FACULTY OF BUSINESS AND LAW

School of

ACCOUNTING, ECONOMICS AND FINANCE

School Working Papers – Series 2004

SWP 2004/05

FINANCIAL REPORTING FOR ENVIRONMENTAL AND SOCIAL RESPONSIBILITY: A NORMATIVE STRATEGIC CONCEPT

Jean Raar Ph.D
Deakin University
Burwood 3125

URL: http://www.deakin.edu.au/fac_buslaw/sch_aef/publications/default.htm

Paper presented at the Corporate Governance and Reporting Conference, California State University, Los Angeles USA, January, 2004.

FINANCIAL REPORTING FOR ENVIRONMENTAL AND SOCIAL RESPONSIBILITY: A NORMATIVE STRATEGIC CONCEPT

Jean Raar Ph.D
Deakin University
Burwood 3125

Corporate responsibility demands that firms address environmental and social values in their firm's policy and key performance indicators. These are integrated through strategic planning and require firms to merge the longer term environmental and social values with short term economic objectives and performance measures. Each firm's strategy will differ. This paper provides a normative reporting concept to connect the financial implications associated with longer term planning for environmental and social values, with short term accounting reports. Reporting variants adapted from total cost assessment, life cycle costing, variable costing are integrated to offer upstream information based on a product segment view.

Journal of Economic Literature Classifications: Q2 and M2

Keywords: Strategy, environmental reporting, life cycle costing, cost systems, multi-period accounting, multi-stage fixed costs.

This paper is a working paper and comments and suggestions would be appreciated. Please do not quote.

All correspondence should be direct to:
Jean Raar Ph.D
Deakin University
225 Burwood Hwy
Burwood Vic 3125
Ph: 61 3 9244 6470 Fax: 61 03 9244 6283
E-mail: raar@deakin.edu.au

INTRODUCTION

Worldwide stakeholder influences are also intensifying pressure for business firms and industry groups to demonstrate accountability and responsibility that demands assimilation of environmental values into business practices (Henderson, 1991), including a greater degree of 'transparency' in terms of disclosure on the extent of environmental and financial risk. International efforts towards increasing transparency and accountability are evidenced in ISO 14000 environmental management series, and the suggestion by Elkington (1999) of a Triple Bottom Line (TBL) reporting approach which is implicit in the Global Reporting Initiative Guidelines (GRI, 2002). A TBL reporting approach includes the provision to stakeholders of three separate reports or information sets – financial social and environmental.

Suojanen (1954) formulated the enterprise theory that firms form part of the social community, as an institution where decisions are made that influence parties other than shareholders. Management is responsible for the firm as a corporate citizen and the resources, monetary, natural and physical used as a result of its decisions. This is also underpins the external reporting guidelines formulated by GRI in 2002.

Comprehensive triple bottom line reporting in a separate environmental and social report is increasing; however, for many firms environmental issues and performance are only discussed briefly in an Annual Report. While there appears a predisposition to increase disclosure of environmental social issues (Deegan and Gordon, 1998), even if triple bottom line reporting is adopted, external parties are unable to gain insights into the financial outcomes and risk associated with management's decisions relating to the environment. Decisions are improved if environmental issues can be linked with financial decision-

making process, and the approach used by individual firms to address environmental issues can influence the success or failure of products (Post and Altman, 1992). This information is not currently linked.[1] The aim of this paper is to offer a reporting concept to allow stakeholders to relate the strategic choices associated with environmental issues with the associated financial outcomes.

The need for a practical reporting concept and the motivation for this study came from

(a) DiPiazza Jr and Eccles (2002)

> propose a three tier model that includes (a) international accounting standards, (b) industry based standards, and (c) company specific information based on guidelines for reporting strategy, risk management and performance measures which would result in a 'holistic view of the enterprise, its strategies and their outcomes and financial results',

(b) the comments by Henn and Fava (1994) in discussing life cycle assessment and life cycle costing were:

> "*These life cycle techniques need to be married. However, the attempt at any such merger immediately confronts a significant dilemma; our present system of economic measurement and decision making doesn't know how to keep meaningful score. If or when it does know how, it doesn't choose to do so. The system simply doesn't count all the costs or assign accountability for all those costs it can count. New ideas, rules and frameworks are needed*" (p. 569), and

(c) the conceptual research model by Kumaran, et al (2001) which links life cycle assessment with a mathematical model for product life cycle costing.

[1] A range of environmental strategic choices and actions is listed in Banerjee (2001, page 38)

The approach and composition undertaken in this paper is to contend that:

a) The firm's policy, strategic planning and the corresponding performance measurements systems offer a mechanism for firms to 'reorchestrate' responsibilities and linkages (Dent, 1990) to the environment;

b) a total cost assessment approach complements accounting practices, corporate planning and forecasting[2];

c) life cycle assessment and cost estimation techniques can include environmental costs;[3]

d) life cycle system analysis includes a wide range of strategic elements associated with longer-term decision making;

e) total cost and materials flow accounting are congruent with strategic elements;

f) the GRI Reporting Guidelines (2002) include reporting on policy, key performance indicators, management performance and product performance which can be associated with strategic planning through the Balanced Scorecard approach of Kaplan and Norton (1996);

g) for reporting purposes, the multiple stages of environmental issues over the life cycle phase can be linked to environmental costs by the use of the German multiple-stage fixed costing approach;

In the first section of the paper the literature support from academic and professional sources is discussed. The second section includes the concepts underpinning Life Cycle Costing and its application in relation to environmental issues (a) on the functional elements

[2] (http://www.oit.doe.gov/showcasetexas/pdfs/presentations/a2/rschuette.pdf)

[3] http://www.oit.doe.gov/showcasetexas/pdfs/presentations/a2/rschuette.pdf

associated with the life cycle assessment of a product, (b) the techniques to estimate individual elements and their components, (c) a total cost. A hypothetical case study follows to demonstrate a linkage between cost estimations and is provided, together with an associated reporting framework adapted from Gutschelhofer and Roberts (1997) who integrated life cycle costing and the concept of multiple-stage fixed cost accounting (Stufen Fixkostendeckungsrechnung) and the multi-period accounting approach of Riebel (1994a & b). The result is a summarised external reporting concept which can be aligned with GRI reporting guidelines, and the details upon which the report was compiled can be used by internal management.

The escalating need to link environmental and financial issues?

Alexander and Buchholz (1978) expressed the view that:

> "*Socially aware and concerned management will also possess the requisite skills to run a superior company in the traditional sense of financial performance, thus making its firm an attractive investment"* (p.479).

