Sustainability Management Accounting System (SMAS): Towards a Conceptual Design for the Manufacturing Industry

Abstract

The study reported in this paper aims to identify an effective management accounting system using sustainability accounting concept for environmental and social cost measurement to add value to organizations. The motivation for undertaking this research is driven by the current practice of activity based costing (ABC), which has not identified and allocated costs of environment and social impacts to a single production activity. This has resulted in inaccuracies in cost accounting information when preparing environmental and social performance disclosures for internal management decisions, as well as external disclosures. This study therefore develops a conceptual model for a Sustainability Management Accounting System (SMAS) to improve the identification and measurement of environmental and social impact costs. A SMAS also provides sustainable organizations with a way to enhance cost allocation and analysis efficiently, thus creating more accurate cost accounting information for management decisions and reporting disclosure purposes. This paper describes preliminary work undertaken to date. Currently, it would appear that most Australian firms fail to report on their environmental performance, however, social indicators make it increasingly important for organisations to embrace corporate social reponsibility in their financial reporting and disclosure. Further, the results of quantitative data anlaysis will be used to identify an effective management accounting of sustainable organizations while supporting the development of a SMAS conceptual model.

Keywords-component: activity based costing (ABC); environmental management accounting (EMA); social management accounting (SMA); sustainability management accounting system (SMAS); environmental cost, social cost.

1. INTRODUCTION

An effective management accounting framework for environmental and social cost measurement facilitates manufacturing companies to accurately create cost accounting information for internal management decision making. It can also support companies in incorporating economic, social, and environmental information when disclosing through the form of a triple bottom line report (Berkel 2003; Gadenne & Zaman 2002; Hubbard 2009). As a result, environmental costs need to be captured both internally and externally, while social expenditures need to be considered and collected as social costs. Companies also need to appropriately identify and measure these costs before allocating them to a single production activity to evaluate reductions in and controls of these costs and contaminants (wastes, solids, and/or emissions) (IFAC 2005; UNDSD 2001). In doing so, companies not only reduce their negative impact on the environment, but also improve the quality of society as a whole (Nachtmann & Al-Rifai 2004). Moreover, companies develop into more environmentally and socially aware organizations and, at the same time, add value as sustainable organizations and ensure corporate sustainability is achieved in the eye of stakeholders and the marketplace (Gale 2006; Jacob 1994; Sikdar 2007).

However, as environmental costs have been treated as overheads by traditional management accounting, this has resulted in these costs being hidden among production and/or service processes (IFAC 2005; UNDSD 2001). Meanwhile, social costs have been ignored as a measure to improve quality of life of employees, society and, to some extent, the environment as they are claimed as private costs (Hazilla & Kopp 1990). This results in inaccurate cost information within companies endeavouring to enhance their environment and social internal decision making. Additionally, companies are unable to support stakeholders' demands when these costs are based on imprecise environmental and social performance disclosers (Berkel 2003; Gadenne & Zaman 2002; Gray 2006). Additionally, a holistic system of a sustainability

accounting concept combining environmental management accounting and social management accounting has not been widely adopted by organizations for environmental and social costs identification and measurement (Gadenne & Zaman 2002; Spence 2009). Thus, an effective management accounting system for measuring environmental and social costs is needed by companies to enhance environmental and social cost dimensions in order to fully cost more accurately to prepare sustainable development reporting (Gray 2006; Gray et al. 2001).

Consequently, this paper describes the development of a conceptual model of a Sustainability Management Accounting System (SMAS) as an effective management accounting tool for sustainable organizations. A sustainability management accounting system (SMAS) refers to sustainability and management accounting concepts and practices dealing with environmental and social issues. Sustainability has been accepted as an integration of three performance aspects—economic, social and ecological systems (environment)—that companies require to sustain development (Dixon & Fallon 1989). The main areas of development are related to human, social, economic and environmental aspects (Goodland 2002) that companies need to disclose in the form of triple bottom line reporting (Berkel 2003). Therefore, a SMAS identified by this study aims to capture more accurate cost accounting data on environment and social impacts and allocating costs to a single product. Environmental management accounting (EMA) and social management accounting (SMA) concepts and practices are integrated in the design of a SMAS to help in cost measurement and identification in order to separate these costs from overheads. An activity based costing (ABC) approach is expanded to help in cost allocation and analysis using costs drivers or cost centres to assign these costs to a single production activity. Thus, companies are able to effectively identify and measure costs of environment and social impacts while creating cost accounting accuracy to support external disclosures and to enhance internal management decisions. By adopting a SMAS, companies can fully cost products and services while providing external

disclosures through triple bottom line and/or corporate social responsibility (CSR) reporting to add value as a sustainable organization in the eyes of their stakeholders and in the marketplace (Berkel 2003; Gadenne & Zaman 2002). In the following section, relevant literature is provided to support cost measurement and identification of environment and social impacts, as well as identifying key terms to inform the development in designing a SMAS.

