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Developing a model for reviewing the implementation and utilisation of Environmental Accounting

Wilhelm Alheit

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W. Alheit

University of Cape Town

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Abstract

The environment as a cost factor for business

Environmental regulation and environmental pressures from various interest groups have been steadily increasing in recent years. Poor environmental performance by business may be costly and may lead, for example, to increased environmental taxes, financial liabilities resulting from lawsuits related to environmental incidents, or damage to public image as a result of pressure group campaigns. The environment has become a significant cost factor for business.

Lack of environmental cost information

However, many companies do not know how what the magnitude and extent of their environmental costs are. Financial accounting and reporting systems are not designed to extract environmental cost information from general financial information. Financial accounting systems do not reveal how high environmental costs and liabilities are, nor what the sources of environmental costs are. Environmental management systems on the other hand, produce environmental data, but this data is not monetized and therefore does not reveal much about environmental costs either.

Why financial accounting systems fail to reveal accurate environmental cost information

Accounting systems typically pool environmental costs into overhead accounts. The result is that both the sources of the environmental costs and its nature as environmental costs are obscured by the financial reporting system. This becomes a problem when the environmental costs assigned to overhead accounts are significantly high, or when different products, materials or processes contribute to environmental costs unequally.

How environmental accounting generates environmental cost information

Environmental accounting generates environmental cost information by identifying the significant environmental costs of a company. This is done by identifying the processes, materials, wastes or products of a company that create significant environmental impacts. Environmental accounting then investigates the financial reporting system and identifies all the costs that are associated with these processes, materials, wastes or products and that may potentially be

hidden in overhead accounts. Once the environmental costs have been identified in overhead accounts, the costs can be allocated to its sources. Thus environmental cost information is generated that reveals the true extent and the sources of environmental costs. This information can then be used to inform a company's business decisions.

The process described above illustrates how environmental accounting combines the disciplines of environmental and financial management. Environmental data from the environmental management discipline is used to focus attention on the processes, materials, wastes or products of a company that create significant environmental impacts. The skills of the financial management discipline is then used to link the processes, materials, wastes or products with significant environmental impacts to the costs created by them. These costs would typically have been obscured or hidden in overhead accounts. Through providing more accurate environmental cost information, environmental accounting can reveal opportunities to management for the reduction of environmental costs and the improvement of environmental performance.

The purpose of this thesis is to develop an Environmental Accounting Review Model that presents guidelines against which the adequacy of an environmental accounting project can be assessed. What follows is a brief description of the main elements of the Environmental Accounting Review Model, which outlines the basic elements of the process of environmental accounting.

Overview of the Environmental Accounting Review Model

Broadly speaking, two phases can be identified in an environmental accounting project:

- The generation and analysis of environmental information
- The use of that information in order to integrate environmental considerations in decision-making, optimise environmental and economic performance and promote environmental sustainability

Generating environmental information

Firstly the objectives a company has with an environmental accounting project with must be considered. The intended applications of environmental accounting information will determine the types of environmental costs that will need to be investigated and the depth of the investigation. Then potential sources of environmental information need to be identified. Once these steps have been taken, the process of identifying, tracing and allocating environmental costs can begin.

Integrating environmental considerations into business decisions.

Two of the main sources of environmental information are the existing financial and environmental information and management systems. Methods must be developed to extract environmental cost information from the general cost information of the financial system. Non-financial environmental information must be obtained from the environmental management system and processed into a format that is useful as input into the decision-making process. The environmental information can then be integrated into the decision-making processes of the business. The information may also complement and be used in conjunction with other business systems, strategies or approaches that seek to improve and optimise economic and/or environmental performance.

The Environmental Accounting Review Model

The uses of environmental accounting

The primary function of environmental accounting is to provide environmental cost information. Without adequate environmental information, environmental accounting cannot achieve the other objectives stated below. By providing environmental cost information that reveals the magnitude and causes of environmental costs, environmental accounting enables a company to search for and identify opportunities for cost reductions.

Environmental accounting facilitates more cost effective environmental management and aids in the development of a company's environmental management system. For instance, insight into the extent and nature of environmental costs can aid a company in prioritising environmental initiatives and assessing opportunities for pollution prevention.

Environmental accounting can identify environmental costs that have been overlooked and trace these costs to their sources. The same methods can be used to estimate the potential costs of new investments or new processes and products. Environmental accounting can therefore be applied to capital budgeting and to process & product design.

Environmental accounting supports the search for more sustainable ways of doing business by providing accurate environmental data and cost information. Accurate information on the environmental impacts of current or planned activities and the associated environmental costs or liabilities can provide indicators of how sustainable these activities are, enabling companies to measure ecological efficiency, improve environmental performance (reduce environmental impacts) and develop greener products, processes & services.

There are strong incentives for management to implement environmental accounting, because of the contribution it can make toward general business

management by integrating environmental considerations into business decisions and management.

Implementing environmental accounting may hold significant financial benefits for companies. Environmental accounting can contribute toward the financial performance of business by improving the management of environmental costs, assessing and reducing environmental risks and liabilities and improving market share through the development of greener products and services.

Types of environmental costs

Conventional costs are the costs of environmental considerations influencing normal business decisions, regarding issues such as capital equipment, materials, supplies and labour, for example the cost of waste management.

Potentially hidden environmental costs, such as the costs of environmental monitoring, may not be allocated to environmental accounts, but be pooled into overhead or administrative accounts, and may thus be hidden as environmental costs. These costs can be grouped into the following categories:

- Regulatory costs, i.e. costs of compliance with environmental laws and regulations
- Voluntary costs, i.e. costs associated with environmental initiatives that goes beyond the standards required by regulation
- Contingent costs, i.e. costs that might be incurred in the future through, for example, changes in environmental regulations, possible environmental incidents, or remediation of environmental damage.
- Image and relationship costs, i.e. costs incurred to improve relationships with stakeholders, such as annual environmental reports or community relations activities.

External environmental costs (societal costs) refer to the costs of a company's activities that are borne by the environment and society, such as wastes and pollutants released into the environment. There is increasing pressure on business from government and other stakeholders to assume responsibility for more societal costs. Even if companies decide not to internalise the external environmental costs of their activities, accurate information about the nature and extent of their social costs can be valuable for management purposes.

The objectives of an environmental accounting project will determine which types of environmental costs should be investigated in the project. For example, if the main objective of an environmental accounting project were to improve environmental cost control and reduce environmental costs, the company would focus on potentially hidden environmental costs.

Sources of environmental cost information

The financial sources of environmental cost information are the general ledger, income statement and balance sheet. Non-financial sources of environmental information could be any form of recordkeeping or estimations on the flow of materials, energy and wastes through the organization

More accurate environmental cost information can assist both financial and environmental managers in understanding and managing environmental impacts and costs better. It is therefore important that an environmental accounting project is linked and integrated as far as possible with the existing environmental and financial management systems.

