the study.

8.2 Contributions of the study

8.2.1 Contributions to the literature

This study appears to be the first attempt to combine environmental management accounting (EMA) and social management accounting (SMA) practices, as well as applying an activity based costing (ABC) approach in an integrated holistic SMAS. The initial aim of this study was to create more accurate cost accounting data on environment and social impacts for management decisions and reporting systems. Other studies have mainly focused on sustainability reports that companies provide to address stakeholder concerns and do not necessary align with societal interests. Therefore, actual costs of environment and social impacts have tended to be inaccurate (Deegan 1996). This study designs the holistic SMAS conceptual model as suggested by the literature.

a). Various points of view in the literature (e.g. Lamberton 2005; Schaltegger 2004; Schaltegger, Bennett & Burritt 2006 ; Taplin, Bent & Aeron-Thomas 2006) promote the idea that sustainability accounting should be introduced as a new form of business activity which sustainable organizations can adopt to help make informed internal management decisions when measuring costs of environment and social impacts. Sustainability accounting frameworks should be developed as a new management accounting mechanism for data accuracy of environment and social impacts—which is unachievable with traditional accounting methods. Previous studies (e.g. Beer & Friend 2005; Gale 2006a; IFAC 2005; Qian & Burritt 2007) have identified the need for environmental management accounting to better manage physical and monetary units. Limited studies (e.g. Cullen & Whelan 2006; Mook, Richmond & Quarter 2003; Owen & Swift 2001; Spence 2009) also suggest that social accounting should be employed to measure social issues and create shareholder value when disclosing corporate social responsibility reporting. This study, therefore, conceptualizes sustainability accounting by designing a sustainability management accounting system (SMAS) conceptual model for Australian non-service manufacturing companies.

b). As sustainability accounting is a new form of business decision-making and sustainability reporting, it provides companies with a way to create cost accounting data of environment and social impacts. This study combines environmental management accounting (EMA) and social management accounting (SMA) practices in the SMAS conceptual model for cost identification and measurement. EMA practices are incorporated in the SMAS to make environmental costs visible while creating business opportunities for cost savings and carbon emissions reductions (Gale 2006b, 2006a; Sendroiu et al. 2006). However, as EMA practices do not cover social costs—which are of significant concern to stakeholders and society—(IFAC 2005) this study integrates social management accounting (SMA) in the SMAS conceptual model for social cost identification and measurement. An integration of the SMAS conceptual model would help companies meet data accuracy needs.

c). Limited studies (Lamberton 2005; Schaltegger 2004; Taplin, Bent & Aeron-Thomas 2006) suggest that sustainable costs (environment and social impacts) should be fully captured for decision-making on cost savings and reporting purposes. As ABC plays an important role in cost analysis and cost allocation (Armstrong 2006), it helps in assigning environmental costs to each production activity where actual costs are consumed (Jasch 2009; Neumann et al. 2004). According to Cãpusneanu (2008), activity based costing (ABC) application should involve ‘green accounting’ using activity cost drivers and cost analysis to reduce production costs—reductions in materials, energy and water in production processes. In the meantime, social costs provided to support social and community development should be allocated and captured as product costs. This helps in creating accurate accounting data for management decision-making and corporate social responsibility (CSR) reporting (Gray 2006; Gray et al. 2001).

However, for environmental and social costs, an ABC approach appears to have not previously been employed to help in the cost allocation and analysis to support decision-making on cost savings and/or reporting (Geri & Ronen 2005). ABC application should be developed in an accounting framework to create cost accounting data for business decision-making, activity-based management, management performance, and/or supply chain management (Nachtmann & Al-Rifai 2004). In relation to this, ABC in an accounting framework should also help in cost analysis—measuring physical units (e.g. material, energy, water and wastes) against unit outputs, including emissions and wastes (Sendroiu et al. 2006). Gale (2006a) identified wastes and emissions created from production processes as ‘end-of-pipe solution’ and should be collected as environmental costs. These costs need to be allocated to a single production activity based on flows of materials, energy, and/or water used in production processes (Sendroiu et al. 2006).

By applying an ABC application, it could effectively create cost allocation and analysis while more accurately providing social cost information to enhance business decision-making (Schaltegger & Burritt 2000). Companies could improve their investment decisions on social expenditure or funding provided to support the development of social performance (Tinker, Lehman & Neimark 1991). As a result, ABC application in the SMAS could help to create more accurate social data to analyse cost-benefits (Armstrong 2006; Northrup 2004) so that companies could appropriately provide social expenditure to address stakeholder and societal interests (Gray 2006; Gray et al. 2001).

d). The SMAS applies activity based costing (ABC) application to help in activity cost drivers, activity-based management, and performance management (Cãpusneanu 2008; Jasch 2009) of environmental and social impact costs (Sendroiu et al. 2006). This study develops environmental and social cost allocation and analysis, applying ABC application in relation to cost drivers or cost centres (Schaltegger & Burritt 2000). ABC in the SMAS was extended by fully costing products that capture environmental and social costs for business decision-making and reporting purposes (Gadenne & Zaman 2002; Nachtmann & Al-Rifai 2004; Sendroiu et al. 2006). An extended ABC is used in EMA practices to identify environmental costs, manage the use and flows of resources, energy and water while measuring reductions of these costs and contaminants (Beer & Friend 2005; Gale 2006a; IFAC 2005; Qian & Burritt 2007). ABC application is also applied in SMA practices, providing companies with the ability to measure social costs relating to improvements in quality of society, employees and the environment (Gray 2006; Mook, Richmond & Quarter 2003). This helps provide more accurate environmental and social cost information to improve internal decision-making (Burritt, Herzig & Tadeo 2009; Gadenne & Zaman 2002; Gale 2006a; Gray 2006) while developing three areas of performance—economic, environmental and social (Berkel 2003; Hubbard 2009; Lamberton 2005).

8.2.2 Contribution to practice

This study expects that the SMAS conceptual model would bring essential benefits such as improved management accounting practices/systems for environmental and social impact costs to non-service manufacturing companies. Subsequently, the SMAS could provide companies with a new management accounting mechanism to help improve the following areas.

a). *Cost identification and measurement:* an additional management accounting practice in SMAS such as *separating environmental and social costs from overhead accounts* would create more accurate cost accounting data. The SMAS could appropriately identify environmental costs from different directions in production processes and from external organizations. Environmental data is *daily* collected from unit inputs— cost of physical quantities (e.g. materials, energy, air, and water and unit outputs), production processes (e.g. packaging materials, product in process, product design), —and non-production outputs (e.g. solid wastes, emissions, waste disposal, and/or wastes). Environmental data is reported *monthly* to support internal decision-making and management of use and flows of physical quantities or unit inputs (e.g. material, energy, water and/or wastes). Environmental data includes unit outputs such as emissions, wastes and/or disposal wastes. Expenditure on environmental management and pollution prevention programs would also be identified as environmental costs—including end-of-pipe solution (Berkel 2003). The SMAS collects social costs *daily* from more sources of expenditures spent on development of quality of life of employee, working performance, social well-being. Social data is reported *monthly* as social performance expenditure and benefits provided to support local communities where companies operate. The SMAS attempts to create data accuracy of environment and social impacts as a result of recording and tracking systems thus allowing reporting *yearly* to stakeholders to disclose environmental and social performance.

b). *Cost allocation and analysis:* the SMAS collects environmental and social impact costs to allocate to each production activity where these costs are consumed. For instance, environmental expenditure invested on energy reduction and GHG emissions abatement projects are allocated to the cost centre of an individual product that needs energy to support the production process (Jasch 2009). In the meantime, social expenditure provided to support employee benefits (e.g. over-time, working hours, and/or sick/business leave) and/or community development that could reflect production processes are collected as social costs (Gray & Bebbington 2001). Environmental and social costs are assigned to cost centres while allocating to each production activity to estimate cost reductions for future production. Separate cost accounting data of environment and social impacts is incorporated in financial transactions, thus facilitating the development of recording, tracking and reporting systems. Thus, companies are able to provide more accurate accounting data to support stakeholders' and societal interests while employing data accuracy to support internal decision-making on cost reductions and GHG emission abatement.

c). *Benefits for accountants:* As the SMAS provides more accurate cost accounting data of environment and social impacts, this would make it easier for accountants in preparing financial statements for external stakeholders. In addition, as the SMAS was designed as a holistic system, it can be integrated with existing financial accounting systems. An integration of environmental management accounting (EMA) and social management accounting (SMA) concepts in the SMAS would help accountants to more accurately report environmental and social information internally when investment decisions need to be made (Epstein & Roy 2001). In addition, by adopting the integrated SMAS, accountants would find it relatively straightforward to extract environmental and social data for incorporation into financial reports to address the interests of stakeholders and the public.

d). *Effective management decisions:* by utilising the SMAS, companies would enhance decision-making by way of more accurate cost accounting data of environment and social impacts (Schaltegger, Bennett & Burritt 2006). More accurate cost accounting data of environment created by the SMAS would support early leaders in establishing environmental efficiency thus bringing environmental aspects into companies' operations (Gale 2006b, 2006a). Meanwhile, more accurate social data would effectively guide social decision-making when investing social expenditures on the development of quality of employees, community, and social well-being. Consequently, more accurate cost information of environment and social impacts incorporated in financial disclosures would support investment decisions thus creating eco-efficiency—along with the development of environmental and social performance (Epstein & Roy 2001).

e.) *Sustainable growth:* the holistic SMAS conceptual model could build long-term profits by reducing production costs and GHG emissions. By utilising the SMAS, companies could be equipped to wisely manage use and flows of natural resources to create lower levels of carbon contaminants. Companies could also add value to their triple bottom line (Berkel 2003; Milne 1996) by using environmental and social cost information and externally report initiatives (Borga et al. 2009; Taplin, Bent & Aeron-Thomas 2006). The SMAS has the potential to build better relationships with stakeholders while building a positive reputation as a ‘green’ producer in the marketplace (Carbon Trust 2005; EPA Victoria 2007). Furthermore, adopting the SMAS may provide sustainable organizations with the ability to comply with reporting energy consumption and emissions abatement to the NGER and meet the requirements of the GRI.