2. RELEVANT LITURATURE

As economic, environmental and social performance is required to be incorporated into financial disclosures through the form of a triple bottom line, companies need to provide more accurate cost accounting data on environment and social impacts (Berkel 2003; Carbon Trust 2005; Gadenne & Zaman 2002; Hubbard 2009). Such reporting can help reduce stakeholder pressure on the development of economic, social and environmental performance while improving internal decision-making on management of and reductions in these costs and contaminants (Berkel 2003; Gadenne & Zaman 2002; Gale 2006). Companies can create 'green' and 'social' products and services while gaining greater benefits from higher economic performance in the long-term (Schaltegger & Wagner 2006). This study, therefore, fuses three theories—deep ecology theory, Marx's labour theory of value, and stakeholder theory—to examine the ethical and moral obligations in providing cost information (Donaldson & Preston 1995; Drengson & Inoue 1995; Shaw 2009; Yee et al. 2008) relating to environmental and social impacts.

2.1 Theoretical perspectives

Deep ecology theory is applied in the theoretical design of a SMAS using shallow ecology to explain ethical and moral responsibilities of companies in measuring environmental costs and managing usage of resources, energy and water (Devall & Sessions 1985; Jacob 1994). Meanwhile, deep ecology helps explain why measuring reductions of emissions and wastes would help to reduce negative impacts on the environment and society

(Jacob 1994). Deep ecology theory was developed by Naess in 1973 to explain improvement in quality of humans and the environment by reducing environmental pollution and avoiding extractions of natural resources (Devall & Sessions 1985; Drengson & Inoue 1995). Naess (1973) also deeply questioned how superior ecological patterns need to be maintained in order to improve human life, the environment and natural systems (Devall & Sessions 1985). In addition, the theory also indicates that the movement of shallow and deep ecological management approaches seeks to question ethical and moral actions in reducing negative impacts on society and the environment (Barrow 1999; Drengson & Inoue 1995). Thus, by applying deep ecology theory, it helps examine identification of environmental cost information when providing environmental performance disclosures to support stakeholders' concerns. However, deep ecology appears to have not been used before to examine the identification of social issues (Jacob 1994). This research also uses Marx's labour theory of value to explain measurement of social impact costs.

Marx's labour theory of value helps explain measurement of social impact costs while creating surplus value or maximizing profits in selling large quantities of products in the marketplace (Jasch & Stasiškienė 2005). Karl Marx developed a concept of surplus-value(s) to explain a company's interest in measuring costs of production processes while producing large quantities to support high consumption in the marketplace (Little 1986). To realize the surplus-value contained in products (under capitalism), the products must be sold in the market at a price reflecting the labour time of average (in terms of efficiency) producers (Marx 1976, 1978, 1981). Therefore, both workers and capitalist business owners are concerned with efficient production, training and skilling of the workforce, and selling products demanded by consumers (Marx 1976, 1978, 1981). Otherwise, the surplus-value produced in the factory by workers cannot be realized and even part or all of the original capital invested in production may be wasted (Marx 1981; Yee et al. 2008). Thus, employing Marx's labour theory of value

helps explain measurement of social impact costs while creating surplus value or maximizing profits in selling large quantities of products in markets (Jasch & Stasiškienė 2005). Companies also need to provide cost information for social internal decision making and to address stakeholders' concerns. In doing so, stakeholder theory is employed to examine collecting more cost information for both environmental and social impact.

Stakeholder theory helps in the identification of stakeholders and explains the ethical and moral obligations of management in considering the interests of these stakeholders (Freeman 1984; Freeman & Reed 1983). This research applies stakeholder theory to explain associating disclosure with economic and social performance by combining three dimensions—stakeholder power, strategic posture, and economic performance (Ullmann 1985). Thus, in the design of a SMAS, stakeholder theory helps determine key concerns and objectives of stakeholders while explaining ethical and moral obligations in measuring environmental and social costs. These concerns are translated into measures which, in turn, are incorporated as system characteristics for data input required for reporting and internal decision making. This can create more accurate cost information to support environment and social internal decision making and external disclosures. However, as there is considerable disagreement in the literature on definitions, this study reviewed relevant literature of terminologies used to support the focus of the study in order to define key terms of accounting and their expanding role for a developed SMAS.

Consequently, in the designed SMAS, these fused theories help in creating more accurate cost information for internal management decisions—thus fully costing products and/or services. Companies can also prepare financial disclosures to create better relationships with their stakeholders when disclosing through the form of a triple bottom line and/or corporate social responsibility (CSR).

2.1 Accounting and expanding roles

2.2.1 Traditional accounting

Traditional accounting has two components—financial accounting (FA) and management accounting (MA). Financial accounting helps in companies' disclosures when reporting financial performance to guide decision-making on investments and performance management, as well as supporting stakeholders' information needs (Holland 2004; IFAC 2005; UNDSD 2001). Meanwhile, management accounting is widely used to measure the cost of inputs (materials and labour) while treating all other costs as overheads. For environmental costs, management accounting has historically treated these as overheads (Hill, McAulay & Wilkinson 2006), using an activity based costing (ABC) approach for cost allocation and cost drivers. ABC has not (to date) separately identified the costs associated with environmental and social impacts and ABC recognizes these costs as overheads. Thus, they are hidden among other production and service processes (IFAC 2005; Milne 1996; UNDSD 2001). Companies are now having difficulty in measuring (for example) reductions and control of environmental costs and contaminants (Bose 2006; Gale 2006; IFAC 2005; Pramanik, Shil & Das 2007; Qian & Burritt 2007; UNDSD 2001). As a result, companies are not able to fully cost for setting correct prices of products and services (Englund & Gerdin 2008; Lamberton 2005; The Sigma Project 2003). Thus, extending the application of the ABC approach to separately identify environmental and social impact costs from overheads before allocating to individual product costs is appropriate for this study (Cãpusneanu 2008; IFAC 2005; Sendroiu et al. 2006). This can create more accurate cost information to support internal decision-making and flow on to external reporting and disclosures, and incorporate sustainability accounting concept.