Integrating environmental information with other business processes

A number of management accounting techniques are available that can assist management in processing financial and non-financial environmental data into information for management use, and are therefore useful for an environmental accounting project. Some techniques are concerned with the analysis and interpretation of existing environmental data (such as life-cycle assessments, performance measurement, budgeting, internal auditing and costing), while others (such as demand forecasting, shareholder value analysis and investment appraisal) aim to make projections into the future. The extent to which an environmental accounting project utilises other business techniques and links up with other business systems is an indication of how well the environmental cost information generated by the project is being used by management and integrated with business decision-making.

Implementing an environmental accounting project

A number of elements are critical to the successful implementation of an environmental accounting project. Adequate resources (staff and time) should be available to the project team to conduct the study. The bigger the scale of the project and the broader the scope of environmental costs are that will be investigated, the more staff, time and financial resources will have to be committed to the project.

The environmental accounting project team should be a multidisciplinary team with members from different company departments and/or levels. The environmental accounting team should work towards better co-operation and integration between the different company departments, specifically between the environmental and financial management functions.

Gathering and analysing environmental data is one of the most important elements of the environmental accounting process. Important elements of an effective and organized data gathering process are:

- Determine which data is needed to assess the financial implications, now and in future, of environmental pressures

- Determine how much of this data is being collected already and from what sources
- Determine standardised definitions of environmental costs and data collection procedures that are suited to the objectives of the project
- Consider which non-financial data, from which sources, is needed and available for the project and whether this data can be reported and presented in more suitable ways
- Find ways of simplifying the reporting and presentation of data, such as matrices and checklists, that can communicate environmental cost and benefit information more effectively through the organization

Typical findings and recommendations of an environmental accounting project

Case studies show a wide variety of findings for environmental accounting projects, reflecting the differences in the businesses analysed and their specific needs and challenges. In general, the variety of findings could lead in three directions. The findings could indicate:

- Potential reductions in environmental costs, such as lower-cost waste management alternatives or more cost effective raw materials
- The need for changes in the organization's environmental, accounting or managerial practices in order to generate environmental cost information more effectively, such as a revision of the cost allocation system
- The benefits of the environmental accounting project should be extended to other departments, facilities or the whole organization

If an environmental accounting project has identified such opportunities for improvement, companies should consider what actions they could take to realize the potential benefits of environmental accounting.

Integrating environmental accounting information into business decisions and processes

Environmental accounting aims not only to improve our understanding of environmental costs, but also to use that knowledge to better manage environmental costs. Environmental accounting information should be applied to influence business decisions and processes towards the goals of environmental accounting, such as optimising environmental and economic performance.

Environmental accounting should inform decision-makers about the environmental costs that they generate. Environmental costs should be tracked and allocated to its sources. Regular summaries of environmental cost information should then be made available to management, so that managers can focus their attention on controlling and reducing environmental costs.

As environmental accounting provides insight into where environmental costs are generated within a company, managers should be encouraged to assume responsibility for those costs and to search for ways of reducing environmental costs. Managers can be held accountable for the environmental costs they generate through the use of levies or internal taxes for environmental costs such as waste management & energy consumption.

Providing environmental information and incentives and rewards for reducing environmental costs should lead to increased environmental performance, since a reduction in environmental costs implies a reduction in environmental impacts.

Business can expect environmental pressures and environmental costs to increase in future. Future changes in environmental regulation and other environmental pressures are uncertain and difficult to predict. The challenge for industry is to find ways of conducting their existing operations without incurring future environmental costs and liabilities. Companies must find ways of anticipating future environmental costs. One way of doing this is to supplement cost accounting with materials accounting – the assessment of the input, use and release of materials with significant environmental impacts. The potential future environmental costs or liabilities associated with these significant environmental impacts can then be estimated.

To ensure that environmental considerations are integrated into core business decisions, environmental accounting should be practised on an ongoing basis. Strategic planning efforts, such as capital budgeting, new product development or the development of a corporate environmental strategy offers excellent opportunities for using environmental accounting to incorporate environmental cost information into business decisions.

Application of the Environmental Accounting Review Model

The Environmental Accounting Review Model was applied to three case studies on the implementation of environmental accounting to review how effectively the companies have implemented and used environmental accounting. In evaluating the application of the Environmental Accounting Review Model, the following conclusions were reached: The Environmental Accounting Review Model did provide deeper insight into the environmental accounting projects to which it was applied. It measured the internal consistency of the projects, such as whether the projects made links between environmental accounting and other business initiatives and whether or which of the projects' goals have been achieved. The model could be effectively used as a tool to evaluate an environmental accounting project, providing insight into:

- The objectives of the environmental accounting project
- The corresponding types of costs that should be investigated
- The integration of environmental accounting with environmental and financial management systems

- The integration of environmental accounting with other business strategies, approaches and data processing techniques
- Important elements of the process of implementing environmental accounting
- Important elements of the process of managing environmental costs

However, the Environmental Accounting Review Model has a weakness with regard to synthesizing the insights it generates. The problem is that the model does not distinguish adequately between planned actions and the implementation thereof. This is not an inherent fault of the EA Review Model, but rather an indication that the model was applied to the case studies in an inadequate way. The way the model has been applied groups together insights about planned activities and implemented activities. It is therefore difficult to evaluate the progress of an environmental accounting project in reaching its objectives. In order to address this, the model should be applied to environmental accounting projects in a way that distinguishes between:

- Planned objectives
- The implementation of actions to achieve those objectives
- An evaluation of the extent to which the implemented actions have achieved the objectives.

This would strengthen the Environmental Accounting Review Model's capabilities as a critical evaluation tool that can identify weaknesses in an environmental accounting project and recommend where corrective action should be taken.

Overall, the Environmental Accounting Review Model has much potential as a tool for evaluating environmental accounting projects, but it should be developed further. If changes to the way the model is applied are made, it could become a very useful evaluative tool.

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1 Background to the thesis

1.1 Objectives of the study

The primary objective of this thesis is to develop a model that can be used to review and evaluate the effectiveness of an organization's implementation and utilisation of environmental accounting (EA). The EA Review Model should contain a generic framework for an EA project that describes a comprehensive approach to implementing an EA system within large organizations. As a secondary objective, the developed model could serve as a guide for organizations that wish to implement EA in South Africa.