8.3 Limitations of the study

The scope of this study primarily involved management accounting practices/systems for environmental and social cost identification and measurement, as well as cost allocation and analysis (Berkel 2003). Companies employing cost accounting data of environment and social impacts to support management decisions on cost savings and GHG emissions reductions as well as external reporting initiatives (Burritt 2004) formed the basis of this study. In addition, the study is limited to *non-service sectors* particularly Australian manufacturing companies and New Zealander firms. Purposive sampling methods were used to identify fifty-three manufacturing companies in Australia and nine companies in New Zealand considered appropriate for this study. These companies provided responses to the Carbon Disclosures Project questionnaire (CDP 2009) relevant to items on the survey created for this study. Limitations to the study are as follows:

a). The design of the SMAS conceptual model was limited to system characteristics of non-service manufacturing sectors in terms of management accounting practices/systems for environmental and social cost identification and measurement. The system characteristics employed to support the design of the SMAS were limited to identifying and measuring environmental data from unit inputs in production processes (e.g. material, energy, water, and/or wastes) and unit outputs such as packaging materials, production processes, and non-production outputs (e.g. emission, solid waste, and/or waste disposal). Meanwhile, system characteristics for social data were limited to social expenditure that non-service manufacturing companies provided to support the development of employees, society, and local communities where companies operate.

b). The limitation of the sampling group in a survey was suggested by previous studies (e.g. Gadenne & Zaman 2002; Gale 2006a) and identified that Australian and New Zealander companies in this study are in the early stages of developing an understanding of environmental cost identification and measurement. In the meantime, Deegan (1996) also claimed that Australian companies provided sustainability reporting to create images and positive reputations as sustainable organizations, although social impact costs appear to be ignored. Chief accounting officers, financial controllers, and chief executive officers (Gadenne & Zaman 2002) participated in the study while providing information about environmental and social reporting mainly.

c). The limitation on the sample size was a result of those identified from the total number of companies that responded to the Carbon Disclosures Project questionnaire (CDP 2009). Purposive sampling methods selected a sample group from non-service manufacturing companies in Australia and New Zealand. Companies studied were limited to the same sectors identified in the survey. Fifteen companies were used for interview purposes as they were cases that were considered to be best practice in Australia for this study to determine environmental and social cost identification and measurement. Case studies provided sustainability reporting and disclosure on economic, environmental and social aspects of organizational activities (Berkel 2003). The cases studied were limited to companies that complied with requirements of external reporting initiatives such as NGER and/or GRI.

d). The use of statistical analysis was limited to general information on companies' background and participant profiles. The use of a Likert-type scale for cluster analysis was employed by this study to group similar responses to the questionnaires to each object (*not at all*, *monthly*, *quarterly*, *half yearly*, and *yearly*). In the meantime, a benchmarking model was developed adopting DMAIC of Lean Six Sigma Process Improvement Cycle as a measurement tool. This study employed define (D), measure (M), analyse (A), and improve (I) in the benchmarking model, while control (C) was given as is. These methodologies have their limitations but were considered appropriate given the exploratory nature of the study.

e). This study was limited to management accounting (MA) for cost identification and measurement of environment and social impacts. The SMAS conceptual model was developed to separately identify and measure cost of environment and social impacts from overheads.

f). Finally, the study was limited to expanding an ABC approach on cost allocation and analysis, thus individually assigning environmental and social costs to the production activity where these costs are consumed. The SMAS aims to accurately analyse environmental and social data within production processes and from external organizations, thus fully costing products for decision-making and reporting purposes. By expanding the ABC approach, the SMAS focuses on cost savings while creating eco-efficiency—and the development of environmental and social performance.

8.4 Recommendations for future research

It is recommended that future research extends beyond the sample group to further identify accurate accounting data of environment and social impacts. The research suggests future exploration in the following areas:

1). It is suggested that future research should reduce limitations to the design the SMAS conceptual model from system characteristics of the service sector relating to unit inputs (e.g. energy, water, air, and/or wastes) in service processes. Future research should investigate environmental and social data of service companies incorporating cost accounting data in corporate social responsibility (CSR) reporting. As Australian companies are lagging in the development of social performance, future research should focus on the need of service companies to improve quality of life of employees, society, and local communities where they operate.

2). Companies survey were limited to non-service manufacturing sectors in exploring environmental and social cost identification and measurement within production processes. Thus, future research should include *service sectors* to identify cost-benefits of environment and social impacts to create shareholder value. Environmental data should be identified from service processes such as identifying energy consumption to estimate reductions in GHG emissions. Meanwhile social costs should be identified from social expenditure or funding provided to support working performance or life assurance of employees in providing services. Service sectors should identify and measure environmental and social impact costs for internal decision-making and sustainable development reporting, thus adding sustainable value.

3). Case studies were limited to benchmarked companies globally. This study would suggest that future research should select more case studies and conduct in-depth interviews with selected chief accounting officers, sustainable development teams, chief executive officers and/or chief financial officers. Sampling groups up to fifteen companies would create a deeper understanding of the study from different points of views in creating environmental and social data to support management decisions and/or financial reporting. In addition, benchmarked companies should be globally selected from the service sector.

4). Data analysis adopted by the study has limitations. This study would also suggest that future research should employ factor analysis if the number of respondents is larger. In the meantime, this study developed a benchmarking model from adopting DMAIC of Lean Six Sigma Process Improvement Cycle as a measurement tool. This study employed define (D), measure (M), analyse (A), and improve (I) in the benchmarking model, while control (C) was given as is. Thus, this study would recommend that future research should reduce limitations to control (C) implementation. Future research should also examine control development of economic, social, and environmental performance while reporting triple bottom line to stakeholders and the public.

5). Financial accounting (FA) for environmental and social development performance is another issue for further research. As this study is limited to management accounting (MA) for cost identification and measurement, future research should examine financial accounting on monetary units when preparing external reporting to address the demands of stakeholders and the public. The need for companies to disclose accurate accounting data of environment and social impacts should be studied further to establish how companies could address the ever-increasing concerns of stakeholders. Companies should either create business opportunities or competitive advantages from disclosing financial performance of their organizations via accurate accounting data of environment and social impacts.

6). Full cost accounting for environmental and social impact costs should be further developed for the service sector. This is because full cost accounting mainly identifies environmental-related costs for business management decisions and/or reporting purposes. Future research should, therefore, examine full cost accounting for sustainability reporting, including environmental and social impact costs. Cost identification, measurement, and allocation of environment and social impacts should be identified to fully cost for management decisions on pricing systems, GHG emissions abatement, and/or social external development.

7. Finally, this study would suggest that future research should develop a fully holistic system from the conceptual model. A fully developed SMAS would support Australian companies to successfully enhance internal management decisions on cost savings while an ability to measure reductions in GHG emissions. Companies could also successfully enhance investment decisions on social cost measurement for improvement in quality of employee, community, and social well-being. Thus, by having a fully developed SMAS, Australian companies may create economic, environmental, and social value added while becoming more sustainable in the eye of stakeholders and the public.

8.5 Concluding remarks

This study designed the Sustainability Management Accounting System (SMAS) conceptual model to improve cost identification and measurement of environment and social impacts. The SMAS is combined with environmental management accounting (EMA) and social management accounting (SMA) practices to create accurate environmental and social impact costs. ABC application in SMAS should helps in cost allocation and analysis, thus fully costing products to enhance decision-making on cost savings and GHG emission reductions.

In a design of the SMAS conceptual model, this study examined management accounting best practices of environmental and social cost identification and measurement to support a holistic approach in the SMAS. Current practising companies that employed system characteristics (management accounting practices) in their sustainability reporting were investigated using quantitative components. The investigation aimed to establish appropriate management accounting practices for accurate accounting data of environment and social impact costs. This study further identified management accounting best practice for environmental and social impact costs by conducting in-depth interviews with selected chief accounting officers, financial controllers and sustainable management teams. This aimed to create a deeper understanding of management accounting best practices for cost identification and measurement, and design the holistic SMAS conceptual model.