The above statement highlights the relationship between corporate citizenship, financial performance and the market price of the firm's share. Shareholder wealth in terms of its future ability to generate earnings can be influenced by the environmental and social policies and goals a firm adopts. Kreuze et al (1996) highlight the recent trend by investors[4] to outlay funds '*on the basis of ethical, environmental and political criteria is estimated to*

[4] Refer also Jessie Smith Noyes Foundation

6 East 39th Street, 12th Floor,

New York, NY 10016-0112

TEL: (212) 684-6577 FAX: (212) 689-6549

be in excess of one trillion dollars' (p.132), i.e., a longer term focus. The fifteen most popular Australian managed 'ethical' and 'social responsible' funds in 2001 totalled A$165M[5]. According to Environment Australia 2002 Benchmarking Survey conducted for the Ethical Investment Association, assets of SRI managed funds in Australia grew by 31% between 2001 and 2002, in marked contrast to assets of managed funds as a whole, which declined by 0.1% during the year to 30 June 2002. Since 1996, SRI managed fund assets in this country have achieved a staggering growth rate of over 700%.

The number of SRI managed funds has also increased dramatically. In 1996, there were 11 funds. The 2001 baseline study identified 46 funds, and in 2002 they had increased to 74. In 2003, the measure of social and environmental performance forms part of investor preference within the market system. This study identified $13.9 billion in socially responsible investment assets in Australia[6].[7]

There are two main aspects to socially responsible investments. First, if firm's social and environmental strategies result in a performance that is deemed unacceptable to an investor they will perceive no value in investing in that particular firm. Second, if financial returns are not deemed satisfactory – the investment will simply be sold (Reich, 1998).

---

[5] Interested readers are referred to the United Nations Environmental Program Finance Initiatives and the Financial Initiatives website http:/www.uneptie.org/wssd/ and the Us Environmental Bankers Association Report information at http://www.envirobank.org.

[6] $1.8 billion in managed SRI funds
$124 million in private SRI portfolios managed by financial advisers
$6.7 billion in investments by religious organisations
$116 million invested by charitable trusts using SRI criteria
$5 billion in employer superannuation funds using SRI overlays
$164 million in community finance investment

[7] (http://www.ea.gov.au/industry/finance/publications/framework/index.html)

Therefore the inclusion of social and environmental issues into corporate goals is an increasing necessity, if management are to demonstrate to investors that associated costs and risks are being managed. Furthermore, international benchmark standards (ISO 14000 series) require firms to track, monitor, and provide performance measures relating to environmental issues. Both of these requirements can be formulated within the strategic plan.

STRATEGY: THE MISSING LINK TO BRIDGE THE GAP?

Strategic decisions and planning underpins the financial, environmental and social resources firms use in the pursuit of economic performance (Ramanathan, 1976) in order to fulfil their accountability duty to stakeholders and provide relevant information on the employment of those resources.

The link between environmental and social reporting and finance issues was highlighted by Ullman (1985), who viewed 'strategy' as the missing element to bridge the gap between economic performance reporting considered that stakeholder demands influence management decisions, and ultimately the environmental resources the firm uses. Organisational strategic planning can be using to link business decisions with the public good (Wenmouth, 1994).

Firms can introduce both innovative and pro-active strategies, including diversification (Dooley and Fryxell, 1999) to integrate environmental issues into their overall business strategy (Schot, 1992; Parker, 1997; Reinhardt, 1998; Banerjee, S. B., 2001; Jones, 2001).

However a firm's financial reports are focused on profit in the short-term and include retrospective rather than forward-looking and long-term information. They are misleading for strategy (Hansen and Smith, 2003). There is a growing awareness that the challenge for management accountants is to accumulate information that identifies estimates and allocates both monetary and non-monetary information on environmental issues to the strategic alternatives, product mixes and individual products initiating their costs (Brooks et al., 1993; Kreuze and Newell, 1994; Ditz et al., 1995; Hamner and Stinson, 1995; Dunk 2002; Banerjee, 2001; Institute of Chartered Accountants in Australia, 2003).

Strategy and the longer term cost.

The strategy adopted by management will determine the variety of cost types and their associated classification within the accounting information system. The following discussion includes examples of managerial choices.

Lack of corporate social and environmental responsibility can create the need for additional costs to ensure regulatory compliance, and will be in addition to the current costs (Cormier and Magnan, 1997). For example, it may be decided to simply reduce environmental risk and adopt the 'least change' business alternative – a reactive strategy. This alternative will result in the addition of environmental costs to the income statement without any corresponding benefits (Boer et al., 1998; Emblemsv^{og}, 2003). Alternatively, cost changes can include end-of-pipe strategies, process-improvement strategies, and pollution-prevention strategies in association with quality control costs (Dunk, 2002). Adopting a process-improvement strategy may require an increased investment in fixed costs to recycle wastes into marketable by-products, or it can redesign its production process to reduce

pollution, also requiring fixed costs outlays to implement the design changes (Boer et al., 1998).

- "*Environmental costs require the same tough scrutiny that executives give to other costs, and, just like any operating cost, they respond to sound management decisions. Because environmental costs tend to be spread across various parts of the organization, many managers are not aware of the size of these expenses. Executives who ignore the management of environmental costs do so at great risk to their bottom lines"* (Boer et al., 1998, p.28).

Environmental costs can be both implicit and explicit (Brookes et al., 1993), and both warrant attention during the evaluation of strategic alternatives. Therefore, present decision-makers need to gain insights into 'hidden' cash flows and cost categories; for example, value of waste and emissions, disposal costs; compliance and associated administration and personnel costs; environmental contributions; related financial costs of associated investments; maintenance and utilities; which are expected over the environmental-related life of the strategic approach. This necessitates a system that also incorporates associated uncertainties.

Clancy (1998) argues that product and process design is crucial to tie together new products, operating efficiency, production, quality and delivery. Hence, the formulation, implementation and outcomes of environmental issues in the strategic planning process, cross both organisational boundaries and professional disciplines, as do environmental costs.

Any claims relating to environmental issues should be supported by reliable and accurate information (Cattanach, 1995). However, any cost and/or benefits associated with social and environmental related decisions will be the subject of a longer term focus. Hence co-ordination of costs between long and short term accumulation methods is increasingly important to aid cost information and cost recovery. Recovery of outlays on social and environmental issues is associated with relevant costing where future outlays are accumulated according to the decision alternatives.

Each firm's management will undertake different decisions, using available information relevant to their strategic alternatives and goals, product type and the related multifunctional processes throughout the product's life. Environmental-related cost information is important in order to evaluate strategic cost alternatives, and for concerned parties to evaluate their effectiveness and efficiency in handling these issues and resources.