2.2.2 Sustainability accounting (SA)

Sustainability accounting is a new approach to accounting and reporting to facilitate companies' development in three dimensions—economic, social, and environment (Ball 2002;

Milne 1996). Sustainability accounting has recently supported disclosures using a triple bottom line report in order to improve internal decision making and to inform stakeholders (Ball 2002; Bennett, Bouma & Wolteres 2002; Taplin, Bent & Aeron-Thomas 2006). A number of current studies (e.g. Lamberton 2005; Schaltegger & Wagner 2006; Taplin, Bent & Aeron-Thomas 2006) have examined sustainability accounting in terms of physical and monetary measurement to improve financial management. Nonetheless, Gray (2006) pointed out that sustainability accounting should incorporate improvements in social and environmental reporting as external disclosures in order to create shareholder value for sustainable organizations. Furthermore, sustainability accounting provides a company with measurement of all costs, thus, full cost accounting is implemented to support internal and external disclosures through sustainability reporting and corporate social responsibility (CSR) reporting (ICAEW 2004; Lamberton 2005; The Sigma Project 2003). As a consequence, the sustainability accounting concept is appropriate for this study to support a developed SMAS as it is concerned with environmental and social cost measurement for disclosures of environmental and social performance. In a design of a SMAS, sustainability accounting involving environmental accounting and social accounting concepts is considered using environmental management accounting and social management accounting to support the theoretical framework of a SMAS.

2.2.3 Environmental accounting

Environmental accounting (EA) helps in evaluating internal and external costs of the environment from production and service processes, as well as providing environmental performance reporting for management decision on future production (The Sigma Project 2003; UNDSD 2001). Burritt and Saka (2006) claimed that EA has been employed as a business tool to provide financial reports and to manage business performance, including environmental costs. Environmental accounting is also a key concept that supports decision

making in cost analysis and evaluation of environmental costs while allocating costs correctly to products (EPA 1995; IFAC 2005; The Sigma Project 2003). Environmental accounting is made up of environment financial accounting (EFA) and environmental management accounting (EMA). EFA focuses on providing environmental disclosures to external stakeholders (governments, shareholders etc.) (Burritt & Saka 2006). On the other hand, EMA is used to provide information on environmental costs to support internal decision making (IFAC 2005; Bent and Richardsen 2003 cited in Pittman & Wilhelm 2007; The Sigma Project 2003). UNDSD (2001) states that EMA aims to reduce negative impacts on the environment while improving material efficiency (thus adding value to an organization). EMA is mainly measured in both physical units such as materials, energy, water and wastes, and monetary units such as environmental costs, earning and savings (UNDSD 2001).

Environmental management accounting practices (EMA) were investigated by Gadenne and Zaman (2002) in Australian companies, as well as accountants' perceptions in providing EMA information for reporting purposes. Claims were made by Gadenne and Zaman (2002) that Australian companies appeared to develop business strategies to meet the requiements of socially and environmentally-sensitive organizations. However, they identified the need for recording environmental costs using ABC to be intergrated into financial reports, as well as a need to develop appropriate EMA systems (Gadenne & Zaman 2002). In examining the relationships between environmental performance and economic performance of an electricity company in the United States, Burnett and Hansen (2008) found that decreasing pollution enabled the company to create eco-efficiency. Furthermore, they found that it is preferable for the implementation of environmental accounting to be included in a environmental management accounting system (Burnett & Hansen 2008). This enables companies to measure environmental costs from unit inputs (raw materials, energy, and water), as well as non-

product outputs (wastes and emissions) (Gale 2006) while evaluating reductions of these costs and contaminants (IFAC 2005).

Thus, by employing EMA concepts and practices, companies can more accurately identify and measure environment costs and allocate them to the individual product costs (Burritt, Herzig & Tadeo 2009). Companies can also improve environmental performance (UNDSD 2001) while promoting themselves as environmentally aware organizations (Burritt, Herzig & Tadeo 2009). Essentially, environmental cost information is able to support business decision-making in managing resources by recording the use and flows in physical (resources, energy, and water) and monetary (financial, cost savings, and earnings) units (Burritt, Herzig & Tadeo 2009). This study, therefore, considered environmental management accounting (EMA) concepts and practices as appropriate for the development of a SMAS conceptual model. EMA is applied to identify costs of environmental impacts, use and flows of resources, energy and water, as well measuring reductions in contaminants. EMA records environmental costs information more accurately to support disclosure of environmental performance, but currently does not cover social issues (IFAC 2005) which is key contribution of this study. Therefore, the study integrates social management accounting (part of social accounting approach) into the development of a SMAS. This may assist companies to become more involved in sustainability management accounting (Jasch & Stasiškienė 2005).