Three theories were fused to explain the need of companies to more accurately identify and measure environmental and social impact costs for sustainable value added components—economic, environment, and social performance. Deep ecology theory explained that identifying and measuring environmental costs helps reduce negative impacts on the environment and society, thus creating economic and environmental efficiency. Marx's labour theory of value explained that capitalists maximize profits when quality of employee life, working performance, living standards and community are developed. Stakeholder theory was employed to examine business opportunities in improving accuracy of cost accounting data of environment and social impacts to support external disclosures. Companies created trustworthiness and reliability in the eyes of stakeholders, thus leading to enhanced long-term investment decisions. Thus, by accurately identifying and measuring environmental and social data, companies are able to create eco-efficiency and improve their environmental and social performance in the eyes of stakeholders and the public.

This study concludes that the Sustainability Management Accounting System (SMAS) conceptual model for cost identification and measurement of environment and social impacts supports companies in meeting their sustainable organizational needs. The SMAS conceptual model provides companies with a new management accounting mechanism to fully cost products for improvement in corporate management decision-making on costs and carbon contaminants, while reporting accurate cost accounting data to support stakeholders' interests and public demands. By applying the SMAS, environmental and social costs would be *separately* identified and measured from overheads using a cost driver system to help in cost allocation and analysis. The SMAS *monthly* collects environmental and social data to support internal decision-making on cost saving and GHG emission abatement. Accurate cost information of environment and social impacts are incorporated in annual reports to stakeholders. As a result, companies are perceived as 'green' producers and socially-aware organizations, thus creating a competitive advantage in the marketplace. Importantly, the SMAS creates economic, environmental and social value adding, and ensures sustainability is achieved. It is hoped that this study will prompt further research in this area and that the conceptual model will be used to frame the development of a 'real' sustainability management accounting system which is desperately needed to support organisations' measurement and reporting requirements.

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APPENDICES

Appendix 1: A survey instrument of environmental and social performance[16]

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Dear Sir/Madam:

The enclosed questionnaire is aimed at exploring effective management accounting practices in relation to measurement of environmental and social impact costs. It is being sent to management accountants such as yourself who may be dealing with environmental and social issues. As this study will develop a conceptual model of a sustainability accounting system (SMAS) to help in the identification and measurement of environmental and social impact costs, information you provide in response to the items in the questionnaire will be used as part of the data needed to produce a SMAS. A developed SMAS could help your company to accurately provide cost accounting information of environmental and social impacts to support business decision-making as well as providing triple bottom line disclosures to add value to sustainable organizations.

The questionnaire is completely anonymous. Please do not write your name on the questionnaire (except you are willing to participate in an interview). The conclusions of the study will be drawn in aggregate terms, without any reference to specific organizations or individual respondents. I would also like to assure you that the information you provide will be strictly confidential, and only accessible by me and my supervisors.

Participation in this questionnaire is completely voluntary, but your participation is very important in ensuring the quality of the research as well as assisting in the development of a SMAS. Please complete the questionnaire attached **within two weeks** and return by mail using reply-paid envelop. Should you be prepared to participate in an interview following survey collections, please indicate your contact details at the end of the survey form. A form is also enclosed that asks whether you are interested in receiving a summary of the results from the study. Again, if you are mailing the survey and form make sure they are in separated envelopes if you wish to maintain anonymity. This of course discloses who you are but this will be kept confidential.

Thank you for your participation.

Kind regards,

Neungruthai Petcharat

[16] A set of survey of 62 companies was used to evaluate responses to the Carbon Disclosure Project (CDP) as secondary data as per information in this letter.

Part I: management accounting systems for environmental and social performance

Instruction: *A number of indicators are listed in Part I to respond, please read the question at the top of the indicator column plus the particular indicators listed for example.*

> ***How often does your firm measure total volumes of direct materials in final products to report either internally or externally? And how often will your firm intend to report in future?***

If your firm ***does*** *measure and report either internally or externally* ***please tick (/)*** *the appropriate reporting frequency time frames under* ***column A*** *(current practices).*

If your firm currently ***does not*** *measure and report either externally or internally* ***please tick (/)*** *Not at all, and then go to* ***Column B****.*

If your firm is intending to report in future, you then please indicate by ***ticking (/)*** *the appropriate reporting frequency time frames in* ***column B*** *(future intentions).*

Environmental performance indicators ***How often does your firm measure indicators below to report either internally or externally? And how often will your firm intend to report in future?***	**Column A Current practices**		**Column B** Future intentions
	Internal	**External**	
Indicators	**Not at all, Monthly, Quarterly, Half yearly, Yearly**	**Not at all, Monthly, Quarterly, Half yearly, Yearly**	**Not at all, Monthly, Quarterly, Half yearly, Yearly**
1.total volume of direct materials in final products	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
2.total volume of non-renewable materials (e.g., minerals, metals, oil, gas, coal)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
3.percentage of recycled material used	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
4.total volume of direct energy consumption (e.g., natural gases, coal, oil, biomass energy, solar, and/or wind)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
5.total volume of indirect energy consumption (e.g., electricity, heating and cooling, steam, and other forms of energy)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
6.total amount of energy saved by process design, conservation, and/or changes in employees' behaviours	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
7.energy reduction program and measurement to reduce energy requirement - percentage of less energy used per day in production processes	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
8.energy reduction program and measurement to reduce indirect energy consumption (e.g., use of energy by intensive materials, subcontracted production, transportation, employee commuting)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
9.total usage of water by sources – surface water, wetlands, rivers, lakes, and/or ocean, ground water, rainwater, wastewater, etc.	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
10.percentage of water recycled/reused – wastewater recycled back to the same processes or different processes and other organizations' activities	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
11.description of activities, products, and/or services that have impacts on biodiversity in protected areas	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)

Source: Global Reporting Initiative Guidelines (2010a)

<u>Environmental performance indicators</u>

How often does your firm measure indicators below to report either internally or externally? And how often will your firm intend to report in future?

Indicators	Column A Current practices – Internal (Not at all / Monthly / Quarterly / Half yearly / Yearly)	Column A Current practices – External (Not at all / Monthly / Quarterly / Half yearly / Yearly)	Column B Future intentions (Not at all / Monthly / Quarterly / Half yearly / Yearly)
12.total number of direct greenhouse gas emissions in tonnes of CO_2 equivalent – created from burning fuel, electricity, heat, and/or steam, chemical processing, transporting materials, products, and/or wastes	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
13.total number of other indirect GHG emissions in tonnes of CO_2 equivalent – generated from employee commuting and/or business travelling.	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
14.program/methods/measurement of GHG emissions reductions that meet the emission reduction requirements of NGER	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
15.emissions in tonnes of CFC -11 equivalent of ozone depleting substances	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
16.total volume of production materials used to reduce GHG emissions?	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
17.total volume of spills including location, volume, and material– *oil, fuel, wastes and/or chemical*	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
18.total volume of wastes in tonnes by disposal methods – *composting, reuse, recycling, recover, incinerations, landfill, deep injection etc.*	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
19.total volume of internationally transported, imported, exported, and/or treated hazardous wastes	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
20.percentage of reused products and recycled packaging materials	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
21.initiatives to reduce environmental impacts of products and/or services relating to use of materials and water, emissions, effluents, noise, and/or wastes	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
22.environmental impacts of transporting products and/or materials used for the organization's operations and/or employees' commuting	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
23.total expenditures of environmental protection – *waste disposal and emission treatment, remediation costs, prevention and environmental management costs*	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
24.toxic wastes reductions - chemical wastes, hazard wastes, non-hazard wastes, and/or end-of-life products to minimize landfills and incineration	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
25.- other GHG Emissions - Methane (CH4), Per-fluorocarbons (PFC), Nitrous oxide (N2O), Hydro-fluorocarbons (HFC), and/or Sulfur-hexafluoride (SF6)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)

Source: Global Reporting Initiative Guidelines (2010a)

Social performance indicators ***How often does your firm measure indicators below to report either internally or externally? And how often will your firm intend to report in future?***	**Column A Current practices**		**Column B** Future intentions
	Internal	**External**	
	Not at all / Monthly / Quarterly / Half yearly / Yearly	**Not at all / Monthly / Quarterly / Half yearly / Yearly**	**Not at all / Monthly / Quarterly / Half yearly / Yearly**
Labour practices and working conditions			
1. Benefits provided for employees – *life insurance, health care, disability/invalidity coverage, maternity/paternity leave, retirement prevision, stock ownerships, transportation, special leaves, and/or bonus programs.*	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
2. Minimum notice period(s) to inform employees regarding organizational changes that could affect them	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
3. Education, training, counselling prevention and risk-control programs to assist employees, their families, and/or community members in relation to serious diseases.	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
4. Health and safety topics covered in formal agreements with trade unions	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
5. Average hours of training per year per employee by employee categories	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
6. Programs for skills management and lifelong learning to develop employees' skills and to update abilities, knowledge, and/or qualification	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
7. Percentage of employees receiving a regular performance and career development reviews	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
8. Ratio of basic salary of males to basic salary of females for each employee category	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
Society			
9. Nature, scope, and effectiveness of any programs and practices that manage the impacts of operations on communities	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
10. Percentage of employees trained in organization's failure of policies and procedures	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
11. Actions taken to respond to incidents of failure to follow policies and procedures	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
12. whistle blower policy/ hotline in response to incidents of fraud or other inappropriate activities	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
13. Total number of legal actions for anti-competitive behaviour, anti-trust, and/or monopoly practices regarding major outcomes of these actions	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
14. Total monetary value of fines and/or total number of non-monetary sanctions for non compliance with laws and regulations	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)