1.2 Methodology of the study

In brief, the following methodology was used in the study:

- A literature review of the theory of EA and case studies in EA was undertaken
- An EA review model was developed that provides a generic framework for evaluating the effectiveness of an EA project or program
- The EA review model was applied to selected case studies in EA
- The effectiveness of the EA Review Model was evaluated

Firstly, a literature review of the available literature on the theory and practice of EA and on case studies in the implementation of EA was made. Based on the literature study, a brief introduction of the theory of EA is given in chapters 2 to 4. This includes:

- A description of what EA is, and of the different definitions of EA and applications thereof relevant to this
- A description of environmental costs as defined and utilised in EA
- A discussion on why EA is relevant to business and how EA can assist organizations in improving business decisions

Chapters 5 to 7 discuss the practice and implementation of EA. These chapters provide further insight into the theory and practice of EA and also present the elements of the EA review model, which cover:

- The process of identifying environmental costs
- Techniques for incorporating environmental cost information into business decisions
- General considerations that are relevant to the implementation and practice of EA

Chapter 8 presents the EA review model in the form of checklists.

In chapters 9 – 11 the EA Review Model is used to evaluate the EA projects of the three selected case studies.

In chapter 12 the usefulness of the EA Review Model in assessing EA projects is evaluated.

1.3 Limitations to the study

1.3.1 Field research was not possible

The EA review model should ideally have been tested best by using it to evaluate an ongoing EA project. Since no South African company has introduced EA extensively yet, this opportunity was not available. The next best option was to use case studies on the implementation and practice of EA, that could be found in the available literature, to test the EA Review Model.

1.3.2 Limitations of the available case studies

The literature review for this thesis identified three sources of case studies in EA:

- The US Environmental Protection Agency's EA website at www.epa.gov/opptintr/acctg/. This site contains a number of research articles on EA and related topics, a number of "snapshot" or overview EA case studies, and a few in-depth EA case studies, which focus on different aspects of EA such as its application to capital budgeting, full-cost accounting and externalities costing.
- The Green Bottom Line¹, edited by Martin Bennet and Peter James, contains a number of theoretical contributions on aspects of EA, and a number of case studies focusing on different aspects of EA, such as life-cycle costing, the cost of waste, environmental financial statements, shared savings and investment analysis.
- Green Ledgers², edited by Ditz, Ranganathan and Banks, contains an overview of EA, and a few case studies. These case studies are mostly very specific in focus, such as on a specific product or raw material.

Other references found in the available literature on the practical implementation of EA were too brief to be considered as full case studies.

Ideally, the case studies chosen for this thesis should have a broad focus, covering many aspects and applications of EA. This will ensure that most

¹ Bennet, M. & P. James (eds.) (1998a) *The green bottom line. Environmental accounting for management: current practice and future trends*. Greenleaf Publishing, Sheffield.

² Ditz, D., J. Ranganathan & R.D. Banks (eds.) (1995a) *Green Ledgers: Case Studies in Corporate Environmental Accounting*. World Resources Institute, Washington D.C.

elements of the proposed EA Review Model can be applied to the selected case studies. A few case studies on the implementation of EA in big corporations were suited to this purpose. A drawback of the broadly focused case studies is that they contain less detail on certain specific issues. For example, not many case studies contained much detail on the process of identifying environmental costs, such as the sources of environmental cost information or the categories of hidden environmental costs that were identified. For the purpose of applying the tables on environmental cost management of the EA Review Model, case studies with a narrower focus on environmental cost allocation and management were more suited. The following three case studies were selected, two with a broad focus and approach to implementing EA and one with a specific focus on environmental cost allocation and management:

- Green Accounting at AT&T³, from the US Environmental Protection Agency's EA website. This case study investigates the initiation of an EA project at AT&T, a major telecommunications company. The aim of AT&T's EA project was to develop methods and tools for EA, to identify environmental costs and related activities, and to implement this understanding throughout AT&T. This is one of the more broadly focused case studies on EA available.
- Full Cost Accounting for Decision-Making at Ontario Hydro⁴, from the US Environmental Protection Agency's EA website. The Green Bottom Line contains a summary of this case study. Ontario Hydro is a large electric utility. This case study describes Ontario Hydro's approach to EA, which the company calls "full-cost accounting". This is also one of the more broadly focused case studies available.
- Environmental Accounting at Sulzer Technology Corporation⁵, from The Green Bottom Line. This case study is not as detailed as the ones above, but it is one of the more detailed case studies on the process of environmental cost allocation available. Since thorough environmental cost allocation is a prerequisite for many other applications of EA, this case study was included too.

1.3.3 Not empirical conclusions but better understanding

The methodology of focussing on selected case studies is not suited to reaching empirical conclusions. The study cannot prove that EA can realize all the benefits that its proponents suggest. Therefore the findings of this thesis should rather be interpreted as providing better insight into the way that EA can address the practical challenges, threats and opportunities of increasing environmental

³ United States Environmental Protection Agency (US EPA) (1995a) *Environmental accounting case studies: Green accounting at AT&T*. (EPA 742-R-95-003; Washington DC: EPA) The report can be found on the EPA's EA website at www.epa.gov/opptintr/acctg/.

⁴ US EPA (1996) *Full cost accounting for decision-making at Ontario Hydro*. (EPA 742-R-95-004; Washington, DC: EPA) The report can be found on the EPA's EA website at www.epa.gov/opptintr/acctg/.

⁵ Schroeder, G. & M. Winter (1998) *Environmental Accounting at Sulzer Technology Corporation* in Bennet, M. & P. James (eds.) (1998a) (op cit.)

pressures on business. The findings can improve our understanding of questions such as: Are companies missing opportunities for cost effective environmental investments? Are companies' current financial and accounting practises biased against environmental investments? If so, what information, and what strategic actions, processes and techniques for gathering and processing information can enable us to evaluate environmental investments on the same level as other business investments?

Most of the case studies reviewed come to the conclusion that EA not only assisted them in improving their environmental management and performance, but also resulted in cost savings and financial benefit.⁶ Once again, the methodology of this thesis can not support or deny this claim. What the thesis may achieve however, is to provide some insight into how and why EA may have potential for both cost savings and improved environmental performance, and to present techniques and approaches through which this potential may be realized in practice.

1.3.4 Environmental Accounting is in a developing phase

The need for integrating environmental considerations into business decisions has only recently been recognised. The theory and practice of EA is therefore in its infancy and being developed continuously. Developing and implementing EA in an organization may take many years. This situation is reflected in the available case studies. Different companies are grappling with different aspects and challenges of EA. EA projects typically make some positive findings and recommendations, but also identify problems and challenges that require further study and work. Developing the theory and understanding of EA must, at least for the time being, remain an incomplete and iterative process. This implies that an EA review model cannot propose a complete and finalised theoretical model of what EA should be. Rather, the EA Review Model should attempt to describe the basic thinking and corresponding practices, techniques and processes that are currently in use in EA projects.