2.2.4 Social accounting

Social accounting consists of social financial accounting and social management accounting and is concerned with improvements in negative impacts on society, humanity, and (to some extent) the environment. Social financial accounting (SFA) provides companies with information for corporate social responsibility reporting (CSR) to improve external reporting of social costs and provide information of significant concern to stakeholders (Cullen & Whelan 2006; Richmond, Mook & Quarter 2003). Social management accounting

(SMA) facilitates companies' recording and measurement of social costs for internal decision-making and supports disclosures of social performance. However, social costs have not been measured to a great extent—if at all—because they are sometimes recorded as company overheads or other expenditures, rather than as costs of products (Hazilla & Kopp 1990). As social costs have historically been ignored by traditional management accounting (using ABC to identify and allocate to product costs), this has resulted in companies not using social accounting to improve their social performance (Mobley 1970). Thus, disclosers regarding social performance in the form of corporate social responsibility (CSR) reports have become more complex as the costs of social impacts are increasingly being captured (Tinker, Lehman & Neimark 1991).

Pyatt and Roe (1977) developed a social accounting matrix (SAM) framework to improve the whole area of wage rates in Sri Lanka; they found that employing a SAM to improve the quality of life of employees and labourers in Sri Lanka was successful as a new way to develop economic performance. However, SAM did not include development of social performance (Quarter & Richmond 2001). Notably, Western organizations disagree on the ability of social accounting to reduce social impacts to support stakeholders' concerns (Tinker & Gray 2003). In addition, social accounting has not been successfully employed by companies as it is seen purely as raising production costs. Thus, a new conceptual model or framework for accounting for social costs is needed (Mook, Richmond & Quarter 2003). The proposed SMAS conceptual model, therefore, should integrate economic and social performance to add value to enhance the sustainability of organizations (Mook, Richmond & Quarter 2003). Furthermore, due to increased concerns of stakeholders, companies are being pushed to improve the quality of society, humans, employees and the environment by measuring social costs in order to support disclosure of social performance (Geibler et al. 2006). In doing so, companies can create 'green' and 'social' qualities to products and services while gaining greater benefits from

higher economic performance in the long-term (Sendroiu et al. 2006). This also improves social internal decision making (Borga et al. 2009; Jasch & Stasiškienė 2005). Spence (2009) also suggested that further study should be undertaken in social accounting to consider incorporating social impacts of organizations to add value to their social and economic performance. Combining environmental and social issues could go a long way to improving accounting's approach to these concerns (Gray 2002b). If social accounting could be developed and incorporated into an accounting framework or model, it could assist companies to become more socially and environmentally aware organizations (Gray 2002b).

As a consequence, social management accounting (SMA) should be applied in measuring social impact costs which are related to improvements for society, employees, humanity, and the environment. This would provide companies with a way to create more accurate cost information to support internal decision-making and disclosures of social performance. As mentioned previously, companies could also become more socially and environmentally aware organizations while creating positive reputations as 'green and socially responsible producers' in the eyes of stakeholders and in the marketplace. As a result, environmental management accounting, social management accounting, and activity based costing concepts and approaches become key motivators for this study while underpinning the theoretical framework of a Sustainability Management Accounting System (SMAS) (Figure 1).

2.3 Gaps in the literature

Based on the literature review, it is purported that there was no complete holistic model identified that contained the necessary characteristics of a proposed 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, ABC recognizes environmental costs as overheads (in the main) while having difficulty in measuring reductions of these costs and contaminants (Beer & Friend 2005; Bose 2006; Gale 2006; 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 quality) information on the environment (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 of significant concern to stakeholders and the public (IFAC 2005). This results in social costs being ignored but, if measured, could significantly increase production costs (Hazilla & Kopp 1990; Mook, Richmond & Quarter 2003).

To fill these gaps, this study proposes to develop a conceptual model for a Sustainability Management Accounting System (SMAS) into a holistic system combining environmental management accounting (EMA) and social management accounting (SMA) to help in the identification and measurement of environmental and social impact costs. SMAS will also apply an activity based costing (ABC) approach to help cost analysis and allocation or cost drivers, as suggested by previous studies (e.g. (Gadenne & Zaman 2002; Hubbard 2009; Nachtmann & Al-Rifai 2004; Sendroiu et al. 2006; Snoo 2006). As these concepts are not widely explored in the literature, particularly in relation to social performance, an integration of EMA and SMA within a SMAS could fill part of the gap to help in cost identification and measurement. In the meantime, applying activity based costing (ABC) concepts in relation to allocating cost of environmental and social costs to a single product has not been completely successful. Additionally, 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

while measuring reductions of these costs and contaminants (benefits). Meanwhile, social impact costs need to be measured in order to develop social performance reporting addressing significant concerns of companies' stakeholders. Companies are now seeking appropriate accounting approaches and systems to relate existing financial reports to triple bottom line reporting to more accurately and fully disclose social and environment performance to interested stakeholders while supporting internal decision making.