The necessary steps in the process of environmental costing

The steps to interact the abovementioned points are outlined below:

The first step in the process of linking product costs, and strategic planning with environmental criteria is to determine the potential for the firm's environmental risk, i.e., the potential problems. The environmental management and science disciplines have techniques to establish areas of environmental concern. These include environmental audits, life cycle assessments, accident prevention programs (Kolluru, 1994; Schaltegger et al., 1996).[8] A probability of occurrence for known problems or a likelihood of occurrence for accidents or damage can be attached.

[8] Detailed discussion of each these individual methods is outside the scope of this paper.

The second step is to ascertain the life span of the strategy or investment and the associated environmental risk costs. However, the cash flow should only include those costs (or savings) specifically identifiable with the plan or investment, i.e., the induced or incremental costs. In addition, the 'tracking' of past, present and future costs is important. Costs may include the research and development costs associated with new technology, a change in human resource expertise, training costs, repair of current equipment, potential impacts, litigation, fines etc., and may also include the opportunity costs of avoiding the any perceived problems.

The third step involves the estimation of time-horizons and the magnitude of future costs for example maximum penalty, technology changes, cost of remediation, (Kolluru, 1994; EPA, 1996). As liabilities and contingent liabilities are the result of previous or current activities (Schaltgegger et al., 1996), it is the area of future costs that is of concern for cash flow and risk management.

As Kolluru (1994) points out, costs can be aggregated according to product line, division, geographic location etc. Depending on the decision criteria, the mean cost for each risk allocation and a standard deviation can be calculated (EPA, 1996).

The fourth step involves the choice of techniques for strategic budget forecasting and evaluation.

LIFE CYCLE COSTING:A FUTURE ORIENTED COST SYSTEM

The forecasting, accumulation and reporting of environmental costs are part of a process of product stewardship (Dutton, 1991). White and Savage (1995) suggest, 'environmental'

costs are contingent – driven by future conditions, and are an integral part of any environmentally conscious cost accounting system. Strategic planning is focused on the future – in the longer term. An associated forecasting perspective to costing will include the information necessary in the decision-making process, and also a system that can assist management in tracking environmental costs. Although relevant costing accumulation for management decision making is included in management accounting texts its relationship to external reports has yet to be fully explored

Management accounting texts include topics on risk analysis and statistical techniques for forecasting purposes. Nevertheless, accountants' expertise in statistical analysis is limited (Francis, 1973), while management may not fully understand the implications of risk analysis (Long, 1983). Reibel (1994 a and b) argues that decisions are the true source of costs and revenues, and hence fixed and variable costs are related to decisions, not activities. The accounting system developed by Reibel was criticised by Weber and Weissenberger (1997) as impractical, nevertheless, the latter considered the accounting profession has some lessons to learn.

Thus, in attempting 'to learn' from the abovementioned literature discussions, the concepts underpinning this paper draw heavily on the studies by:

(a) Dhillon 1989 and Shields and Young (1991), who highlighted the operational aspects of life cycle costing,
(b) Long (1973) in which life-cycle costing was defined is a 'figure of merit, an aid in the decision-making process' (p.27), with the focus on the decision not the estimate,
(c) Emblemsvag (2003), who links Activity Based Costing, Net Present Value and Life Cycle Costing, and

(d) the reporting variants of Gutschelhofer and Roberts (1997) linking life-cycle costing and German cost accounting approaches. These authors adapted contribution margin reporting and cost hierarchies for use in a marketing decision framework, however their work is applied herein to environmental related decisions and strategy. The German multiple-stage fixed costing approach can also link the multiple functions associated with environmental cost information thus aiding decision-making and internal reporting.

CYCLE COSTING: Background.

Why use life cycle costing for estimation purposes?

Essentially, risk analysis and decision management form part of Life Cycle Costing (LCC). It also has a longer term focus. Initiated in 1971 by the United States Department of Defense[9], LCC was originally established as a procurement tool for United Sates of America (US) major defence acquisitions. In 1975 the United States Department of Health, Education and Welfare (Dhillon 1989) initiated the project entitled "Life cycle budgeting and costing as an aid in decision-making". The US Air Force Manual 800-11 considers life cycle costing as the total cost of an item system over its entire life, including the cost of acquisition, operation, maintenance, support etc and also disposal, if applicable (Long, 1983). Acquisition costs include those associated with research and development, test and evaluation, production and product support, e.g., training, facilities, the cost of operation, maintenance and technical data.

[9] Refer Dhillon (1989) for an extensive list of published literature and formulae on life cycle costing

The main focus of the US Defence Department was cost reduction over the life of a project, although conceptual support for life cycle thinking has expanded to encompass planning and control of resources (Czyzewski and Hull, 1991). These costs cover all phases of the product's life - a product oriented hypothesis (Levitt, 1965) and provides a more meaningful approach to costing and forecasting than the historical cost-plus method (Enis et al. 1977)[10]. The initial uses of LCC estimates have grown to include design to cost programs, and support of budget estimates (Long, 1983), the flow of funds, motivation, performance evaluation, continuous improvement and 'societal costs' (Shields and Young, 1991).

> "*Life Cycle thinking is a decision-making framework that encompasses the identification of all the revenues and costs associated with a product or service as it moves timewise through predictable stages and phases of evolution. By analysing both the revenues and the costs of the life cycle (womb to womb, cradle to grave, introduction to disposal) as well as their discounted time values"*
> (Schewchuk 1992, p.34)

Life Cycle costing and benefits for accounting

The objectives of accounting information and financial reporting are to provide information to users that can assist in their decision-making and the performance of management in relation to the stewardship of the resources entrusted to their care. As discussed previously, the stock price of an individual firm may reflect its environmental and social performance.

[10] Life Cost posting differs from Life Cycle Assessment (LCA) insomuch as LCA attends to measure in nonmonetary terms the environmental impacts associated with a product/s. Life cycle costing is defined herein in accordance with that of Schewchuk (1992, p.34) above. The emphasis is on the term 'predictable', therefore the tasks in this paper are related to identifiable and traceable environmental costs.

The GRI external reporting principles are also concerned with managerial performance, as evidenced by stated policies, procedures and critical success factors, which form part of a strategic stance toward environmental and social issues. LCC offers the opportunity to aggregate products, their processes, and functions and their activities with society. These are however, the result of management decisions.

Life Cycle can assist in the diagnosis of strategic evolution (Dhillon, 1989); in the co-ordination and implementation of organisational goals; in a dynamic ecological, economic and technological climate and is a useful framework to thinking about the growth and development of a new product (Hayes and Wheelwright, 1979 a & b); and should optimise decisions relating to acquisition, use and disposal (SETAC, 1990; Henn and Fava, 1994; Woodward, 1997). LCC also assists in the communication of consumer information and provides information for target costing (Hutton & Wilkie, 1980; Shields and Young (1989; Artto, 1994).