1.3.5 The study ignores ethical questions

Business leaders and managers, when considering the challenges of sustainability and environmental pressures on business, make decisions not only on the basis of factual data. The worldviews, values and perceptions of businesspeople also play a part in both how the above mentioned challenges are

⁶ Bennet, M. & P. James (1998c) *The green bottom line* in Bennet, M. & P. James (1998a) (op cit.) p. 35; and Ditz, D., J. Ranganathan & R.D. Banks (1995b) *Environmental accounting: An overview* in Ditz, D., J. Ranganathan & R.D. Banks (1995a) (op cit.) p. 6.

understood and what approaches to finding solutions they prefer.⁷ This study does not address related issues such as organizational culture (management style) and ethics, values, perceptions on environmental issues and resistance to change, although it is recognised that there are important spiritual and ethical considerations for improving the environmental performance of business. Instead this thesis focuses on practical considerations of the benefits of EA to business.

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⁷ Meima, R. & R. Welford (1997) *The Ecological Challenge in Organization Theory and Organizational Behavior*, in Welford, R. (ed.) (1997) *Corporate Environmental Management 2: Culture and Organizations*, Earthscan Publications, London, p. 3.

2 Introduction to environmental accounting

2.1 Contexts of environmental accounting

2.1.1 Broad context of environmental accounting

EA has many meanings and uses. EA is an umbrella term that can be used in a diversity of contexts, such as:

- National income accounting, which measures the consumption of a nation's natural resources. The focus here is on the nation.
- Financial accounting, which refers to the external reporting of corporate environmental performance. The focus here is on the firm.
- Management accounting, which refers to the identification, collection and analysing of environmental information for internal management purposes. The focus here is on the firm, division, facility, product line or system.⁸

The focus of this research paper is on the integration of environmental considerations into core business decisions. EA will therefore be approached from the context of management accounting, investigating the use of EA as a managerial tool used to inform business decisions.

2.1.2 Private and social costs

EA has two more major dimensions: it can refer only to costs that directly affect a company's financial performance (private or internal costs). These are the costs that appear on a company's income statement, such as the cost of resources. EA can also be applied to the costs of a company's activities for which they are not held legally responsible (social or external costs). These are the costs of a company's activities, for example pollution and resource use that are borne by individuals, society and the environment. The deteriorating quality of the natural or human environment as a result of resource consumption or pollution by industry can be described as a loss or cost to society as a whole. Yet business and industry are not expected to compensate or pay society for these costs, society bears the loss, hence the costs are called societal costs. There is increasing pressure on business from government and other stakeholders and pressure groups to assume responsibility for more societal costs. The boundary between private and social costs is continually shifting. New, more stringent environmental regulation and environmental permits and penalties are examples of business being forced by law to internalise some external environmental costs. Many companies may voluntarily internalise some of their external environmental

⁸ US EPA (1995b) *An introduction to environmental accounting as a business management tool: key concepts and terms* (EPA 742-R-95-001; Washington, DC: EPA) p. 4. The full report can read on the US EPA's EA website at www.epa.gov/opptintr/acctg/.

costs as a way of showing their environmental responsibility and commitment. (An example of a company internalising external environmental costs would be investments in pollution prevention technology, such as installing scrubbers in smokestacks. The company pays for the technology, and society is spared the costs of excessive pollutants being released into the atmosphere.) Companies will in future have to assume responsibility for an increasing share of their societal costs, since the environmental pressures and regulation of business are likely to increase in future. Many companies do not internalise external environmental costs, but take estimates of these costs into account in their decision-making and planning processes. They do not necessarily bear the costs of their external environmental impacts themselves, but do take information on the potential external environmental costs of their activities into account in their business procedures. Of the selected case studies, Sulzer Technology Corporation examined only internal environmental costs in their EA project. AT&T and Ontario Hydro do consider external environmental impacts in their decision-making processes, and their EA projects focussed on external environmental costs as well as internal costs.

2.1.3 Contexts of environmental accounting related to the firm level

On the level of the individual firm, different contexts for environmental accounting can be identified, depending on whether the focus is on financial or non-financial information, and on costs internal or external to the firm. Six domains of environmental accounting can be identified that are relevant at the level of the firm.⁹

	Organization	Supply chain	Society
Financial focus	Environment-related financial management	Life-cycle cost assessment	Environmental externalities costing
Non-financial focus	Energy and materials accounting	Life-cycle assessment	Environmental impact assessment

Figure 1: Contexts for environmental accounting on the firm level¹⁰

- *Environment related financial management* refers to the collection, analysis and use of monetary information to improve an organization's economic and environmental performance.

⁹ Bennet, M. & P. James (1998c) (op cit.) p. 31.

¹⁰ Bennet, M. & P. James (1998c) (op cit.) p. 31.

- *Energy and materials accounting* refers to the determination and analysis of all flows of energy, materials and wastes into, through and out of an organization.
- *Life-cycle assessment* refers to the process of identifying the environmental impacts of a product or service, and looking for opportunities for reducing environmental impacts, through its entire life-cycle: raw materials acquisition; manufacturing; consumer use/reuse/maintenance; and recycle/waste management.
- *Life-cycle cost assessment* refers to the process of assigning measures of monetary value to the environmental impacts associated with the life-cycle of a product or service.
- *Environmental impact assessment* refers to the process of identifying all the environmental impacts of the operations of an organization, site or project.
- *Environmental externalities costing* refers to the process of assigning measures of monetary value to all the environmental impacts of the operations of an organization, site or project.

2.1.4 Environmental accounting as a managerial tool for business decisions

Figure 1 illustrates different contexts in which EA can be applied. Within the context of the organization or company EA focuses on environment related financial management and energy and materials accounting. This relates to internal environmental costs and would be the initial focus when implementing EA. Internal environmental costs are easier to identify, quantify and interpret than external environmental costs, because internal environmental costs are related to on-site activities such as resource use, waste management and environmental management. The contexts of the supply chain and society involve environmental costs that are mostly external to companies. These costs are difficult to estimate, because they are related to the impacts of a company's activities on society and the environment, such as the impacts of wastes on the ecosystems into which they are released. Companies that are committed to reduce the environmental impacts of their activities and to strive towards more sustainable business practices will also consider the contexts of the supply chain and society in their EA projects.

Figure 1 illustrates the link that EA makes between environmental and financial management. In its financial focus, EA attempts to measure environmental costs and monetise environmental impacts. In its non-financial focus, EA attempts to gather and analyse environmental data from non-financial sources. Put in simple terms, EA attempts to integrate environmental and financial management in order to optimise environmental and economic performance.