Source: Global Reporting Initiative Guidelines (2010a)

Social performance indicators ***How often does your firm measure indicators below to report either internally or externally? And how often will your firm intend to report in future?***	**Column A Current practices**		**Column B** Future intentions
	Internal	**External**	
Product responsibility	Not at all / Monthly / Quarterly / Half yearly / Yearly	Not at all / Monthly / Quarterly / Half yearly / Yearly	Not at all / Monthly / Quarterly / Half yearly / Yearly
15. Life cycle stages in which health and safety impacts of products and services are assessed for improvement	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
16. Total number of incidents of non-compliance with regulations and voluntary codes concerning health and safety impacts of products during their life cycle	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
17. Product information required by procedures, and/or percentage of products subject to information requirement	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
18. Practices related to customer satisfaction including results of surveys measuring customer satisfaction	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
19. Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, advertising, promotion, and/or sponsorship by type of outcomes	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)
20. Total monetary value of fines for non-compliance with laws and regulations concerning the provision and use of products	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)

Source: Global Reporting Initiative Guidelines (2010a)

Part II: Company's profile

Instruction: *These questions are provided to seek participant's responsibilities and your company's profile relating to environmental and social management accounting practices. Please indicate by ticking questions that are relevant to you.*

1. What non-service manufacturing sectors does your organization belong to and what are ANZSIC Codes relating to your manufacturing sectors? *(Please tick as many as apply)*

( )1. Transport [ANZSIC Code: 461-529]

( )2. Mining [ANZSIC Code: 060-109]

( )3. Electricity, Gas and Water Supply [ANZSIC Code: 261-292]

( )4. Food, Beverage and Tobacco Manufacturing [ANZSIC Code: 121-122]

( )5. Textile, Clothing, Footwear and Leather Manufacturing [ANZSIC Code: 131-135]

( )6. Wood and Paper Product Manufacturing [ANZSIC Code: 149-152]

( )7. Printing, Publishing and Recorded Media [ANZSIC Code: 161-162]

( )8. Petroleum, Coal, Chemical and Associated Product Manufacturing [ANZSIC Code: 170-184]

( )9. Non-Metallic Mineral Product Manufacturing [ANZSIC Code: 209-213]

( )10. Metal Product Manufacturing [ANZSIC Code: 223-224]

( )11. Machinery and Equipment Manufacturing [ANZSIC Code: 249-251]

( )12. Other Manufacturing [ANZSIC Code: 259]

2. In what sectors does your company operate? *(Please tick as many as apply)*

3.1 Local only	( )	3.2 State wide	( )
3.3 Interstate	( )	3.4 Internationally	( )

3. Where is your department/section based?

City ____________________ State ___________________

Interview participation

Would you be willing to participate in an interview for this study?

( ) Yes ( ) No

If yes, please provide contact details

Name: ____

Company: ____

Location:____

Telephone: ____

E-mail address: ____

-----------Thank you for your participation---------

Appendix 2: Interview list of environmental and social cost identification and measurement

USQ UNIVERSITY OF SOUTHERN QUEENSLAND

Neungruthai Petcharat (Nickie)
PhD Candidate
School of Accounting, Economics & Finance
University of Southern Queensland
West St. Toowoomba, Qld 4350 Australia
E-mail: petchara@usq.edu.au

Dear Interview participant

I am a PhD candidate at the University of Southern Queensland, Australia. I am conducting an interview to generate part of the data needed for my PhD dissertation titled: 'Identification of Effective Management Accounting System Characteristics to Support Sustainable Value Chains: Towards a Management Accounting System for Sustainable Development in Non-service Manufacturing Industry'.

For this interview, you will be phoned and asked the questions attached to this letter. During the interview, I will listen to and record your responses using phone recoding device. At any time, you will have the right to say you do not want your responses recorded. The transcript will be used to identify current practice of environmental and social cost identification and measurement, without any reference to your identity. Therefore, your name, your company's name, and/or any identifier will not appear in any of the outputs of the research.

I would also like to advise that participation in this interview is voluntary and you may choose to withdraw at any time during or after the interview.

I, ________________________________have read the above statements and agree to participate in an interview under the conditions stated.

I, ________________________________give / do not give permission for the interview to be digitally recorded.

____________________________________ ____________________

Signature of participant Date

Neungruthai Petcharat 25 / 05 / 2010

Signature of interviewer Date

General characteristics of company
1. To confirm that your company belongs to ……………………………………..sector(s), your company' ANZSIC Code is ……………………………………………………..., and your operation/department/sections are based in…………………………………..…..
Management accounting for environmental and social performance
2. What accounting system/software does your company use? 3. What system does your company use to capture environmental and/or social data? 4. Was the environmental and/or social system bought off the shelf/ developed internally from scratch/ a modified system based on an existing financial/management accounting system? 5. How long has a company run this system/software for environmental and/or social data recording? 6. Is this system/program/software for environmental and social data recording stand alone or integrated with your financial/management accounting system? Please describe. 7. Are there separate systems for environmental and social data recording? Please describe. 8. Does your environmental and/or social system capture costs and physical quantities (including quantities of energy, materials, waste, emissions etc.) from source documents/transaction at first point of input into the system? Please describe how this is done. 9. Please explain how this system/software assists your company to separately identify environmental and social impact costs from overheads? 10. Please identify what other sources of environmental data that your company would like to collect to support environmental performance disclosures. And in what timeframe? 11. Please identify what other sources of social data that your company would like to measure to support sustainability reports. And in what timeframe? 12. Please describe what motivated your company to collect environmental and/or social data to support environmental and sustainability reporting – e.g. requirement/regulation, board initiated, corporate social responsibility initiative. 13. How long has your company been reporting environmental and/or social impacts? 14. Please explain how your company calculates GHG emissions in tonnes of CO_2 equivalents. 15. Please describe what other sources of GHG emissions that your company would like to measure to support environmental performance disclosures. And in what timeframe? 16. Please explain how your company measures energy consumption and carbon emissions abatement to meet the requirement of the NGER and/or GRI. 17. Can your current system/software create accurate environmental and social data to support environmental and sustainability reports? Please describe 18. Please describe how your company creates potential sustainable values by identifying environmental and social data to support sustainability reports.

Participants' profile

Participant's background:

1. Participant position:

( ) Chief accountant officer ( ) Chief financial officer

( ) Management accountant ( ) Controller ( ) Other specify)________________

2. Your education background: *(Please tick as many as apply)*

( ) Accounting ( ) Finance ( ) Economics

( ) Management ( ) other (specify)______________________

3. Role / position title:____

4. Work experience in accounting: _________________ years

5. Work experience in environmental accounting: _____________________years

6. Work experience in social accounting: _____________________________years

7. Have you ever attended any short training courses relating to your work that involves in environmental/social issues? Yes ( ) No ( )

If Yes, please indicate total number of hours: ___________hours in the last 12 months

8. Should we have further questions, would you be prepared to answer additional questions?

Yes / No

If you would like to receive a copy of summary results of this study, please provide your contact details

1. *Electronic copy ( ) Email:*____
2. *Hard-copy ( ) Address:*____

____

____

-----------------Thank you for your predications-----------------

Appendix 3: A summary of results of system characteristics - Environmental performance indicators – internal reporting