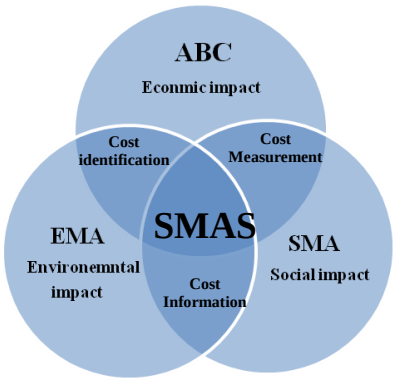

Figure 1. Accounting concepts underlying the Sustainability Management Accounting System (SMAS)

3. RESEARCH DESIGN

3.1 Research questions and propositions

In an attempt to fill the key gaps identified from the literature, this study posed one main research question. This was to investigating system characteristics within companies that could be employed for environmental and social management decisions. System characteristics identified by this study are full cost accounting that could fully cost to allocate to appropriate production activity. As full cost accounting aims at collecting costs from external and internal organizations (Bebbington et al. 2001), the system characteristics could capture full costs of products, including environment and social impacts. The systems could also allocate cost information to a single production activity using cost analysis and cost drivers of activity based costing approach. This would enable companies to successfully improve their business

decision-making and their preparation of economic, social, and environmental performance disclosures (Englund & Gerdin 2008; The Sigma Project 2003), since without a holistic system this is difficult to accomplish. In order to be able to conceptualise an information system, system characteristics need to be identified and evaluated so that the most appropriate characteristics can be built into a SMAS. This would provide more realistic costs on which to make decisions since the products or services would be more fully costed. To develop the conceptual model for a SMAS, it is necessary to enunciate the systems characteristics required to meet the informational needs of sustainable organizations drawing on best environmental and social management practices while being consistent with accounting concepts. Thus, the main research question solicits these system characteristics for a SMAS.

RQ1: *What system characteristics could companies employ in their sustainability management accounting systems to meet the needs of EMA and SMA practices while adding sustainable value to organizations?*

This study seeks to identify a set of system characteristics that could separately identify costs of environment (rather than being allocated as overheads) while measuring reductions of these costs and contaminants (IFAC 2005; Snoo 2006). Also, the system characteristics identified could measure social impact costs as separately identifiable expenditures of organizations (Hazilla & Kopp 1990) to capture full costs of products and provide cost information for internal decision making (Bebbington et al. 2001). Companies need to provide environmental and social impact cost accounting to create more precise external disclosures (Gadenne & Zaman 2002; Gray et al. 2001). Nonetheless, as environmental and social costs have been identified as overhead expenditures by traditional management accounting, this creates inaccuracies in cost accounting data for environment and social impacts when incorporated into sustainable development reporting (Berkel 2003; Gadenne & Zaman 2002; Gray 2006). As a consequence, companies may intend changing their management accounting

systems to successfully manage cost reductions and emissions abatement. These characteristics capture data on metrics that are identified as environmental and social management accounting best practices. In order to arrive at a set of best practice characteristics, research sub-questions need to be answered as follows:

> ***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 world best practice in environment and social accounting systems and reporting being adopted by manufacturing companies in Australia?*

Answers to these research sub-questions solicit current and future practices as to the characteristics of an information system and whether Australian manufacturing companies have adopted world's best practice. 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.

> **P1**: *Best practice companies indentify costs of environment and social impacts as well as measure reductions of contaminants to reduce negative impacts on humans, society, employees and the environment.*
> **P2**: *Best practice companies more accurately provide environmental and social costs information for internal decision making and to support external reporting disclosures.*
> **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 pubic concerns.*
> **P4:** *A SMAS provides best practice companies with a mechanism to add value in economic, social, and environment areas of performance.*

Best practice companies employ system characteristics of sustainability accounting concepts to separately identify environmental costs from overhead expenditures before allocating to a single product. In doing so, companies are able to measure reductions in these

costs, as well as resources, wastes, solids and emissions in physical and monetary units. Also, social costs are measured and controlled to reduce negative impacts on society, employees and the environment. Best practices companies are able to provide more accurate cost information to enhance environment and social internal decision-making and to create more precise external reporting. In addition, companies are enabled to meet their reporting obligations of energy consumptions and emission abatement under National Greenhouse and Energy Reporting (NGER) requirements and Global Reporting Initiative (GRI).

As a consequence, system characteristics of best practice companies were employed to support the development of a sustainability management accounting system (SMAS) conceptual model. A SMAS could provide companies with an accounting system to continue improvements in environmental and social cost identification and, by having a SMAS, companies are more concerned about reducing negative impacts on the environment and society when reporting their progress in using less energy and emissions abatement. Companies are now able to provide triple bottom line reporting when disclosing the development of economic, social, and environmental performance to add value as sustainable organizations. In the following section, the theoretical framework developed to underpin this investigation as the starting point of a SMAS conceptual model is outlined.

3.2 Theoretical framework

The study sought to identify appropriate system characteristics of sustainability accounting that could be employed by companies from different manufacturing sectors. Thus, Figure 2 consolidates the appropriate literature into an integrated theoretical framework as the starting point for this study. Firstly, Australian manufacturing companies could employ system characteristics of sustainability accounting concepts to identify and measure environmental costs from physical inputs (quantities) such as resource extractions, energy, fuels, oils, and/or chemicals (upstream) and those arising as non-product outputs such as wastes, solids, and

emissions (downstream) (Gale 2006; IFAC 2005; Qian & Burritt 2007; UNDSD 2001). Companies could also measure social costs from product responsibilities and improvements in society, humans, and employees which may cause increases in total costs of products (Gray 2006; Jasch & Stasiškienė 2005; Mook, Richmond & Quarter 2003; Pittman & Wilhelm 2007). In doing so, cost information of environmental and social impacts could be used to successfully enhance business management decisions, as well as supporting financial disclosures (Berkel 2003; Gadenne & Zaman 2002; Hubbard 2009; Lamberton 2005; Richmond, Mook & Quarter 2003). At this stage of the study, system characteristics will be identified from concepts contained in environmental management accounting (EMA) and social management accounting (SMA) that are currently used, or will be used in the future. The most appropriate system characteristics of sustainability accounting will be extended and drawn from best management accounting practices identified by this study to be utilized in the conceptual model of a SMAS.