Thus, LCC is based on estimations allowing planning and control of revenues and expenses, and can be tailored to each function for the life of the product, project or service. Conceptually, in estimates of environmental expenditure LCC has been used in order to: (a) link the costs of operations, (b) determine the hidden regulatory costs, and (c) highlight the costs associated with contingent liabilities, and (d) identify less tangible costs with the product that initiates the outlays (Kreuze and Newell, 1994). The use of LCC for this purpose was to avoid dysfunctional decision-making due to the failure to match the compliance costs with the activity and product generating the expenditure (Susman, 1989; Brooks et al., 1993; Huppes, 1993; Kreuze and Newell, 1994; Hamner and Stinson, 1995).

Life cycle costing has been integrated with different costing methods. For example, Huppes (1993) considered LCC as part of the life cycle assessment and part of the information to guide management choices on products, processes and marketing decisions. Huppes emphasised the joint costs relating to economic inputs and economic outputs (p.203). Focusing on the life cycle assessment associated with physical causation of environmental emissions, the text emphasises the physical aspects and non-monetary data.

A number of cost models exist based on life cycle studies, with differing objectives. Some are linked to life cycle analysis and total cost assessment, while others focus on design to cost and economic input-output and activity based costing. These models were reviewed by Asiedu and Gu (1998) and are listed in Kumaran et al. (2001). Interestingly, many were outside the accounting discipline.

More recently, Emblemsvag (2003) published an excellent book linking LCC with Activity Based Costing (ABC) for environmental costing purposes. Activities are the result of management decisions, and Activity Based Costing is traditionally concerned with the allocation of indirect costs to the products consuming the resource. The author uses Monte Carlo simulations to model uncertainty in forecasting, and highlights the importance of continuous improvement and ABC for cost management. The use of this ABC and LCC may be more applicable to individual segments (for example, the forecasting of specific resources associated with cost elements within the organisational functions outlined below) than the total costs applicable to a strategic stance.

Despite its attributes, Life Cycle Costing is not without problems, specifically: (a) the costs associated with parties external to the firm, e.g., suppliers, waste disposal etc., and (b) the

costs associated with the accumulation of data that may be low in quality (Schaltegger et al., 1996). Nevertheless, these authors also view Life Cycle Costing as a tool to assist strategic management[11]. Caution may be necessary for manufacturing firms where costs, e.g., disposal costs, may be at the user's expenses.

Thus, given that each firm will adopt differing strategic alternatives, life cycle models will also differ accordingly. Dhillon (1989)[12] includes a number of life cycle cost models, some based on the intended specific use, e.g., quality control, cost of appliances, health care facilities, and some are general or non specific models. Using one of these models as a point of commencement, the next section outlines a simplistic approach as a point of commencement to assist in the determination of strategic estimations.

LIFE CYCLE COST MODEL AND ESTIMATION TECHNIQUES

The simple general format of this section is as follows:

First, is the adaptation of one of the base models in Dhillon (1989)[13] . This model has four major components, i.e., research and development cost, product and construction, operating and support costs, and retirement and disposal costs (p.55). The adaptation includes information related to total environmental costs, with specific emphasis on the component, operating and support costs.

[11] Life Cycle Costing differs from budgeting estimates, insomuch as it forms the basis for development of individual cost items for budgeting purposes (Long, 1983, Schaltegger et al., 1996).

[12] For the interested reader this text contains models suitable for a variety of investment options and contains a list of techniques for estimation purposes.

[13] Copyright permission

Second, the techniques used by Long (1983)[14] for estimation of operating and support costs are applied to one of the cost components included in the above adaptation.

Third, a reporting format is presented which includes an isolation of the total operating and support costs - based on German multi-stage fixed costing.

Model example

Based on outline of organisational functions outlined in Diagram 1, and adapted from Dhillon (1989, pp55-57), the following LCC cost model is for the elements developed.

$$L_{cc} = RDC + MA + OPQC + OSC + DRC \quad (1)$$

Where

RDC = research and development costs

MA = marketing and advertising costs

OPQC = Operational management production and quality control costs

OSC = operation and support costs

DRC = disposal and/or recycling costs (end user costs)

Total Cost Estimation

The formulae[15] of Long (1983, pp.74.75) and Dhillon (1989, p.55) have been adapted to estimate the total operation and support (OSC) for the year (q). For example, total OSC costs may consist of energy, fuel, maintenance of pollution prevention equipment, training

[14] Efforts to locate author for copyright permission have not been successful. Upon reading this paper, contact by the author would be appreciated.

[15] Formulae Nos 33-38

of personnel in environmental compliance issues, and occupational health and safety compliance issues..

The following formulae can be used to determine the annual estimate of operating and support costs:

s

Where

OSC_q = Operational and support costs for year q.

s = the number of cost elements i.e. energy, fuel, maintenance of pollution prevention equipment, and training of personnel in environmental compliance issues i.e. 5; .

X_i = cost estimate for the ith cost element for the year q.

n = operational life of the product.

It would appear that the X_i's are independent, thus the expected values and variances of Y_q can be expressed using sums of random variables, as:

$$E[OSC_q] = \sum_{i=1}^{s} E[x_i] \quad (2)$$

and

$$Var[OSC_q] = \sum_{i=1}^{s} Var[x_i] \quad (3)$$

Long views these random variables as independent and uses a Laplace transform to the disbtribution of x_i (Long, 1983, p.75)

The total operational and support costs for the product can be determined from the following equation.

$$TOSC = \sum_{q=d}^{h} OSC_q \quad (4)$$

Where

TOSC = the total Operation and Support costs,

OSC_q= the Operation and Support cost for year q, (refer Equation 2)

d = the year the Operation and Support commences, and

h = the year the Operation and Support is completed.

As TOSC are a function of time, the issues of inflation and discounting require consideration (Long 1983).

As Long (1983) points out there are numerous distribution parameters from which calculations can be made, particularly, lognormal, triangular, poisson, rectangular, gamma and beta. Emblesvag (2003) highlights a back casting approach. Each product, product-line or individual investment may require a different method, depending on the circumstance. Still, management accountants may not be fully familiar with the mathematical underpinnings each of these alternatives and also their applications.

REPORTING FORMATS

Once the total cost components, i.e., Research and Development, Marketing and Advertising, Production and Quality Control, Operating and Support Costs, Disposal and or recycling, are determined, the format for reporting requires flexibility.