Item	Not at all, N (%)	Monthly, N (%)	Quarterly, N (%)	Half yearly, N (%)	Yearly, N (%)	Mean	Median	Missing	Value (N)
1. Total volume of direct materials in final products	35* 56.5**	18* 29**	3* 4.8**	1* 1.6**	5* 8.1**	1.76	1	0	62
2. Total volume of non-renewable materials (e.g., minerals, metals, oil, gas, coal)	37 59.7	20 32.3	4 6.5	1 1.6	-	1.50	1	0	62
3. Percentage of recycled material used	34 54.8	20 32.3	3 4.8	1 1.6	4 6.5	1.73	1	0	62
4. Total volume of direct energy consumption (e.g., natural gases, coal, oil, biomass energy, solar, and/or wind)	9 14.5	21 33.9	-	-	32 51.6	3.40	5	0	62
5. Total volume of indirect energy consumption (e.g., electricity, heating and cooling, steam, and other forms of energy)	8 12.9	22 35.5	-	-	32 51.6	3.42	5	0	62
6. Total amount of energy saved by process design, conservation, and/or changes in employees' behaviours	14 22.6	21 33.9	-	-	27 43.5	3.08	2	0	62
7. Energy reduction program and measurement to reduce energy requirement - percentage of less energy used per day in production processes	17 27.4	17 27	1 1.6	-	27 43.5	3.08	2	0	62
8. Energy reduction program and measurement to reduce indirect energy consumption (e.g., use of energy by intensive materials, subcontracted production, transportation, employee commuting)	19 30.2	16 25.8	1 1.6	-	26 41.9	2.97	2	0	62
9. Total usage of water by sources – surface water, wetlands, rivers, lakes, and/or ocean, ground water, rainwater, wastewater, etc.	51 82.3	6 9.7	1 1.6	-	4 6.5	1.39	1	0	62
10. Percentage of water recycled/reused – wastewater recycled back to the same processes or different processes and other organizations' activities	46 74.2	7 11.3	-	-	9 14.5	1.69	1	0	62
11. Description of activities, products, and/or services that have impacts on biodiversity in protected areas	56 90.3	4 6.5	-	-	2 3.2	1.19	1	0	61
12. Total number of direct greenhouse gas emissions in tonnes of CO_2 equivalent – created from burning fuel, electricity, heat, and/or steam, chemical processing, transporting materials, products, and/or wastes	6 9.7	16 25.8	1 1.6	-	39 62.9	3.81	5	0	62
13. Total number of other indirect GHG emissions in tonnes of CO_2 equivalent – generated from employee commuting and/or business travelling.	6 9.7	16 25.8	1 1.6	-	39 62.9	3.81	5	0	62
14. Program/methods/ measurement of GHG emissions reductions that meet the emission reduction requirements of NGER	7 11.3	16 25.8	1 1.6	-	38 61.3	3.74	5	0	62
15. Emissions in tonnes of CFC -11 equivalent of ozone depleting substances	7 11.1	17 2.4	1 1.6	-	37 59.7	3.69	5	0	62
16. Total volume of production materials used to reduce GHG emissions?	15 23.8	15 23.8	1 1.6	-	31 50.0	3.27	4	0	62
17. Total volume of spills including location, volume, and material– *oil, fuel, wastes and/or chemical*	48 77.4	5 8.1	1 1.6	-	8 12.9	1.73	1	0	62
18. Total volume of wastes in tonnes by disposal methods	45 72.6	7 11.3	1 1.6	-	9 14.5	1.63	1	0	62
19. Total volume of internationally transported, imported, exported, and/or treated hazardous wastes	23 37.1	13 21.0	1 1.6	-	25 40.3	2.89	2	0	62
20. Percentage of reused products and recycled packaging materials	51 81.0	7 11.1	1 1.6	-	3 4.8	1.34	1	0	62
21. Initiatives to reduce environmental impacts of products and/or services relating to use of materials and water, emissions, effluents, noise, and/or wastes	18 29.0	17 27.4	-	-	27 43.5	3.02	2	0	62
22. Environmental impacts of transporting products and/or materials used for the organization's operations and/or employees' commuting	17 27.4	15 24.2	1 1.6	-	29 46	3.15	2	0	62
23. Total expenditures of environmental protection – *waste disposal and emission treatment etc.*	14 22.2	16 25.8	1 1.6	-	31 50.0	3.29	4	0	62
24. Toxic wastes reductions - chemical wastes, hazard wastes, non-hazard wastes, and/or end-of-life products to minimize landfills and incineration	50 80.6	3 4.8	1 1.6	-	8 12.9	1.60	1	0	62
25. Other GHG Emissions - Methane (CH4), PFC, N2O, HFC, and/or SF6	50 80.6	1 1.6	-	-	11 17.7	1.73	1	0	62

*** Number of responses **Percentages**

- Environmental performance indicators – external reporting

Item	Not at all, N (%)	Monthly, N (%)	Quarterly, N (%)	Half yearly, N (%)	Yearly, N (%)	Mean	Median	Missing	Value (N)
1. Total volume of direct materials in final products	57* 91.9**	-	-	-	5* 8.1**	1.32	1	0	62
2. Total volume of non-renewable materials (e.g., minerals, metals, oil, gas, coal)	-	-	-	-	-	1.00	1	0	62
3. Percentage of recycled material used	57 91.9	-	-	-	5 8.1	1.32	1	0	62
4. Total volume of direct energy consumption (e.g., natural gases, coal, oil, biomass energy, solar, and/or wind)	22 35.5	5 8.1	-	-	35 56.5	3.34	5	0	62
5. Total volume of indirect energy consumption (e.g., electricity, heating and cooling, steam, and other forms of energy)	19 30.6	7 11.3	-	-	36 58.1	3.44	5	0	62
6. Total amount of energy saved by process design, conservation, and/or changes in employees' behaviours	24 38.7	7 11.3	-	-	31 50.0	3.11	3.50	0	62
7. Energy reduction program and measurement to reduce energy requirement - percentage of less energy used per day in production processes	25 40.3	8 12.9	-	-	29 46.8	3.00	2	0	62
8. Energy reduction program and measurement to reduce indirect energy consumption (e.g., use of energy by intensive materials, subcontracted production, transportation, employee commuting)	28 45.2	6 9.7	-	-	28 45.2	2.90	2	0	62
9. Total usage of water by sources – surface water, wetlands, rivers, lakes, and/or ocean, ground water, rainwater, wastewater, etc.	57 91.9	-	-	-	5 8.1	1.32	1	0	62
10. Percentage of water recycled/reused – wastewater recycled back to the same processes or different processes and other organizations' activities	50 80.6	2 3.2	-	-	10 16.1	1.68	1	0	62
11. Description of activities, products, and/or services that have impacts on biodiversity in protected areas	59 95.2	1 1.6	-	-	2 3.2	1.15	1	0	62
12. Total number of direct greenhouse gas emissions in tonnes of CO_2 equivalent – created from burning fuel, electricity, heat, and/or steam, chemical processing, transporting materials, products, and/or wastes	15 24.2	6 9.7	-	-	41 66.1	3.74	5	0	62
13. Total number of other indirect GHG emissions in tonnes of CO_2 equivalent – generated from employee commuting and/or business travelling.	15 24.2	6 9.7	-	-	41 66.1	3.74	5	0	62
14. Program/methods/ measurement of GHG emissions reductions that meet the emission reduction requirements of NGER	17 27.4	6 9.7	-	-	39 62.9	3.61	5	0	62
15. Emissions in tonnes of CFC -11 equivalent of ozone depleting substances	16 25.8	6 9.7	-	-	40 64.5	3.68	5	0	62
16. Total volume of production materials used to reduce GHG emissions?	22 35.5	6 9.7	-	-	34 54.8	3.29	5	0	62
17. Total volume of spills including location, volume, and material– *oil, fuel, wastes and/or chemical*	52 83.9	2 3.2	-	-	8 12.9	1.63	1	0	62
18. Total volume of wastes in tonnes by disposal methods – *composting, reuse, recycling, recover, incinerations, landfill, deep injection etc.*	50 80.6	3 4.8	-	-	9 14.5	1.55	1	0	62
19. Total volume of internationally transported, imported, exported, and/or treated hazardous wastes	30 48.4	4 6.5	-	-	28 45.2	2.90	2	0	62
20. Percentage of reused products and recycled packaging materials	56 90.3	2 3.2	-	-	4 6.5	1.29	1	0	62
21. Initiatives to reduce environmental impacts of products and/or services relating to use of materials and water, emissions, effluents, noise, and/or wastes	26 41.9	5 8.1	-	-	31 50.0	3.08	3.50	0	62
22. Environmental impacts of transporting products and/or materials used for the organization's operations and/or employees' commuting	26 41.9	5 8.1	-	-	31 50.0	3.08	3.50	0	62
23. Total expenditures of environmental protection – *waste disposal and emission treatment, remediation costs, prevention and environmental management costs*	24 38.7	6 9.7	-	-	32 51.6	3.16	5	0	62
24. Toxic wastes reductions - chemical wastes, hazard wastes, non-hazard wastes, and/or end-of-life products to minimize landfills and incineration	54 87.1	-	-	-	8 12.9	1.52	1	0	62
25. Other GHG Emissions - Methane (CH4), PFC, N2O, HFC, and/or SF6	51 82.3	-	-	-	11 17.7	1.71	1	0	62