Bennet & James defines EA as follows: "The generation, analysis and use of financial and non-financial environmental information in order to optimise corporate environmental and economic performance and achieve sustainable business."¹¹ As a managerial tool to support business decision-making, EA can make the following important contributions:

- The generation and analysis of useful environmental information, both in financial and data format
- Combining the potential of the accounting and environmental management disciplines, enabling an organization to:
- Optimise both environmental and economic performance
- Promote the search for more sustainable business practices

2.1.5 The challenge of environmental accounting to the accountancy and management disciplines

To many accountants EA may appear to be a contradiction in terms. Accountancy is concerned with financial information systems and the measurement of economic performance. Efforts to improve environmental performance are seen by many accountants as costly, offering little or no benefits to a company. The potential innovation that accountants can contribute to environmental management is constrained within the existing financial information system. Today's accounting systems were developed at a time when the present importance of environmentally related costs and impacts were not anticipated. There are many areas where conventional accounting practice, with its focus on short-term profit measurement, may be in conflict with proactive environmental initiatives. Examples include:

- Incorporating environmental considerations in investment appraisal criteria
- Incorporating environmental considerations in performance appraisal criteria
- Assessing environmental costs (in order to identify environmental costs, new information and accounting systems may have to be developed)¹²

Effective environmental management and the process of integrating environmental considerations into business decision-making processes require adequate environmental data and information. Since traditional information systems are not set up to provide environmental data for management purposes, accountants have a new role to play in the generation, analysis and use of environmental data. This may include initiatives such as:

- Devising new forms of financial and non-financial accounting systems, information systems and control systems to encourage due consideration of environmental information in management decisions

¹¹ Bennet, M. & P. James (1998c) (op cit.) p. 33.

¹² Gray, R., J. Bebbington & D. Walters (1993) *Accounting for the environment*. Paul Chapman Publishers, London, p.11.

- Identifying and separating environmental and related costs and revenues within traditional accounting systems
- Developing new forms of performance measurement, appraisal and reporting
- Identifying, analysing and seeking to rectify areas in which traditional financial criteria and environmental criteria are in conflict
- Seeking ways in which sustainability may be assessed and integrated into organizational practice¹³

EA has now been defined as an attempt to:

- Gather and analyse environmental information
- Combine the disciplines of accountancy and environmental management, so that the environmental information can be useful to inform the business decisions made by management

How will EA gather and produce environmental information that can be of use to general business management? Before this question is addressed, the issue of environmental costs must firstly be considered, because its concepts underlie much of the later sections. This is done in section 3. The question of how EA generates environmental information will be addressed in sections 4 and 5, and the question of integrating this information into business decisions in sections 6 and 7.

¹³ Gray, R., J. Bebbinhton & D. Walters (op cit.) p.13.

3 Defining environmental costs and benefits

3.1 What is an environmental cost?

Environmental costs are a subdivision of the normal costs of operating a business. Before the advent of environmental regulation and pressures, wastes released into the air, water or land were considered an externality and were irrelevant to the cost accounting systems of business. Now permits, taxes and fines regulate the release of pollution, requiring business to internalise these formerly external costs. These new costs are called environmental costs.¹⁴ Environmental costs are thus costs that are driven to a significant degree by environmental considerations.

3.2 Types of environmental costs and benefits

Bennet & James (1998) identifies three broad categories of environmental costs, and three of potential financial benefits from environmental initiatives. Broadly speaking, two categories of environmental costs can be identified: internal and external environmental costs (as discussed in section 2.1.2 on page 8), and also environmental opportunity costs. Environmental opportunity costs are the costs of missed benefits, such as the costs of the inefficient use of energy or resources. Three categories of potential financial benefits from environmental initiatives can be identified: revenues, savings and cost avoidance, and intangible benefits.¹⁵

3.2.1 Internal environmental costs

3.2.1.1 Direct environmental costs

These are costs primarily driven by environmental considerations, such as:

- The costs of monitoring to ensure that environmental impacts are detected and managed properly
- The costs of prevention, such as replacing hazardous substances with environmentally friendly ones
- The costs of environmental failure, such as paying penalties or remediating past environmental impacts

¹⁴ Shields, D., B. Beloff & M. Heller (1996) *Environmental cost accounting for chemical and oil companies: a benchmarking study*, p.6. The full report can be read on the US Environmental Protection Agency's EA website at www.epa.gov.opptintr/acctg/.

¹⁵ Bennet, M. & P. James (1998c) (op. cit.) pp. 55-60.

3.2.1.2 *Conventional environmental costs*

These are the incremental costs of environmental considerations influencing normal business decisions.¹⁶ Normal business decisions refer to decisions regarding issues such as capital equipment, materials, supplies and labour. These decisions are therefore only partially motivated by environmental considerations. These costs are also called business-integrated environmental costs.

It is not always easy to determine which portion of conventional costs should be considered environmental. A company might consider, for instance, what an investment in a new technology would hypothetically have cost if environmental considerations were not an issue at all. Against this baseline, the cost of the investment will give an indication of the monetary value of the environmental considerations. Often investments in new technology, such as waste reduction, not only have environmental benefits but business (financial) benefits too, due to an increase in resource efficiency. This complicates the decision on which portion of the investment should be considered environmental. While no standardised guidelines exist, companies should develop their own methods of determining incremental environmental costs.

3.2.1.3 *Environmental opportunity costs*

Environmental opportunity costs refer to the efficiency with which companies use their resources. The costs of buying and using materials and energy that end up as waste can be very high, and may even be more than the costs of direct and business-integrated environmental costs combined.¹⁷ While some degree of waste is inevitable in practice, waste minimisation and energy efficiency programs may have big environmental and financial benefits to many companies.

3.2.2 **Internal environmental benefits**

3.2.2.1 *Revenues*

A major source of environment-related revenues are those resulting from recycling schemes. In future, due to growing environmental pressures, "greener" products and services may also become a significant source of revenue.

¹⁶ Bennet, M. & P. James (1998c) (op cit.) p.57.

¹⁷ Bennet, M. & P. James (1998c) (op cit.) p.58.

3.2.2.2 Savings and cost avoidance

A major source of savings is cost savings resulting from environmental initiatives such as waste reduction or energy efficiency projects. Decreasing wastes reduces both material and waste disposal costs. Replacing environmentally hazardous substances with greener materials may also bring cost savings in the form of less environmental taxes.

3.2.2.3 Intangible benefits

Intangible benefits are those resulting from enhanced stakeholder perceptions of a company. This may be very difficult to measure and almost impossible to quantify, but within the context of increasing environmental pressures on business, its existence should not be ignored.