Variants Of The German Multiple-Stage Fixed Cost Accounting

The multifunctional aspect of the Life cycle model (1) is used in the reporting concept of Diagram 1. Consistent with materials flow accounting and suggests an opportunity to establish an effective reporting system that displays the functional resources segments in terms of management action toward environmental issues. Future estimations were

necessary to report cost of resources[16], deemed necessary by management for the achievement of the firm's strategic stance. These estimations can be compared at the end of a period with the actual results.

Guschelhofer and Roberts (1997) support their approach to the accumulation of environmental costs as follows. Life cycle costing is not well known in Germany, (Männel, 1994; and a cost contribution *(Deckungsbeitragsrechnung)* and allocation of fixed costs approach to reporting is adopted - based on products, marketing, etc, with the fixed costs allocated at the relevant segments. Income statements for the accounting period can be prepared on a multiple-stage fixed cost approach *(Stufen Fixkostendeckungsrechnung*), allowing the user to determine results for unit of product, product lines, plants division company[17].

The Guschelhofer and Roberts (1997) highlighted the product-market combinations by Simon (1992) and Lambin (1993) and advanced their conceptual framework of life-cycle costing to analyse various factors that determine the profitability of product-marketing over time. The 'sequence of the product life-cycle stages' outlined in Shields and Young (1991) as a base, and the cost accounting structure variation of Guschelhofer and Roberts (1997) which uses a funnel approach (based on a hierarchical contribution margin approach to reporting), is adapted here in Table 1 for the purposes of linking environmental costs over a longer time frame.

---

[16] product, product-line or batch, depending on the type of product and is process of manufacture.

[17] For further reading in this area refer German cost accounting literature: M™nnel (1983; 1994). ; Reibel (1994a; 1994b). Interpretation required.

The first stage in the sequence is the production costs, which provide a profit margin aligned with traditional accounting, i.e., revenue less cost of goods sold. It is however recognised that product is not the first stage in the life-cycle of a product. This margin is further reduced by Research and Development costs, Marketing and Advertising Costs, Operation and Support Costs, and Disposal and Recycling Costs. The reporting framework outlined in Table 1 relates the direct costs and induced[18] fixed costs to the decision making centre (Guschelhofer and Roberts, 1997, p.38).

Many managers making decisions that incur environmental costs may be unaware of the impact of their decisions on the total environmental cost. The figures displayed are summarised totals, and further data funnelling may be required by internal functional managers who use these reports for internal decision-making. The format displayed in Table 1 provides these managers with relevant information to view the 'whole picture' and manage total costs, a view also recommended by Boer et al. (1998).

Their second design variation was adapted from Reibel (1994b) whose seminal contribution to German cost accounting, adopted a cash-outlay approach, with decisions as the source of costs and revenue. As Guschelhofer and Roberts (1997) point out, while it provided them with opportunity to design a multi-period and multi-stage reporting format, the approach classifies fixed and variable costs in relation to the decision context, not the Anglo-Saxon method of activity.

[18] A term used by Schaltegger et al (1996) to refer to environmental costs that are in addition to current levels. In this paper these are referred to as the incremental changes in cost dollars as a result of the strategic stance of process improvement approach to environmental management. The term also includes the anticipated increase in compliance costs that management expect to incur regardless of their strategic position.

Example

The simple reporting example provided herein is of a hypothetical firm J. B. Food Supplies. It assumes (a) all the costs have been estimated in accordance with the aforementioned discussion, (b) that options at strategic level can be accumulated by tactical or operational decisions in the shorter term, and (c) a SWOT (strengths opportunities, weaknesses and threats) analysis is applied.

The scenario is as follows. Top management is concerned with a need to counteract an adverse reputation resulting from their environmental and social actions and be listed as a Socially Responsible Investment. They have been the subject of criticism for their disposal of waste food products. Therefore, the long-term objective is to disseminate information that improves the public image, and reduce sub-optimal outcome in terms of compliance and litigation costs.

Associated with regulatory changes, the disposal costs of their food waste have spiralled over the last two years. Management anticipates this cost component, together with the increasing stringency of food manufacture regulations, will continue, ($80,000 in Year 1, $120,000 in Year 2 and $200,000 in Year 3) without providing any benefit to the company.

Based on a SWOT analysis and risk related decision criteria of (a) do nothing, (b) recycle food and containers, (c) dispose of food and container waste in accordance with regulations, management have decided to adopt a strategic stance of process improvement and recycling. A shorter-term objective is to (a) improve revenue by the return of customers who did not

approve of the firm's reputation, (b) decrease the quantity of waste and also disposal costs, and (c) initiate product recycling[19].

Hence, management has decided to reduce waste, and recycle any waste into by-products. The results of a feasibility study have indicated that with minimal further manufacturing, by-products can be sold as high-grade animal food through the local pet protection agencies and veterinary clinics.

The advertising department have estimated the induced amount to 'reclaim' customers and acquire new customers for their animal products, to be in the vicinity of $100,000 for two years, reducing to $80,000 as the new animal products become more accepted by the market. A five-percent increase in revenue is expected in Year 2, rising to 15 percent in Year 3.

To further support this strategy, fixed production costs are expected to increase to $1.5M in year 1 as the new equipment is installed, research and development relating to the new by-products will increase $1,200,000 reducing to $700,000 in year 2 and $500,00 in year 3. However, management anticipated the current costs of disposal will be reduced by $900,000 over a three year period. In addition, induced environmental operation and support costs are also expected to be added due to the additional personnel time associated with environmental compliance and additional training requirements. Life cycle and risk evaluation estimates have concluded that $250,000 will be required in the first year, $150,000 in year two and $150,000 in year three.

---

[19] (Note further information on the details may support the strategy in accordance with the GRI guidelines, for example, *Waste:* Target: 50% Reduction of Waste per Pound of Prod. *TTUs* Project Specific $/mt $/mt $/mt*; Kilns* Project Specific $/mt $/mt $/mt).

The above information has been incorporated into an adaptation of the multiple stage cost model format of Guschelhofer and Roberts (1997, Figs 8 & 9) and is displayed in Table 1.[20].

Initially, the direct unit, batch or product-line costs (including quality control costs), and also the induced fixed production costs, are deducted from the revenue of all products in order to determine Margin I. The next step is to reduce Margin I by the direct Research and Development Costs together with the induced environmental research and development costs of $1,200,000[21]. The results provide Margin II. The direct Marketing and Advertising costs, together with the induced advertising cost of $100,000[22], further reduce revenue and determine Margin III.