*** Number of responses **Percentages**

- Environmental performance indicators – future intention

Item	Not at all, N (%)	Monthly, N (%)	Quarterly, N (%)	Half yearly, N (%)	Yearly, N (%)	Mean	Median	Missing	Value (N)
1. Total volume of direct materials in final products	**56* 90.3****	**1* 1.6****	-	-	**5* 8.1****	**1.34**	**1**	**0**	**62**
2. Total volume of non-renewable materials (e.g., minerals, metals, oil, gas, coal)	**60 96.8**	-	-	-	**2 3.2**	**1.13**	**1**	**0**	**62**
3. Percentage of recycled material used	**56 90.3**	-	-	-	**6 9.7**	**1.39**	**1**	**0**	**62**
4. Total volume of direct energy consumption (e.g., natural gases, coal, oil, biomass energy, solar, and/or wind)	**20 32.3**	-	-	-	**42 67.7**	**3.71**	**5**	**0**	**62**
5. Total volume of indirect energy consumption (e.g., electricity, heating and cooling, steam, and other forms of energy)	**19 30.6**	-	-	-	**43 69.4**	**3.77**	**5**	**0**	**62**
6. Total amount of energy saved by process design, conservation, and/or changes in employees' behaviours	**20 32.2**	-	-	-	**43 69.4**	**3.82**	**5**	**0**	**62**
7. Energy reduction program and measurement to reduce energy requirement - percentage of less energy used per day in production processes	**19 30.6**	-	-	-	**43 69.4**	**3.82**	**5**	**0**	**62**
8. Energy reduction program and measurement to reduce indirect energy consumption (e.g., use of energy by intensive materials, subcontracted production, transportation, employee commuting)	**21 33.9**	-	-	-	**41 66.1**	**3.65**	**5**	**0**	**62**
9. Total usage of water by sources – surface water, wetlands, rivers, lakes, and/or ocean, ground water, rainwater, wastewater, etc.	**57 91.9**	-	-	-	**5 8.1**	**1.32**	**1**	**0**	**62**
10. Percentage of water recycled/reused – wastewater recycled back to the same processes or different processes and other organizations' activities	**51 82.3**	-	-	-	**11 17.7**	**1.71**	**1**	**0**	**62**
11. Description of activities, products, and/or services that have impacts on biodiversity in protected areas	**61 98.4**	-	-	-	**1 1.6**	**1.06**	**1**	**0**	**62**
12. Total number of direct greenhouse gas emissions in tonnes of CO_2 equivalent – created from burning fuel, electricity, heat, and/or steam, chemical processing, transporting materials, products, and/or wastes	**12 19.4**	-	-	-	**50 80.6**	**4.23**	**5**	**0**	**62**
13. Total number of other indirect GHG emissions in tonnes of CO_2 equivalent – generated from employee commuting and/or business travelling.	**11 17.7**	-	-	-	**51 82.3**	**4.29**	**5**	**0**	**62**
14. Program/methods/ measurement of GHG emissions reductions that meet the emission reduction requirements of NGER	**12 19.4**	-	-	-	**50 80.6**	**4.23**	**5**	**0**	**62**
15. Emissions in tonnes of CFC -11 equivalent of ozone depleting substances	**12 19.4**	-	-	-	**50 80.6**	**4.23**	**5**	**0**	**62**
16. Total volume of production materials used to reduce GHG emissions?	**18 29.0**	**1 1.6**	-	-	**43 69.4**	**3.79**	**5**	**0**	**62**
17. Total volume of spills including location, volume, and material– *oil, fuel, wastes and/or chemical*	**48 77.4**	-	-	-	**14 22.6**	**1.90**	**1**	**0**	**62**
18. Total volume of wastes in tonnes by disposal methods – *composting, reuse, recycling, recover, incinerations, landfill, deep injection etc.*	**49 79.0**	-	-	-	**13 21.0**	**1.84**	**1**	**0**	**62**
19. Total volume of internationally transported, imported, exported, and/or treated hazardous wastes	**27 43.5**	-	-	-	**35 56.5**	**3.30**	**5**	**0**	**62**
20. Percentage of reused products and recycled packaging materials	**53 85.4**	-	-	-	**9 14.6**	**1.59**	**1**	**0**	**62**
21. Initiatives to reduce environmental impacts of products and/or services relating to use of materials and water, emissions, effluents, noise, and/or wastes	**23 37.1**	-	-	-	**39 62.9**	**3.52**	**5**	**0**	**62**
22. Environmental impacts of transporting products and/or materials used for the organization's operations and/or employees' commuting	**21 33.9**	-	-	-	**41 66.1**	**3.65**	**5**	**0**	**62**
23. Total expenditures of environmental protection – *waste disposal and emission treatment, remediation costs, prevention and environmental management costs*	**20 32.3**	-	-	-	**42 67.7**	**3.71**	**5**	**0**	**62**
24. Toxic wastes reductions - chemical wastes, hazard wastes, non-hazard wastes, and/or end-of-life products to minimize landfills and incineration	**51 82.3**	**1 1.6**	-	-	**10 16.1**	**1.66**	**1**	**0**	**62**
25. Other GHG Emissions - Methane (CH4), PFC, N2O, HFC, and/or SF6	**47 75.8**	**1 1.6**	-	-	**14 22.6**	**1.92**	**1**	**0**	**62**

*** Number of responses **Percentages**

- Social performance indicators – internal reporting

Item	Not at all, N (%)	Monthly, N (%)	Quarterly, N (%)	Half yearly, N (%)	Yearly, N (%)	Mean	Median	Missing	Value (N)
Labour practices and working conditions									
1. Benefits provided for employees	**10* 16.1****	**4* 6.5****	**4* 6.5****	**9* 14.5****	**35* 56.4****	**3.89**	**5**	**0**	**62**
2. Minimum notice period(s) to inform employees regarding organizational changes that could affect them	**10 16.1**	**4 6.5**	**4 6.5**	**9 14.5**	**35 56.4**	**3.89**	**5**	**0**	**62**
3. Education, training, counselling prevention and risk-control programs to assist employees, their families, and/or community members in relation to serious diseases.	**10 16.1**	**4 6.5**	**4 6.5**	**9 14.5**	**35 56.4**	**3.89**	**5**	**0**	**62**
4. Health and safety topics covered in formal agreements with trade unions	**10 16.1**	**6 9.7**	**8 12.9**	**9 14.5**	**29 46.8**	**3.66**	**4**	**0**	**62**
5. Average hours of training per year per employee by employee categories	**10 16.1**	**10 16.1**	**4 6.5**	**9 14.5**	**29 46.8**	**3.60**	**4**	**0**	**62**
6. Programs for skills management and lifelong learning to develop employees' skills and to update abilities, knowledge, and/or qualification	**10 16.1**	**7 11.3**	**8 12.9**	**9 14.5**	**28 46.8**	**3.61**	**4**	**0**	**62**
7. Percentage of employees receiving a regular performance and career development reviews	**12 19.4**	**8 12.9**	**4 6.5**	**9 14.5**	**29 46.8**	**3.56**	**4**	**0**	**62**
8. Ratio of basic salary of males to basic salary of females for each employee category	**11 17.7**	**4 6.5**	**4 6.5**	**9 14.5**	**34 54.8**	**3.82**	**5**	**0**	**62**
Society									
9. Nature, scope, and effectiveness of any programs and practices that manage the impacts of operations on communities	**10 16.1**	**4 6.5**	**4 6.5**	**9 14.5**	**35 55.5**	**3.89**	**5**	**0**	**62**
10. Percentage of employees trained in organization's failure of policies and procedures	**10 16.1**	**4 6.5**	**4 6.5**	**9 14.5**	**35 55.5**	**3.89**	**5**	**0**	**62**
11. Actions taken to respond to incidents of failure to follow policies and procedures	**10 16.1**	**4 6.5**	**4 6.5**	**9 14.5**	**35 55.5**	**3.89**	**5**	**0**	**62**
12. Whistle blower policy/ hotline in response to incidents of fraud or other inappropriate activities	**10 16.1**	**4 6.5**	**4 6.5**	**9 14.5**	**35 55.5**	**3.89**	**5**	**0**	**62**
Product responsibility									
13. Total number of legal actions for anti-competitive behaviour, anti-trust, and/or monopoly practices regarding major outcomes of these actions	**10 16.1**	**4 6.5**	**4 6.5**	**9 14.5**	**35 55.5**	**3.56**	**4**	**0**	**62**
14. Total monetary value of fines and/or total number of non-monetary sanctions for non compliance with laws and regulations	**15 24.2**	**4 6.5**	**4 6.5**	**9 14.5**	**30 48.4**	**3.69**	**4.50**	**0**	**62**
15. Life cycle stages in which health and safety impacts of products and services are assessed for improvement	**10 16.1**	**8 12.9**	**4 6.5**	**9 14.5**	**31 50.0**	**3.69**	**4.50**	**0**	**62**
16. Total number of incidents of non-compliance with regulations and voluntary codes concerning health and safety impacts of products during their life cycle	**18 29.0**	**4 6.5**	**4 6.5**	**9 14.5**	**27 43.5**	**3.37**	**4**	**0**	**62**
17. Product information required by procedures, and/or percentage of products subject to information requirement	**14 22.5**	**4 6.5**	**4 6.5**	**31 50.0**	**31 50.0**	**3.63**	**4.50**	**0**	**62**
18. Practices related to customer satisfaction including results of surveys measuring customer satisfaction	**16 25.8**	**4 6.5**	**4 6.5**	**9 14.5**	**29 46.7**	**3.50**	**4**	**0**	**62**
19. Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, advertising, promotion, and/or sponsorship by type of outcomes	**17 27.4**	**4 6.5**	**4 6.5**	**9 14.5**	**28 45.1**	**3.44**	**4**	**0**	**62**
20. Total monetary value of fines for non-compliance with laws and regulations concerning the provision and use of products	**19 30.6**	**4 6.5**	**4 6.5**	**9 14.5**	**26 41.9**	**3.31**	**4**	**0**	**62**