Secondly, with best practice companies identifying and measuring costs of environment and social impacts from internal and external (suppliers and customers), organizations provide cost accounting data to enhance their management decision and financial disclosures (Bartolomeo et al. 2000; Burritt & Saka 2006; IFAC 2005; Sendroiu et al. 2006), as required by environmental management accounting (EMA) concepts (IFAC 2005; UNDSD 2001). *Deep ecology* will be employed to examine the full extent of measuring reductions in physical inputs (materials, energy, and water) to possibly reduce production costs and contaminants (emissions and wastes) (Barrow 1999). Meanwhile, to measure social costs, companies can identify expenditures for the development of social performance in relation to the quality of employees, society, and a green environment (Mook, Richmond & Quarter 2003; Richmond, Mook & Quarter 2003). Based on social management accounting (SMA) concepts, companies can capture costs of social impacts to support disclosures using SMAS, rather than these costs

being buried in overheads (Gray 2006; Gray et al. 2001). *Marx's labour theory of value* will be applied to help identify costs relating to improvements in skills, knowledge, and qualities of employees while maximizing profits from higher consumption (Marx 1874 cited in Keen 2001; Little 1986; Marx 1978). This could help companies to create higher profits when products are sold in larger volumes (Jasch & Stasiškienė 2005). As a consequence, companies collect environmental and social impact costs to fully cost products while allocating to appropriate production activities, or incorporate these costs into individual products or cost centres (activities) by expanding on activity based costing (ABC) application (Neumann et al. 2004).

An expanded ABC could help in the development of cost analysis and allocation while more accurately creating cost information to measure production costs of activities, as well as reductions in contaminants and control costs (Armstrong 2006; Cãpusneanu 2008; Northrup 2004; Sendroiu et al. 2006). Companies can then employ cost information on environmental and social impacts to enhance management decisions while providing disclosures to support stakeholders' demands (Nachtmann & Al-Rifai 2004). *Stakeholder theory* is applied in the framework to examine ethical and moral obligations in providing cost accounting data to disclose environmental and social performance in order to add value as sustainable organizations in the eyes of stakeholders (Freeman 1984; Freeman & Reed 1983). In doing so, a SMAS could track and report timing of impacts that are related to movements in stocks and flows of product/services to disclose costs and benefits of operational performance to stakeholders. Furthermore, a SMAS could effectively manage timing impacts in changing value of stock and flows of materials in production processes, which may have significant impacts on costs and benefits when tracking economic, social, and environmental performance disclosures (The Sigma Project 2003). Thus, the measurement of environmental and social costs needs to be more accurate when providing cost information to support

financial reports and disclosure of environment and social performance (IFAC 2005; The Sigma Project 2003; UNDSD 2001).

Finally**,** the SMAS theoretical framework provides companies with a way of disclosing 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). By incorporating three fused theories in the theoretical framework, it supports a SMAS conceptual model to fully collect direct costs from materials and labour and indirect costs of overheads, as well as social and environment costs (Bebbington et al. 2001; ICAEW 2004; Lamberton 2005). This 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 sustainable value chains by managing the three areas of economic, social, and environmental performance (Ball 2004; Berkel 2003; Lamberton 2005; Taplin, Bent & Aeron-Thomas 2006; Wahaab 2003). Figure 2 illustrates the theoretical framework that is the starting point for the development of a sustainability management accounting conceptual model.

4. RESEARCH METHODOLOGY

4.1 Approach

This study applies mixed methods combining quantitative and qualitative approaches to collect and analyse data using triangulation for credibility, thus avoiding social bias and building stronger results (Creswell 2009; Gorard 2004; Neuman 2006). As an exploratory study, this study employs a quantitative survey to identify system characteristics of sustainability accounting that are used and are intended to be employed by companies for social and environmental cost measurement. The results of the survey are used to compare with an analysis of management accounting best practice using qualitative methods. Meanwhile, a qualitative approach (case studies) is used to investigate management accounting

practices and system characteristics of companies from different manufacturing sectors identified (from the survey) as adopting best practice.