3.2.2.4 Reduction of environment-related financial risks

The reduction of financial-related risks is another important type of intangible benefit. Proactive environmental management aims to anticipate and reduce the potential risks that the environment can present to business. Examples of such risks include:

- Liability exposure due to major environmental incidents
- Adverse environmental impacts over a longer time period, such as the leakage of hazardous waste
- Damage to the reputation and to stakeholders' perception of an organization
- Risk of loss of business profitability due to unsustainable business practises – if the core activities of a business is environmentally unsustainable, the risk exists that in future, higher environmental taxes and other environmental pressures will make the business unprofitable

3.2.3 External environmental costs

External environmental costs (societal costs) refer to the costs of a company's activities that are borne by the environment and society, such as wastes and pollutants released into the environment. As mentioned in section 2.1.2 on page 8, there is increasing pressure on business from government and other stakeholders to assume responsibility for more societal costs. Even if companies decide not to internalise the external environmental costs of their activities, accurate information about the nature and extent of their social costs can be valuable for management purposes.

The definitions of environmental costs and benefits are summarized in tables 2 and 3 of the EA review model, section 8.2.3/4 on pages 45 - 46.

4 Why do environmental accounting

4.1 Motivation for increasing environmental performance

4.1.1 A changing context for business

Today's industry and commerce originated in a scientific and social paradigm that was built on a mechanistic and fragmented worldview.¹⁸ The scientific method and way of thinking of the modern industrial age were based on the mathematical description of nature (the search for natural laws) and the analytical method of reasoning. Analytical reasoning takes apart the object of its study, as if it is a machine of which the functioning of its constituent parts must be investigated and understood. Accordingly, parts of the world (such as economy or industry) were studied and understood in isolation. As a result, economic and industrial theory and understanding did not link the economy and the environment. Economic theory did not pay much attention to environmental issues such as pollution and resource scarcity. Also, at the start of the industrial revolution resources were so abundant that resource scarcity was not a problem for business.

Due to an increasing awareness of global environmental problems, a new worldview has emerged. This worldview is one of an interdependent world in which resources are scarce.¹⁹ This worldview combines analytical reason with synthetical reason, which attempts to understand the links and interdependence between different systems such as the economy and the environment. There is a growing awareness of our dependence on and interaction with the earth's ecosystems and that our current industry and commerce are severely disturbing and sometimes even destroying these ecosystems. Business leaders are beginning to realize that environmental and economic considerations need to be integrated. As the CEO of Kunert writes in their 1994 Environmental Report; "If our successful social market economy is also to integrate the preservation of the environment in its control circuit system, then ecology must become relevant for the market."²⁰

4.1.2 Increasing pressure on business for environmental action

¹⁸ Capra, F. (1982) *The turning point: Science, society and the rising culture*. Flamingo, London, p. 38.

¹⁹ Birkin, F. (1996) Environmental management accounting. *Management Accounting*, February 1996, p. 35.

²⁰ Quoted in Birkin, F. (op cit.) p. 37.

The need to address worsening global environmental problems means that there is pressure on business for environmental action and that this will increase in future. Examples of such pressures are:

- An increase in environmental taxes, e.g. taxes or fees on emissions
- Large financial liabilities resulting from lawsuits related to environmental incidents
- Damage to public image and reputation as a result of environmental pressure group campaigns
- Closure of markets as a result of environmental legislation, e.g. the phasing out of CFCs, and emerging markets for alternatives
- Increased costs of capital for companies with poor environmental performance due to higher risk premiums
- Evidence that some manufacturing companies have huge 'inefficiency costs' – with wastes making up 5 – 10% of their turnover²¹

4.1.3 The economic rationality of increasing environmental performance

Environmental pressure on and regulation of business is a recent development. Two decades ago the awareness of environmental impacts and accompanying environmental compliance costs were low for most businesses. At the same time, the skills, knowledge and technology of environmental accounting, information management, environmental management and impact reduction were relatively less developed than today. Thus, relatively speaking, it was cheaper to pollute and more expensive to invest in pollution prevention two decades ago than at present.

Today this situation has been reversed through environmental regulation and taxation on the 'polluter pays' principle. Environmental compliance costs are high and still increasing. At the same time, advanced accounting and information management skills, combined with advanced pollution prevention and mitigation technologies, have made pollution prevention relatively cheaper. Thus it is presently relatively expensive to pollute and relatively affordable to invest in pollution prevention. To put it in economic terms: The marginal costs²² of environmental damage have been steadily increasing during the last decade and can be expected to increase further, while the marginal costs of measuring and reducing environmental impacts have been decreasing. Since the costs of neglecting environmental concerns have risen substantially, companies now

²¹ Bennet, M. & P. James (1998d) The green bottom line: Management accounting for environmental improvement and business benefit. *Management Accounting*, November 1998, p.20.

²² Marginal costs are the incremental costs of producing more units of output, the marginal costs of environmental damage are therefore the incremental costs (e.g. permits, fees & fines) of releasing more pollution.

need to improve their environmental performance as a logical consequence of changed relative costs.²³

4.1.4 Economic opportunities created through environmental action

Many case studies on the implementation of EA in business have found that it has created substantial business benefits for the companies involved.²⁴ Many companies have realized that it can be more efficient and cost effective to avoid pollution than it is to clean it up. A survey made among management accountants in the US manufacturing sector on the application of EA techniques in the capital budgeting process concluded that: '...the case for [environmental] improvements may be made purely on the basis of the firm's self-interest. This is the central message...to firms seeking to understand and apply environmental accounting techniques...' ²⁵

4.1.5 The challenge of sustainability

According to the Brundtland Commission's definition, sustainability is a system of development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs'.²⁶ This definition acknowledges that aspects of our current economy and industry are not sustainable in an ecological sense. According to this definition the sustainable use of resources means limiting their use to a rate at which they can be regenerated through natural processes. Much of our current economical and industrial activities are based on the use of mineral deposits and fossil fuels. On a human time-scale these resources are non-renewable and industries based on their use, such as metals and mining, oil and derivative chemicals and fossil fuel power generation, can never be operated sustainably. Birkin & Woodward write that 'if an industrial activity is not sustainable, it will either stop or it will have to change in the long term, if not in short and medium terms'.²⁷ Thus, for the sake of its own survival, business should take the challenge of sustainability and the efficient use of energy and resources seriously.

²³ Schaltegger, S., K. Muller & H. Hindrichsen (1996) *Corporate environmental accounting*. John Wiley & Sons, Chichester, p. 9.

²⁴ Bennet, M. & P. James (1998c) (op cit.) p. 54.

²⁵ White, A.L. et al (1995) *Environmental cost accounting for capital budgeting: A benchmark survey of management accountants*. Tellus Institute, Boston, p. 49. The report can be read on the US EPA's EA website at www.epa.gov/opptintr/acctg/.

²⁶ The world commission on environment and development (1987) *Our common future*. UNWCED.