The operation and support costs, and the induced costs of advertising, further reduce this amount to Margin IV. The next section of the income statement displays the expected reduction in regulatory costs as a result of management's strategic stance, in conjunction with the induced increase in environmental regulatory and compliance costs expected over the three year period. The results provide a total operating margin for each period. It is noticed in Table 1 that the JB Food supplies do not recoup financial benefits in the shorter term. The benefits of a report format of this type display to the external user that results are not expected to be evident in the shorter term. If required, further funnelling of this information can provide more detail and indeed support goals and performance measures for individual product lines and responsibility centres.

[20] Monetary information contained in the report is hypothetical unless specifically related to the strategic example provided. Furthermore, detailed calculations of the time value of money are not included although it is assumed in practice this procedure would be undertaken in the determination of future cash flows.

[21] For purposes of discussion, only Year 1 used at this point.

[22] $100,000 for years 1 and 2, reducing to $80,000 in year 3.

Using the functions of a product's life cycle in a multi-stage approach allows report users to determine the changes in expenditure in the short term, e.g., increased research and development costs, and the benefits in terms of revenue increases and reduction in compliance and disposal costs in the longer term. This approach to management and reporting is a similar to that associated with Total Quality Management costs associated with prevention and failure.

POTENTIAL LIMITATIONS.

Three issues which have the potential to limit the use of this reporting framework are considered.

1. It may be argued that the above format would not be suitable for external reporting purposes, due to the proprietary nature of the information and the associated strategies on which it is based - the benefits would only be to internal management decision-makers. Nevertheless, the GRI reporting guidelines include information relating to management policies, and performance, which are expressed in summary form. If appropriate these can be linked key performance indicators expressed in non monetary performance measures.

2. The inclusion of estimated and actual information is also more related to internal decision making, particularly budgeting and control variances. They would however provide external users with a basis for evaluating managerial performance in the longer term – what did they expect and what was the actual result? Such disclosure offers credibility in terms of communicating and signalling to the investors that management

are endeavouring to interact with the environment and community in a 'responsible' manner.

3. The costs associated with the accumulation and measurement of information may appear prohibitive. The benefits may not appear obvious in the shorter term.

CONCLUSION

The adaptations presented in the paper offer mechanisms to estimate, track and report environmental cost information. The format provides information on the total cost of (a) each cost element over an annual period, (b) over the life of the product, and (c) total environmental costs.

The use of these a 'total' life cycle costing mechanism can aid strategic planning and new product processes decisions by providing total environmental costs of strategic alternatives, e.g., design, product re-use, take-back and recycling. Importantly, this approach to estimation of the financial implications of environmental management can be congruent with management policies and environmental objectives, e.g., reduce quantity of waste by 'x'. This is also congruent with the nonmonetary information categories contained in a GRI framework and reporting guidelines. Both the LCC and the reporting concept presented can support the use of Total Cost Assessment approach and assist in the capture of risk capture (White et al., 1993).

Given the accent on Life Cycle Assessment (LCA)[23] for risk assessment, the use of associated environmental cost management information can influence the strategic approach adopted, insomuch as environmental benefits can be achieved by a least-cost alternative.

Collection of data in this way provides insights into any variation in costs from those anticipated, allowing the user to assess the overall effectiveness (in financial terms) of the particular strategic approach adopted for environmental management purposes. Furthermore, the reporting format outlined here can form the basis for control measures to assist in ascertaining the quality of environmental management.

Risk analysis is a fundamental issue in determination of the dynamic process of costing environmental issue, insomuch as the incorporation of risk analysis will assist management to ensure that future business alternatives are not overlooked and replaced with favourable short-term economic cash flows. In order to offer stakeholders more transparency, details of the risk methods used to generate the figures contained in the report can be included as a qualitative discussion in the footnotes.

Future case study research can ascertain the practical applications associated with integration of strategic costs, life cycle costing models or estimation models, and their relationship with internal reporting mechanisms, management decisions, and to external reports. Particular emphasis can be directed to linking the GRI guidelines with financial reports. Research efforts may also be directed to refining the reporting mechanism that is

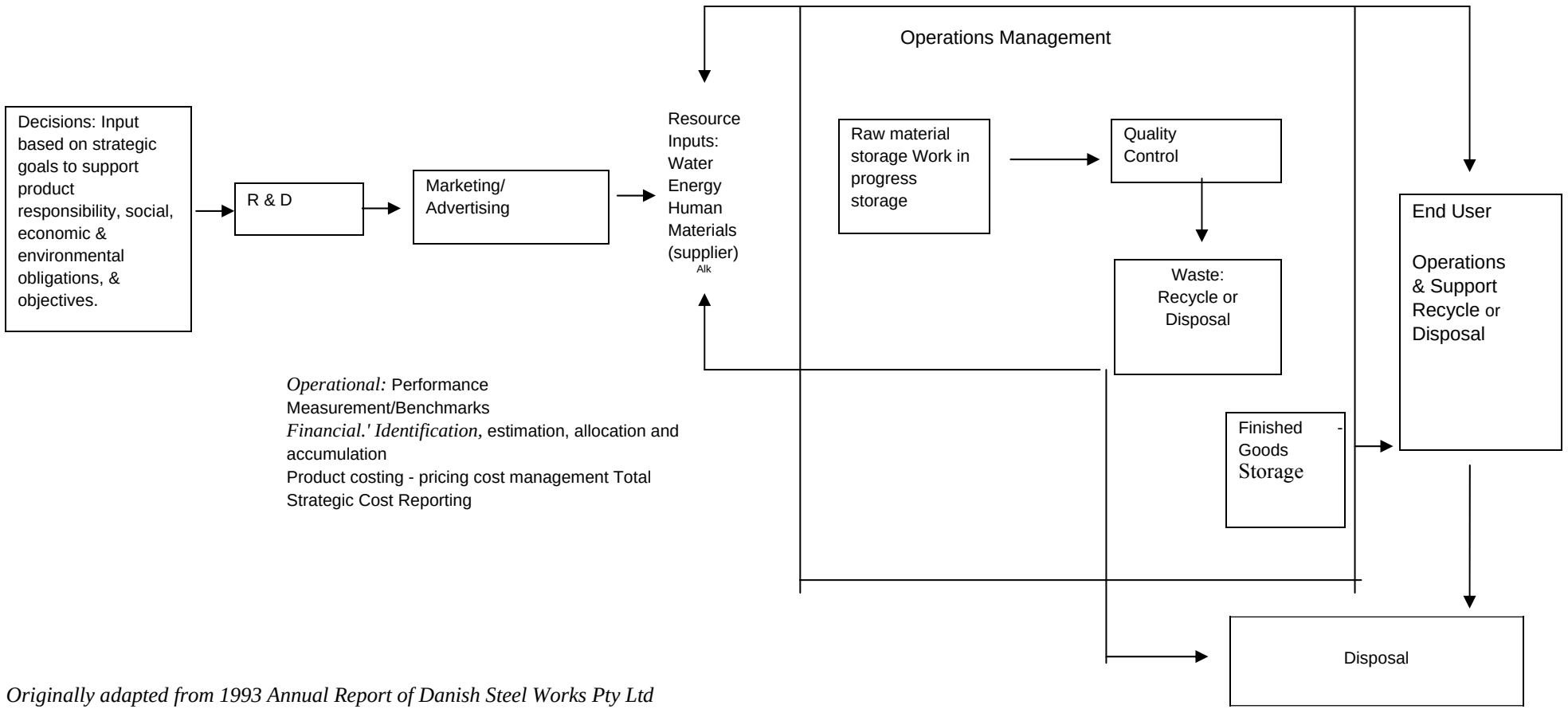
[23] Defined as "LCA identifies the impacts of products and services over all life cycle stages and media, enabling informed decision-making. LCA can identify and verify environmental benefits that will lead to sustainable practices (USEPA, 1999 p.;1).