*** Number of responses **Percentages**

- Social performance indicators – external reporting

Item	Not at all, N (%)	Monthly, N (%)	Quarterly, N (%)	Half yearly, N (%)	Yearly, N (%)	Mean	Median	Missing	Value (N)
Labour practices and working conditions									
1. Benefits provided for employees	**21* 33.9****	**1* 1.6****	**1* 1.6****	**3* 4.8****	**36* 58****	**3.52**	**5**	**0**	**62**
2. Minimum notice period(s) to inform employees regarding organizational changes that could affect them	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
3. Education, training, counselling prevention and risk-control programs to assist employees, their families, and/or community members in relation to serious diseases.	**20 32.2**	**2 3.2**	**-**	**3 4.8**	**37 59.7**	**3.56**	**5**	**0**	**62**
4. Health and safety topics covered in formal agreements with trade unions	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
5. Average hours of training per year per employee by employee categories	**20 32.2**	**5 8.6**	**-**	**4 6.53**	**33 53.2**	**3.40**	**5**	**0**	**62**
6. Programs for skills management and lifelong learning to develop employees' skills and to update abilities, knowledge, and/or qualification	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
7. Percentage of employees receiving a regular performance and career development reviews	**23 37.1**	**1 1.6**	**-**	**3 4.8**	**35 56.5**	**3.42**	**5**	**0**	**62**
8. Ratio of basic salary of males to basic salary of females for each employee category	**22 35.5**	**1 1.6**	**-**	**3 4.8**	**36 58.1**	**3.48**	**5**	**0**	**62**
Society									
9. Nature, scope, and effectiveness of any programs and practices that manage the impacts of operations on communities	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
10. Percentage of employees trained in organization's failure of policies and procedures	**21 33.9**	**1 1.6**	**-**	**2 3.2**	**38 61.3**	**3.56**	**5**	**0**	**62**
11. Actions taken to respond to incidents of failure to follow policies and procedures	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
12. Whistle blower policy/ hotline in response to incidents of fraud or other inappropriate activities	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
Product responsibility									
13. Total number of legal actions for anti-competitive behaviour, anti-trust, and/or monopoly practices regarding major outcomes of these actions	**21 33.8**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.59**	**5**	**0**	**61**
14. Total monetary value of fines and/or total number of non-monetary sanctions for non compliance with laws and regulations	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
15. Life cycle stages in which health and safety impacts of products and services are assessed for improvement	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
16. Total number of incidents of non-compliance with regulations and voluntary codes concerning health and safety impacts of products during their life cycle	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
17. Product information required by procedures, and/or percentage of products subject to information requirement	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
18. Practices related to customer satisfaction including results of surveys measuring customer satisfaction	**21 33.9**	**1 1.6**	**-**	**3 4.8**	**37 59.7**	**3.55**	**5**	**0**	**62**
19. Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, advertising, promotion, and/or sponsorship by type of outcomes	**28 45.2**	**1 1.6**	**-**	**3 4.8**	**30 48.4**	**3.10**	**4**	**0**	**62**
20. Total monetary value of fines for non-compliance with laws and regulations concerning the provision and use of products	**20 32.3**	**1 1.6**	**-**	**3 4.8**	**38 61.3**	**3.61**	**5**	**0**	**62**

*** Number of responses **Percentages**

- Social performance indicators – future intention

Item	Not at all, N (%)	Monthly, N (%)	Quarterly, N (%)	Half yearly, N (%)	Yearly, N (%)	Mean	Median	Missing	Value (N)
Labour practices and working conditions									
1. Benefits provided for employees	**12* 19.4****	**3* 4.8****	**9* 14.5****	**1* 1.6****	**37* 59.7****	**3.77**	**5**	**0**	**62**
2. Minimum notice period(s) to inform employees regarding organizational changes that could affect them	**11 17.7**	**1 1.6**	-	**1 1.6**	**49 79.0**	**4.23**	**5**	**0**	**62**
3. Education, training, counselling prevention and risk-control programs to assist employees, their families, and/or community members in relation to serious diseases.	**10 16.1**	**1 1.6**	-	**1 1.6**	**50 80.6**	**4.29**	**5**	**0**	**62**
4. Health and safety topics covered in formal agreements with trade unions	**10 16.1**	**3 4.8**	**4 6.5**	**1 1.6**	**44 71.0**	**4.06**	**5**	**0**	**62**
5. Average hours of training per year per employee by employee categories	**10 16.1**	**2 3.2**	**2 3.2**	**1 1.6**	**47 75.8**	**4.18**	**5**	**0**	**62**
6. Programs for skills management and lifelong learning to develop employees' skills and to update abilities, knowledge, and/or qualification	**10 16.1**	**1 1.6**	-	**1 1.6**	**50 80.6**	**4.29**	**5**	**0**	**62**
7. Percentage of employees receiving a regular performance and career development reviews	**12 19.4**	**2 3.2**	-	**1 1.6**	**47 75.8**	**4.11**	**5**	**0**	**62**
8. Ratio of basic salary of males to basic salary of females for each employee category	**11 17.7**	**1 1.6**	-	**1 1.6**	**49 79.0**	**4.23**	**5**	**0**	**62**
Society									
9. Nature, scope, and effectiveness of any programs and practices that manage the impacts of operations on communities	**10 16.1**	**1 1.6**	-	**1 1.6**	**50 80.6**	**4.29**	**5**	**0**	**62**
10. Percentage of employees trained in organization's failure of policies and procedures	**11 17.7**	**1 1.6**	-	**1 1.6**	**49 79.0**	**4.28**	**5**	**0**	**62**
11. Actions taken to respond to incidents of failure to follow policies and procedures	**10 16.1**	**1 1.6**	-	**1 1.6**	**50 80.6**	**4.29**	**5**	**0**	**62**
12. Whistle blower policy/ hotline in response to incidents of fraud or other inappropriate activities	**10 16.1**	**1 1.6**	-	**1 1.6**	**50 80.6**	**4.29**	**5**	**0**	**62**
Product responsibility									
13. Total number of legal actions for anti-competitive behaviour, anti-trust, and/or monopoly practices regarding major outcomes of these actions	**10 16.1**	**1 1.6**	**4 6.5**	**1 1.6**	**46 74.2**	**4.10**	**5**	**0**	**62**
14. Total monetary value of fines and/or total number of non-monetary sanctions for non compliance with laws and regulations	**10 16.1**	**5 8.1**	-	**1 1.6**	**46 74.2**	**4.16**	**5**	**0**	**62**
15. Life cycle stages in which health and safety impacts of products and services are assessed for improvement	**10 16.1**	**1 1.6**	**4 6.5**	**1 1.6**	**46 74.2**	**4.16**	**5**	**0**	**62**
16. Total number of incidents of non-compliance with regulations and voluntary codes concerning health and safety impacts of products during their life cycle	**11 17.7**	**6 9.7**	-	**1 1.6**	**44 71.0**	**4.03**	**5**	**0**	**62**
17. Product information required by procedures, and/or percentage of products subject to information requirement	**10 16.1**	**2 3.2**	**3 4.8**	**1 1.6**	**46 74.2**	**4.15**	**5**	**0**	**62**
18. Practices related to customer satisfaction including results of surveys measuring customer satisfaction	**10 16.1**	**1 1.6**	**6 9.7**	**1 1.6**	**44 71.0**	**4.10**	**5**	**0**	**62**
19. Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, advertising, promotion, and/or sponsorship by type of outcomes	**10 16.1**	**6 975**	**3 4.8**	**1 1.6**	**42 67.7**	**3.95**	**5**	**0**	**62**
20. Total monetary value of fines for non-compliance with laws and regulations concerning the provision and use of products	**10 16.1**	**2 3.2**	**7 11.3**	**1 1.6**	**42 67.7**	**4.08**	**5**	**0**	**62**

*** Number of responses **Percentages**

Appendix 4: Brief backgrounds of case studies

Case#	Case study background
1	Company in metal and mining sector (ANZSIC Code: 080) that has not yet measured or identified environmental and social costs to incorporate in financial disclosure. Company has not prepared corporate social responsibility reporting. This is because the company creates lower level of GHG emissions. Nonetheless, company is intending to reduce negative impacts on environment and society while creating cost accounting data of environment and social impacts to disclose its sustainability reporting.
2	Company is in food and beverage manufacturing sector (ANZSIC Code: 121). Company has been concerned with measuring environmental and social costs to support corporate social responsibility reporting. Company has provided these costs to support stakeholder and public concerns.
3	Company is in chemical and associated product manufacturing sector (ANZSIC Code: 184) that has provided environmental measurement programs to measure energy consumption reductions and GHG emissions abatement. Company is intending to improve energy efficiency and GHG inventory, thus maintaining levels of energy used and GHG emissions created in production processes.
4	Company is in energy, gas and water supply sector (ANZSIC Code: 261) which has taken environmental and social issues into account. Company has been working with government departments and energy regulators. This has helped reductions in energy consumption while creating lower levels of GHG emissions.
5	Company is in metal and mining sector (ANZSIC Code: 080) that has significantly been concerned with water consumption and emissions intensively. Company manages less water consumption by employing recycled water to support production processes in order to reduce on site water losses.
6	Company is largest public company in Australia in food retailing sector (ANZSIC Code: 411) that has been concerned with reducing major impacts on environment and society to ensure its sustainability is achieved.
7	Company is in chemical and associated product manufacturing sector (ANZSIC Code: 184). Company has actively responded to all government requirements regarding environmental and social issues. Company has provided accurate data of energy consumptions and GHG emissions to create reliability of sustainability reporting. Accurate cost accounting data has been also employed to support internal management, as well as providing information to educate on environmental programs for other Australian businesses.
8	Company is in food and beverage manufacturing sector (ANZSIC Code: 121) that has measured GHG emissions to provide more accurate information for sustainability reporting. Company has responded to the NGER while creating lower levels of GHG emissions and using less energy in production processes. Company has provided a recycling program to meet recycling targets of reused materials, wastes, and water.