²⁷ Birkin, F. & D. Woodward (1997) *Management accounting for sustainable development: From ecological to economic efficiency*. *Management Accounting*, July/August 1997, p. 42.

4.2 The use of environmental accounting in improving business decisions

The previous section has outlined the pressures on business for improving their environmental performance and reducing environmental impacts. What contribution can EA make in this regard?

EA provides methods and techniques through which companies can gather, evaluate and act on environmental information. This includes both environmental cost information and data on environmental performance. Without the appropriate data, management will not be able to manage environmental issues adequately. The environmental data gathered through EA have many potential business uses.

4.2.1 Providing environmental cost information

The primary function of EA is to provide environmental cost information. Without adequate environmental information, EA cannot achieve the other objectives stated below. EA provides insight into the environmental costs of a company by identifying environmental costs that are hidden²⁸, and thus not revealed by the financial reporting system. EA can trace these costs to its sources, so that both the magnitude and also the causes of environmental costs are revealed. This information enables a company to search for and identify opportunities for cost reductions.²⁹ The information may also be useful for other improvements in environmental cost control, such as:

- Reducing the cost of inefficiency (the inefficient use of energy and materials)
- Guiding more accurate costing and pricing of products
- Guiding product mix and development decisions
- Comparing costs across facilities
- Evaluating alternative manufacturing inputs
- Improving resource allocation decisions
- Serve as basis for budgeting

4.2.2 More cost effective and improved environmental management

EA information can facilitate more cost effective environmental management and aid in the development of a company's environmental management system.³⁰ Insight into the extent and nature of environmental costs can aid a company in:

- Prioritising environmental initiatives
- Assessing opportunities for pollution prevention

²⁸ US EPA (1995b) (op cit.) p.1.

²⁹ Bennet, M & P. James (1998a) (op cit.) p. 34.

³⁰ US EPA (1995b) (op cit.) p.2.

- Evaluating waste management and energy efficiency options
- Improving environmental, health and safety performance

4.2.3 Decision making

EA can identify environmental costs that have been overlooked and trace these costs to their sources. The same methods can be used to estimate the potential costs of new investments or new processes and products.³¹ Business decisions are based partly on projected revenues and costs. If environmental costs are misallocated or hidden, environmentally costly products may be subsidised by less costly ones and this bias could lead to a bias in the projected revenues and costs.³² EA information can be very useful for normal business decision-making processes, because it removes the potential bias of misallocated and hidden environmental costs. Possible applications of EA in business decision-making include:

- Applying EA to cost allocation
- Applying EA to capital budgeting
- Applying EA to process & product design

4.2.4 Supporting sustainable business

EA supports the search for more sustainable ways of doing business by providing accurate environmental data and cost information. Accurate information on the environmental impacts of current or planned activities and the associated environmental costs or liabilities can provide indicators of how sustainable these activities are.³³ EA information can facilitate:

- Measuring ecological efficiency (ecological efficiency measures the extent to which business activity recognises and functions within the ecological constraints of the ecosystems that are influenced by its activities)
- Improving environmental performance (reducing environmental impacts)
- Developing greener products, processes & services
- Placing greater emphasis on environmental impacts in the decision making process
- Internalising external environmental costs

4.2.5 Management incentives

There are strong incentives for management to implement EA. EA can make a contribution toward general business management by:

- Integrating environmental considerations into business decisions and management

³¹ US EPA (1995b) (op cit.) p.27.

³² Ditz, D., J. Ranganathan & R.D. Banks (1995b) (op cit.) p. 22.

³³ Bennet, M & P. James (1998a) (op cit.) p. 37.

- Improving the management performance evaluation process³⁴
- Safeguarding investment decisions for the future³⁵
- Gaining competitive advantage

4.2.6 Financial incentives

Implementing EA may hold significant financial benefits for companies.³⁶ EA can contribute toward the financial performance of business by:

- Improving the management of environmental costs
- Identifying short term cost savings
- Assessing and reducing environmental risks and liabilities
- Improving market share through the development of greener products and services

The potential benefits of EA and the objectives that a company may have in implementing EA, are summarized in table 1 of the EA review model, section 8.2.1 on page 43.

4.3 Applying environmental accounting to cost allocation

In order to illustrate how EA can achieve the benefits mentioned above, a brief description follows on how EA can be applied to improve environmental cost allocation.

4.3.1 The problem with traditional accounting systems

4.3.1.1 A narrow focus on short-term profit measurement

The way companies traditionally accounted for costs were shaped by external financial reporting requirements. These requirements were to present a company's profits or losses and assets and liabilities to its shareholders. This happened at the expense of developing accounting systems that can deliver managerial information for internal use.³⁷ Financial reporting often focused on short-term profit measurement, ignoring questions regarding the long-term economic viability of a company's activities, such as the potential financial liabilities of the environmental impacts of a company's activities. Today, environmental factors are both significant cost-drivers and significant financial liabilities. (Recent studies have shown that environmental costs can be as high

³⁴ Bennet, M & P. James (1998d) (op cit.) p. 22.

³⁵ Bennet, M & P. James (1998c) (op cit.) p. 35.

³⁶ Bennet, M & P. James (1998c) (op cit.) p. 35; US EPA (1995b) (op cit.) p.27.

³⁷ Ditz, D., J. Ranganathan & R.D. Banks (1995b) (op cit.) p. 9.

as 20% of operational costs.³⁸ While many firms have identified the more obvious and measurable environmental costs, few have attempted to identify those that are less tangible and difficult to quantify. Environmental costs may therefore be even higher than these estimates.³⁹)

Consider the hypothetical example of a company that produces toxic wastes in its manufacturing processes. Apart from the costs of the storage, handling and disposal of the toxic wastes, the company may also be held responsible for the maintenance of the waste disposal site. This may incur costs such as the costs of remediating spills and leakages, and paying damages to third parties injured as a result of spills and leakages. Financial damages as a result of criminal or civil lawsuits related to environmental accidents or long-term effects of environmental pollution have become a major problem for industry. For example, Exxon's bill (not finalised yet) for fines, compensation and cleanup costs for the Exxon Valdez oil spill in Alaska is already about \$10 billion.⁴⁰ The example illustrates that a focus on short-term profit measurement may ignore potential future environmental costs and financial liabilities incurred as a result of a company's current activities. Traditional accounting systems tend to produce profit/loss accounts that ignore the potential future environmental costs of current activities and asset/liabilities balance sheets that ignore the potential environmental liabilities of current activities. Consequently, traditional accounting systems do not provide adequate information to management on the environmental costs and potential environmental liabilities of a company's current activities.