presented in this paper. Research and reporting efforts can be directed to disclosure of information in both a GRI environmental report and linking it with monetary information, or other alternatives to publicise the firm's financial performance by comparison with long and short-term environmental objectives.

If management accountants are to be respected and accepted as 'business partners', the management accounting skills associated with the provision of information for decisions under uncertainty, risk management and reporting formats are fundamental to the provision of more relevant and accurate estimations, may require adaptation. Nevertheless, it is in this domain that accountants can aid stakeholder scrutiny of the relationship between environmental issues and financial performance and add credibility to the external reporting process.

DIAGRAM 1

STRATEGIC MANAGEMENT CONCEPT TO COSTING AND REPORTING



Originally adapted from 1993 Annual Report of Danish Steel Works Pty Ltd

J. B. Food Supplies Ltd.

PERIODIC MARGIN STATEMENT.

STRATEGIC APPROACH:

***LONG TERM ENVIRONMENTAL OBJECTIVES:** Improve Public Image relating to Corporate Citizenship; Reduce Non Compliance Risk

SHORT TERM GOALS: Increase Revenue, Decrease Disposal and remediation Costs

	PERIOD 1		**PERIOD 2**		**PERIOD 3**	
	Product/product line		**Product/product line**		**Product/product line**	
	ESTIMATED	**ACTUAL**	**ESTIMATED**	**ACTUAL**	**ESTIMATED**	**ACTUAL**
Product revenue	**$5,000,000**		**$5,250,000**		**$5,750,000**	
Less Unit/Batch/Product Line Costs	**1,450,000**		**1,450,000**		**1,450,000**	
(including quality control costs)						
Less Induced Fixed Production Costs new Recyling equipment	**$1,500,000**					
Margin I						
Less Research & Development Costs	**100,000**		**100,000**		**100,000**	
Less Induced Research & Development Costs (inc. fixed costs)	**1,200,000**		**700,000**		**500,000.**	
Margin II						
Less Marketing and Advertising Costs	**200,000**		**200,000**		**200,000**	
Less Induced Advertising Costs for new products	**100,000**		**100,000**		**80,000**	
Margin III						
Less Operational and Support Costs	**150,000**		**150,000**		**150,000**	
Less Induced personnel training costs	**250,000**		**150,000**		**150,000**	
Margin IV						
Less Disposal and Recycling Costs	**$1,200,000**		**$ 700,000**		**300,000**	
Induced Environmental compliance costs	**80,000**		**200,000**		**300,000**	
Operating Margin for periods 1 + 2 + 3.	**$1,230,000**		**$1,500,000**		**$2,720,000**	

*For external reporting these strategic approaches can be reported to external parties within the GRI policies and key indicators section of the report.

Acknowledgements: Former versions of this paper have benefited from comments by participants at the Hawaii Business Conference, Honolulu, June 2001, and Finance Educators Conference, Deakin University 2000, and Allan Purnell, Deakin University.

REFERENCES

Artto. K. A., 1994, Life Cycle Cost Concepts and Methodologies, Journal of Cost Management, Fall 28-32.

Asiedu. Y. and P. Gu, 1998, Product life cycle costs analysis - state of the art review. International Journal of Production Research, Vol. 36. No. 4, 883-908.

Banerjee. S.B., 2001, Corporate environmental strategies and actions Management Decision, 39 1, 36-44.

Brearley. R. A. and S.C. Myers, 1996, Principles of Corporate Finance, Fifth Ed. McGraw-Hill (US).

Brooks. P. L.; L.J. Davidson and J.H. Palamides, 1993, Environmental compliance: You better know your ABCs, Occupational Hazards 55 2, February, 41-46.

Cattanach. R. E., J. M. Holdreith, D. P. Reinke and L. K. Sibik, 1995, The Handbook of Environmentally Conscious Manufacturing, Irwin Professional Publishing.

Czysewski. A. B. and R. P. Hull, 1991, Improving Profitability with Life Cycle Costing, Journal of Cost Management (Summer) 20-27.

Clancy. D. K., 1998, Strategic design cost analysis, Cost Engineering 40, 8,25-30.

Dhillon. B. S., 1989, Life Cycle Costing: Techniques, Models and Applications, Gordon & Breach.

DiPiazza. S.A Jr and R. G. Eccles, 2002, Building Public Trust: The Future of Corporate Reporting, John Wiley Ltd.

Ditz. D., J. Ranganathan, and D. R. Banks., 1995, Greed Ledgers: Case Studies in Corporate Environmental Accounting, World Resources Institute, (Baltimore MD).

Dunk, A. S. 2002 Product quality, environmental accounting and quality performance" Accounting, Auditing & Accountability Journal 15, 5, 719-732.

Dutton. G., 1998*a,* Breaking down Environmental Costs. Management Review 87, 9, 61-62.

Elkington , J. 1997 Cannibals with forks: The Triple Bottom Line of 21st Century Business, Capstone (United Kingdom).

Emblemsv°ag J., 2003, Life-Cycle Costing: Using Activity-Based Costing and Monte Carlo Methods to manage future costs and risks, John Wiley & Sons Inc

Francis. M. E., 1973, Accounting and the Evaluation of Social Programs, a Critical Comment, Accounting Review, 48, 3. 245-257.

Global Reporting Initiative (GRI). www.globalreporting.org.

Gutschelhofer. A., and H. Roberts, 1997, Anglo-Saxon and German Life-Cycle Costing, The International Journal of Accounting, Vol. *32*, 1, 23-44.

Hayes. R. H. and S. G. Wheelwright, 1979a, Link Manufacturing process and product life cycles, Harvard Business Review, 133-140.