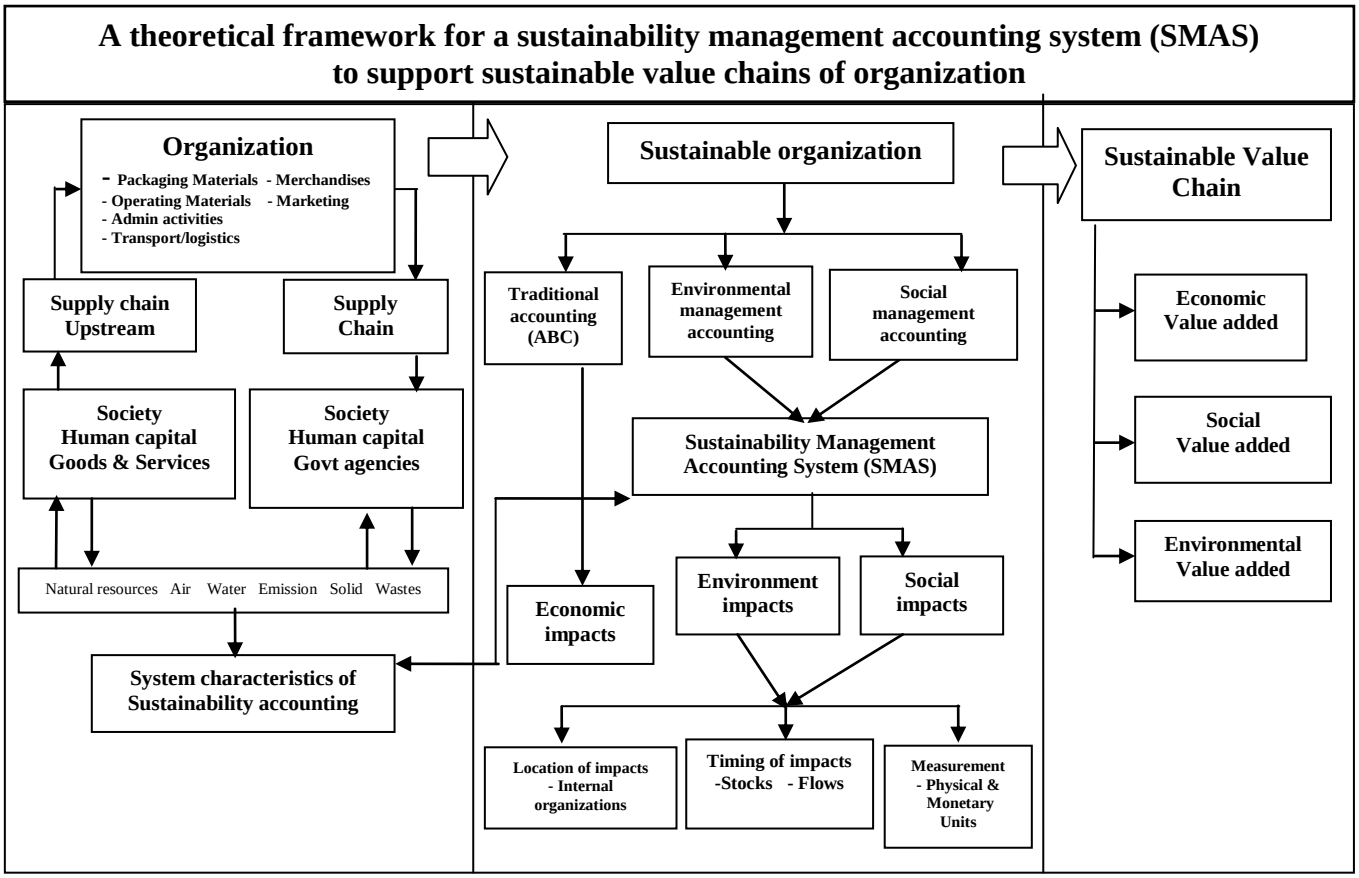

Figure 2: Theoretical framework for SMAS

4.2 Sample and data collection

To select a sample group, this study employed simple random sampling to select 1,000 Australian manufacturing companies from five sectors (200 from each sector) including paper and furniture products, machinery and equipment, constructions, automobile and metal products, and mining and chemical industries (PricewaterHouseCoopers 2009) to be surveyed. The companies studied were selected by utilizing a purposive sampling method. Thus, manufacturing companies that apply management accounting best practice to measure costs of environment and social impacts, as well as evaluating reductions of these costs and impacts, were targeted. The purposive sampling method assisted this study to select appropriate cases

for investigation to gain a fuller understanding of best practice used among sectoral groups (Neuman 2006; Patton 1990; Yin 2009). Management accountants dealing with environmental and social issues were appropriately targeted for data collection.

4.3 Data collection

Quantitative research methods were employed to survey 1,000 Australian manufacturing companies. A set of questions was provided using environmental and social performance indicators from Sustainability Reporting Guidelines by GRI (2006) to investigate what characteristics of sustainability accounting systems are used by organizations for environmental and social cost measurement and identification. Chief accountants, controllers, chief financial officers, and management accountants dealing with environmental issues (Gadenne & Zaman 2002) were requested to complete a survey questionnaire. The questionnaires solicited current practices and system characteristics currently employed, as well as respondents' attitudes, opinions, and points of views as to what system characteristics should be incorporated into a SMAS for a manufacturing company and their future intentions to incorporate characteristics into their systems. Following the survey, quantitative data will be gathered from fifteen companies from the same sectors used for the survey using interviews of management accountants to gain a richer understanding of environmental and social cost measurement and identification.

5. PRELIMINARY DATA ANALYSIS

Based on a small sample from respondents, this section describes some preliminary analysis of quantitative data received to date. The quantitative survey responses to sub-questions SR1, SR2, and SR3 were analysed using cluster analysis. Hierarchical cluster analysis (Hair et al. 1998; Manning & Munro 2007) was used to identify how often data was collected and reported while determining for each observation their frequency (not at all,

monthly, quarterly, half yearly, and yearly). Thereafter, agglomerative methods of hierarchical cluster were employed to agglomerate all objects into individual clusters while minimizing similarities (final cluster) using the maximum distance of the complete linkage approach (Hair et al. 1998). Therefore, each object (environmental and social performance indicators) fell into its own cluster based on frequency depending on the nature of responses. The results of preliminary data analysis are interpreted below.