Source: Carbon Disclosure Project (CDP 2009)

- Brief backgrounds of case studies (cont.)

Case#	Case study background
9	Company is in petroleum, oil and gas extraction sector (ANZSIC Code: 170) that has imported and purchased petroleum products from importers and local suppliers. Company has fully maintained its status as a great competitor in the oil refining industry. However, company has created high levels of GHG emissions and has been a larger GHG emission polluter yearly. This has resulted in company being largest purchaser of emissions permits in Australia. Although, company has fully maintained its position as a greater competitor in the oil refining industry; a large requirement of GHG emissions permit has significantly affected production costs and raised total debt of company.
10	Company is in air transport sector (ANZSIC Code: 490) that has taken environmental issues into account. Company has consumed high levels of energy as well as creating large volumes of GHG emissions. This has resulted in company being highly concerned with negative impacts on environment, society, and ecological systems. Company has monthly measured energy consumptions to reduce GHG emissions while providing Emissions Reporting and Verifications to the European Union scheme.
11	Company is in petroleum, oil gas and extraction sector (ANZSIC Code: 170) that has significantly employed high levels of energy to support production processes. As the major products of company are oil, gas, liquefied natural gas, and uranium, company creates large volumes of GHG emissions. This has resulted in attempting to meet government requirements regarding costs of GHG emissions and energy consumptions. In the meantime, company has actively complied with European Union Emission Trading Scheme, as well as providing emissions credits under Kyoto Protocol requirements.
12	Company is in food retailing sector (ANZSIC Code: 411) which is largest food retailer and supplier company. Company was required to participate in energy consumptions and emissions abatement programs to report level of energy use and volume of GHG emissions to the NGER.
13	Company is largest integrated energy firm in Australia. Company is in petroleum, oil and gas extraction sector (ANZSIC Code: 170) that has measured reductions in energy used and GHG emissions created in producing processes. Company has significantly taken environmental and social issues into account by employing renewable energy to support production processes. This has helped in creating lower levels of GHG emissions, as well as reducing energy consumptions yearly.
14	Company is in metal and mining sector (ANZSIC Code: 080) that has added value as a sustainable company by creating sustainable business framework. An initial aim of this framework is to create eco efficiency, quality of employee life, as well as promoting reductions in energy consumptions and GHG emissions abatement.
15	Company is in construction material mining sector (ANZSIC Code: 301) that has developed internal environmental and climate change programs to help in measuring environmental and social data for sustainability reporting. Company has employed environmental strategic plan to estimate reductions in energy consumption and GHG emissions created in production processes.

Source: Carbon Disclosure Project (CDP 2009)

Appendix 5: A summary of measurement procedures of sub-research questions and their source of data collection and instrument

Sub-research questions	Measurement procedures				Data sources	Instrument
	Focused area	Source of data	Level of measurement	Method of measurement		
SR1	Environmental performance indicators	– internal reports – external reports	Scale	Measured using cluster analysis to group similar responses into each time-frame. 5-point Likert-type scale was employed to identify period of time-frame. Environmental performance indicators were measured to seek which time-frame companies identified costs of environment to support decision-making and disclosing internally or externally. (see appendix 1)	Companies' responses to the CDP questionnaires	A set of survey
SR2	Environmental performance indicators Social performance indicators	–internal reports –external reports –future intention –internal reports –external reports –future intention	"	Measured using cluster analysis to group similar responses into each time-frame. 5-point Likert-type scale was employed to identify period of time-frame. Environmental and social performance indicators were measured to seek which time-frame companies identified costs of environment and social impacts to disclose internally and externally. The measurement also identified future intention those that did not currently disclose. (see appendix 1)	"	"
SR3	Environmental performance indicators Social performance indicators	Overview of the analysis results answered to SR1 and SR2	"	Identified the results of SR1 and SR2 to answer SR3	"	"

Appendix 6: A summary of proposition findings and their sources of data collection and instrument

Proposition	Measurement			Data sources	Data collection method	Instrument
	Focused area	Level of measurement	Method of measurement			
P1	Defining effective management accounting systems for cost identification and measurement of environmental and social impacts Measurement of data accuracy, NGER/GRI requirements, and sustainable development needs	- Nominal - Benchmarking procedures	-Nominally measured as: Category1: Source of environmental and social accounting system Category2: Type of systems Category3: Motivation of cost identification Category4: Measurement of environmental and social impacts costs – monthly, half yearly, yearly Category5: Energy reduction and GHG emission abatement targets - Compared management accounting practices among cases	Selected chief accountants, accountants, and sustainable management teams	Interview	A set of interview questions
P2	Analysing management accounting best practices for environmental and social impact costs including reductions in energy consumptions and GHG emissions abatement	- Matrix comparison	Measured against benchmarked companies (IBM, Toyota, Shell) to meet three areas of performance areas - Data accuracy, - Internal decision-making, - Sustainable development organization	“ Sustainability reporting	Interview Document reviews	“
P3	Improving effective management accounting system such a SMAS conceptual model for more accurate cost information of environment and social	Management accounting best practices for cost identification and measurement	Improved current practices of management accounting systems to enhance environment and social internal decision-making and to create preciseness of sustainable development reporting			
P4	Improving decision-making and tracking reporting systems to ensure sustainability organizations	A new management accounting mechanism for long-term sustainable growth	Created economic, environmental, and social value added			

Appendix 7: A summary of the relationships among sub-research questions, propositions, and analysis results within a conceptual framework for the SMAS

SR1, SR2, and SR3
Organization

- Packaging Materials
- Operating Materials
- Admin activities
- Merchandises
- Marketing
- Transport/logistics

Quantitative results indicate that current practising companies measured environmental costs from unit inputs in production processes and non-product outputs e.g. emissions, wastes, disposal wastes, product in processes, and/or product designs. Cost information was utilized to lead decision-making on cost savings such energy reductions and GHG emission abatement monthly while disclosing internally and externally. Companies tended to change their management accounting systems to more accurately create cost accounting data of environment to effectively enhance management decisions and reporting purposes. Companies would also provide more precise cost information of social impacts to support investment decisions on social expenditures. By changing a new accounting mechanism of environment and social impacts, current practising companies would become world's best practice in corporate social responsibility – meeting cost efficiency target inducing environment-friendly and social well-being.

System characteristics of Sustainability accounting

P1 and P2: Sustainable organization

Qualitative results: Best practice companies identified and measured environmental and social data to support management decisions and external reporting initiatives. Companies collected environmental data from productions processes and external organizations. Companies also provided social expenditures to support social development and bring benefit to local community where companies operate. However, these costs were identified as overheads while hiding cost information within production processes.

P3: Sustainability Management Accounting System (SMAS)

The SMAS conceptual model was developed based on sustainability accounting concepts combing with **EMA** and **SMA** practices for accoutre cost information of environment and social impacts. **Quantitative results** were employed to support the development of the SMAS conceptual model in identifying the needs of environmental and social cost measurement. An effective management accounting practices of best practise companies **(qualitative results)** were supported cost identification and measurement for management decisions and By applying **ABC** application in the SMAS, this helps in cost allocation and analysis thus ensuring that every environmental and social data is measured and allocated to single production activity thus fully costing products.

By having the SMAS, companies create more accurate cost information to effectively enhance environment and social internal decision making. Companies can significantly develop tracking and reporting system while having ability to deal with resource flows and stocks in appropriate period of time. The SMAS provide a new management accounting mechanism for measurement physical and monetary units to add value in economic, environmental, and social performance.

P4: Sustainable Value Chain

Economic value added:

The SMAS provides a new management accounting mechanism for sustainable companies to create cost efficiency from minimizing resources consumptions in production processes. Companies would have more ability to measure reduction in carbon contaminant, minimize packaging materials, and create water efficiency while investing in renewable energy technology. These would surely create return-on-investment objectives.

Environmental value added:

The SMAS facilitates companies to involve in environment-friendly thus having more ethical and moral responsibility to reduce negative impacts on environment and ecological systems. Companies use less natural resource and create lower levels of GHG emissions thus avoiding harmful environment and natural patterns.

Social value added:

The SMAS supports sustainable companies to engage board-initiated and corporate social responsibility initiatives to create long-term sustainable growth. The SMAS provides more accurate cost information of social impacts to help in cost measurement for improvement in society and local community. Companies are involved in social efficiency when disclosing sustainable development reports to reduce pressure from regulators, stakeholders, and/or customers.