Hayes. R. H. and S. G. Wheelwright, 1979b, The dynamics of process-product life cycles, Harvard Business Review, 127-136.

Hansen. F. and M. Smith, 2003, Crisis in corporate America: The role of strategy, Business Horizons, January-February, 7-18.

Henn. C. L. and J.A. Fava, 1994, Life Cycle Analysis and Resource Management, in R. V. Kolluru (ed) , Environmental Strategies Handbook: McGraw-Hill, Inc. (New Jersey).

Huppes. G., 1993, Macro-Environmental Policy: Principles and Design, Elsevier.Hussey, D. E., 1979, Introducing Corporate Planning. Second Edition, Pergamon Press.

Hutton. R. B. and L. W. Wilkie, 1980, Life Cycle Cost: A new form of Consumer Information, Journal of Consumer Research March, 349-360.

ISO 14040 1997, Environmental management – life cycle assessment – principles and framework, ISO (Paris).

Jones. G., 2001, Personal Values and Corporate Philanthropy -A Theoretical Model for the Role Senior Executives' Personal Values Play in Decisions Regarding Corporate Philanthropy. Paper presented Governance and Corporate Social Responsibility in the New Millennium, Deakin University, November, 2001.

Kaplan. R. S and D. P. Norton, 1997, Using the balanced scorecard as a strategic management system, Readings in Management Accounting Ed. S. M. Young, Prentice-Hall, 222-230.

Kreuze. J. G. and G.E. Newell, 1994, ABC and Life-Cycle Costing for Environmental Expenditures, Management Accounting, LXXV, 8, 38-42.

Kreuze. J. G.; G.E. Newell and S.J. Newell, 1996, What companies are reporting. Management Accounting July, 37-43.

Kumaran. D. S., S. K. Ong, R. B. H. Tan, and AYC Nee., 2001, Environmental life cycle costs analysis of products, Environmental Management and Health, Vol. 12. No. 3, 260-276.

Lambin. J. J., 1993, Strategic Marketing: A European Perspective, McGraw-Hill International.

Long. J. A., 1983, Life Cycle Costing in a Dynamic Environment, Unpublished Ph.D. Thesis. Department of Industrial and Systems Engineering, Ohio State University.

Männel. W., 1993, Deckungsbeitragsrechnungen (Contribution Accounting Systems) Handwörterbuch der Betriebswirtschaft (Handbook of Business Administration) Schaeffer-Poeschel Verlag, Stuttgart 731-733.

Männel. W., 1994, Frūhzeitige Kostenkalkulation und lebenszyklusbezogene Ergebnisrechnung (Timely cost Calculation and Life-Cycle based Income Accounting) Kostenrechnungspraxis 106-110.

Norton. D. P., 2001, Building Strategy Maps: The Importance of Time-Phasing the Strategy, Balanced Scorecard, Volume 3, Number 2 March-April, 2001, 1.

Parker. L., D., 1997, Accounting for Environmental Strategy: Cost Management, Control and Performance Evaluation, Asia-Pacific Journal of Accounting 4, 2, 145-173.

Post. J. E. and B.W. Latnman, 1992, Models of corporate greening, how corporate social policy and organizational learning inform leading-edge environmental management. Research in Corporate Social Performance and Policy 13, 3 – 29.

Redmann. C., 2000, Flow Cost Accounting and Corporate Material Flow Management. Presented at Environment Australia 2nd Workshop, March.

Reibel. P., 1994a, Einzelkosten und Deckungsbeitragsrechnung: Grundfragen einer markt- und entscheidungsorientierten Unternehmensrechnung (Unit Costs and Contribution Accounting: Basic questions of a market and decision-oriented business accounting) 7th Ed. 178-185. Wiesbaden: Gabler, in Gutschelhofer. A. and Roberts. H., 1997, Anglo-Saxon and German Life-Cycle Costing. The International Journal of Accounting Vol. 32, 1, 23-44.

Reibel. P., 1994b, Core Features of the Einzelkosten-und Deckungsbeitrags-rechnung. The European Accounting Review 3, 515-543.

Reich. R. B. 1998. The New Meaning of Corporate Social Responsibility, California Management Review, 40, 2. Winter, 8-17.

Reinhardt. F. L., 1998, Environmental Product Differentiation: Implications for Corporate Strategy. California Management Review, 40, 4, 43-73.

Schaltegger. S.; K. Muller and H. Hindrichsen, 1996, Corporate Environmental Accounting. Chichester, John Wiley & Sons.

Schewchuk. J., 1992, Life Cycle Thinking. CMA Magazine, May, 34-36.

Shields, M. D. and S. M. Young, 1991, Managing Product Life Cycle Costs: an organizational model, Journal of Cost Management, Fall, 39-51.

Society of Environmental Toxicology and Chemistry (SETAC) 1990. A Technical Framework for Life-Cycle Assessments. Vermont, SETAC.

Standards Australia/Standards New Zealand 1995, Interim Australian/New Zealand Standard: Environmental management systems - General guidelines on principles, systems and supporting techniques. AS/NZS ISO 14004 (Int). Homebush, Standards Australia/ Standards New Zealand.

Suojanen. W., 1954, Accounting theory and the large corporation. Accounting Review, July.

Susman. G. I., 1989, Product Life Cycle Management, Journal of Cost Management 3, 2. Summer, 8 – 22.

United Nations: 1999, International Accounting and Reporting Issues: 1998 Review. Report by the Secretariate of the United Nations Conference on Trade and Development.

United States Environmental Protection Association (EPA), International conference on Life Cycle Assessment, http://www.epa.gov/ttbnrmrl/inlca.htm. 23.12.1999

Weber. J. and B. E. Weissenberger, 1997, Relative Einzelkosten-und Keckungsbeitragsrechnung: A Critical evaluation of Reibel's approach. Management Accounting Research, 8. 3. 277-298.

Wenmouth. B. A. 1994, Quality systems and environmental management, Journal of Environmental Health 57, 4, 15-20.

White. A. L.; D.E. Savage and A. Dierks, 1995, Environmental Accounting: Principles for the sustainable Enterprise. Presented at the 1995 TAPPI International Environmental Conference, May 7-10 (Atlanta).

White. A. L. and D.E. Savage, 1995, Budgeting for Environmental Projects: A Survey. Management Accounting (October): 48-54.

White. A. L, D. Savage and M. Becker, Evaluation approaches to the Financial Evaluation of Industrial Pollution Prevention Investments, Risk Analysis Group, Tellus Institute, June 1993, 10.

Woodward. D. G., 1997, Life cycle costing – Theory, information acquisition and application. International Journal of Project Management 15, 6, 335-344.