Table 1: Overall index of measurement indicators of environmental and social performance reporting

Overall Index of measurement indicators			
Rank (%)	**CI** (%)	**CE** (%)	**FI** (%)
Max 100			
51-60			
41-50			20
31-40			
21-30	20	20	40
11-20	20		
1-10	40	40	40
No reporting 0	20	40	
	100%	**100%**	**100%**

***CI = Current practice – internal reporting, CE= Current practice – external reporting, FI = Future intentions**

Overall, non-financial performance reporting—both currently and in the future—is summarised by the index of measurement indicators. Based on the indicator measures used in the survey, the maximum reportability index is 100% at which level a company reports on all indicators adopted by this study from the literature and Australian/international standards. Analysis shows that companies are at the lower end of scales currently, but do significantly intend to measure costs of environment and social impacts in the future (Table1). Current reporting practices by companies appear to be biased towards reporting internally, with less emphasis on external reporting (Gadenne & Zaman 2002; Gale 2006; IFAC 2005). Thus, changing to a holistic accounting system that could support future intentions may help companies to more accurately report information on environment and social impacts for management decisions and to support environmental and social performance disclosures (Gadenne & Zaman 2002; Gray et al. 2001) without substantially increasing reporting costs.

To analyse if there are any differences between environment and social measures being reported, the sample was further disaggregated into these two components. The environment indicators index shows that there are higher levels of reporting by some firms both internally and externally, but a significant percentage of firms do not report currently. This can tentatively be 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). All firms indicated that they will report in the future (Table 2). Companies, therefore, will 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 contaminant such as wastes, emissions, and/or waste disposal, thus reducing negative impacts on the environment and society (Burnett & Hansen 2008; Gale 2006).

Table 2: Environment measurement indicators index

Environment indicators index			
Rank	**CI** (%)	**CE** (%)	**FI** (%)
Max 100			
51-60			20
41-50			40
31-40	20	40	20
21-30	20		
11-20			
1-10			20
No reporting 0	60	60	
	100%	**100%**	**100%**

***CI = Current practice – internal reporting, CE= Current practice – external reporting, and FI = Future intentions**

Social indicators index reported by Australian manufacturing companies measure social costs and impacts of doing business (Table 3). Companies currently measure costs of social impacts and report internally at a higher level than environment impacts, with only 20% not reporting any measures currently and all reporting externally. This can be tentatively

interpreted as manufacturing companies being significantly concerned about measuring social costs to improve social internal decision-making while supporting social performance disclosures (Gray 2002a, 2006). Companies indicated by their responses that they place a high priority on environmental measures and their future intention is to capture social costs to support social disclosures. Again, companies need 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).

Table 3: Social measurement indicators index

Social indicators index			
Rank	**CI** (%)	**CE** (%)	**FI** (%)
Max 100			
51-60			20
41-50			
31-40			
21-30	40	40	20
11-20	40	20	20
1-10		40	40
No reporting 0	20		
	100%	**100%**	**100%**

***CI = Current practice – internal reporting, CE= Current practice – external reporting, and FI = Future intentions**

6. CONCLUSION

It is early days in this study to draw any evidenced-based conclusions, thus, this paper will postulate what is anticipated from this study and the expected contributions. As a result of these tentative findings, manufacturing companies are intending to measure costs of environment and social impacts to meet requirements of environmental management accounting (EMA) (IFAC 2005; UNDSD 2001) and social management accounting (SMA) (Gray 2006; Gray et al. 2001) concepts and practices. Companies report these impacts internally and externally while creating cost information to enhance management decision-making and support disclosures (Burritt, Herzig & Tadeo 2009; Gadenne & Zaman 2002; Gale 2006; Gray 2006). Nonetheless, as environmental and social impact costs are hidden among production processes, companies are having difficulty in providing cost accounting

information (Sendroiu et al. 2006). Thus, changing accounting systems could help companies to fully cost products/services, as well as creating more accurate information to enhance management decisions and disclosures (Gray 2006; Gray et al. 2001). From this very preliminary analysis, Australian companies have a long way to go to meet world's best practices and add value before being considered as sustainable organisations in the eyes of stakeholders and in the marketplace. Further qualitative data to be gathered will probe companies' intentions so that this study can employ management accounting best practices adopted by companies in order to develop a sustainability management accounting system (SMAS) conceptual model.

An effective management accounting information system is required by manufacturing companies to efficiently measure costs of environment and social impacts. This is because of increased concerns shown by companies' stakeholders that require organisations to provide disclosures incorporating economic, social, and environmental performance in the form of triple bottom line reporting. Thus, developing a conceptual SMAS as proposed is an appropriate way to assist companies in the development of a holistic management accounting system to support the demands of their stakeholders. Companies can then employ environmental and social information to enhance decision making and management of these costs, as well as evaluating reductions in contaminants. The right SMAS can also provide organisations with the ability to report energy consumption and emissions under NGER and meet the requirements of GRI.

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