4.3.1.2 Pooling environmental costs into overhead accounts

Not all materials, processes and products are equally responsible for generating environmental costs. Some products and processes may be more hazardous-materials intensive, generate more emissions, require more intense monitoring and licensing costs, generate greater quantities of waste, and may have higher future regulatory compliance and contingent liability costs than others. Most firms place environmental costs into overhead accounts.⁴¹ (An overhead account contains costs that are not attributed to a single process, system or product.) While some of these costs are subsequently allocated (assigned to a source), this often happens on a basis (e.g. labour hours) that bears little resemblance to the activities that created the costs. Managers thus receive incomplete

³⁸ Ditz, D., J. Ranganathan & R.D. Banks (1995b) (op cit.) p. 15. Findings on environmental costs from the Green Ledgers case studies include: Amoco Oil's Yorktown refinery found environmental costs made up 22% of operating costs; at Ciba-Geigy the environmental component of the chemical investigated was 19% of operating costs; and at Du Pont the environmental component of the pesticide investigated was 19% of manufacturing costs.

³⁹ White, A.L. et al (op cit.) p. 48.

⁴⁰ Bennet, M. & P. James (1998d) The green bottom line: Management accounting for environmental improvement and business benefit. *Management Accounting*, November 1998, p.20.

⁴¹ White, A.L. et al (op cit.) p. 12.

information regarding the true costs and profitability of different materials, products and processes and are blind to the fact that different products and/or processes contribute to environmental costs unequally.⁴²

For example when choosing a process chemical, not only the cost of purchasing the material should be considered, but also associated costs such as:

- The cost of storing and handling the chemical (higher if it is a hazardous substance)
- Treating contaminated rinse water or managing the resulting sludge
- Securing the necessary permits
- Monitoring compliance and reporting on that
- Worker training, etc⁴³

A product manager may select the most affordable chemical, without realising that the overall environmental costs to the company incurred by the use of this chemical is higher than other alternatives.

In summary, traditional accounting have the following drawbacks from the perspective of environmental management:

- It does not reflect the reality that environmental costs and environmental liabilities have become significantly high for many industries
- It does not provide information to management on the sources and magnitude of environmental costs and liabilities

The result is that traditional accounting systems do not adequately measure and reflect environmental costs, liabilities and values. The costs of poor environmental performance are therefore not calculated and considered in normal business decisions.⁴⁴

4.3.2 The use of cost allocation

The use of cost allocation in environmental accounting is to identify environmental costs in overhead accounts and then allocate these costs to the products, processes, systems or facilities that drives those costs. Figure 2 illustrates the process of how costs are pooled into overhead accounts and allocated back to products and how, from an environmental perspective, environmental costs may be misallocated.

⁴² Ditz, D., J. Ranganathan & R.D. Banks (1995b) (op cit.) p. 9.

⁴³ Ditz, D., J. Ranganathan & R.D. Banks (1995b) (op cit.) p. 10.

⁴⁴ DeSimone, L. & F. Popoff (1997) *Eco-efficiency: the business path to sustainable development*. Cambridge, MA: MIT Press, p93-94.

Product 1	Product 2	Product 1	Product 2
Materials	Materials	Materials	Materials
Labour	Labour	Labour	Labour
Overhead:			Toxic waste product 2
Toxic waste product 2		Overhead:	
Supervisor's salaries		Supervisor's salaries	
Worker training		Worker training	
Monitoring		Monitoring	
Cost product 1	Cost product 2	Cost product 1	Cost product 2

Figure 2: The misallocation of environmental costs

Products 1 and 2 are part of the same product line. The production of product 2 produces toxic wastes. The main inputs or cost drivers for both products are materials and labour. The labour and material costs of each product are directly assigned to the product itself. As part of the same production line, both products share costs related to the functioning of that production line, such as the costs of worker training, supervisor's salaries and monitoring. These costs are pooled into an overhead account for the production line. These costs could later be allocated back to products 1 and 2 in relation to the relative costs of materials and labour for these products. If the costs of handling, storing and disposing of the toxic wastes of product 2 are also pooled in the overhead for the production line, a misallocation will occur. The costs of the toxic waste would be proportionally (with regard to materials and labour costs) allocated back to products 1 and 2. Effectively, product 1 will subsidise a part of the toxic waste costs of product 2. The direct allocation of the toxic waste costs of product 2 is to take it out of the overhead account and assign it directly to product 2.

Figure 2 illustrates that pooling environmental costs into overhead accounts may be ineffective when:

- The environmental costs pooled into overhead accounts are significantly high
- Different materials, products or processes contribute to environmental costs unequally

If costs are allocated to overhead accounts incorrectly, products may bear an overhead allocation greater or lesser than warranted. This results in poor product costing and pricing, and since management is unaware of the true costs of certain products or processes, there will be little incentive to find ways of reducing environmental costs. Environmental costs that have not been identified and allocated adequately cannot be managed properly.

4.3.3 The process of cost allocation

The goal of cost allocation should not be to identify and allocate all environmental costs or to gather as much environmental cost data as possible. Big companies may take years to identify and allocate all their environmental costs, and the EA project may reach a point where diminishing returns on the resources committed to the project set in. Therefore the goal of an EA project should rather be to gather data that is useful for the purpose of reducing environmental costs and increasing environmental performance. The focus of an EA project should be on the most significant environmental impacts and costs. The first step in environmental cost allocation should therefore be to determine the scale and scope of the environmental costs to be investigated.

4.3.3.1 Environmental cost inventories

Once the scale and scope of environmental costs have been determined, the potentially hidden environmental costs should be identified. An environmental cost inventory can be very useful in identifying hidden costs. Such an inventory lists the typical categories of environmental costs that a company incurs through its activities. The inventory could list specific categories of activities, or specific categories of materials or wastes, or specific categories of processes, or a combination of these, with which significant environmental impacts and costs are associated.

In order to draw up an environmental cost inventory, a company must know which of its activities, materials, wastes and processes have significant environmental impacts. Section 5.3.1 on page 28 discusses an approach that can be employed to identify a company's significant environmental impacts. An example is given below of a cost inventory for activities and resources.

Activities	Resources
Training	Materials
Permits	Recycling materials
Monitoring	Waste
Reengineering	Consulting fees
Recycling	Environmental staff
Waste treatment	Products
Waste storage	Etc. ↓
Waste disposal	
Etc. ↓	

Figure 3: An activities and resources cost inventory

The cost inventory does not reveal the hidden environmental costs, but focuses attention on the activities, resources or processes with which the most significant environmental costs are associated. The EA team must then go to the financial reporting system and identify all the costs that are associated with these activities, resources or processes. If some of these environmental costs are pooled into overhead accounts, they should be traced to the responsible activities, resources or processes and allocated accordingly.

A proper environmental cost inventory and cost allocation system can assist managers in assessing the environmental performance and profitability of different products, processes and divisions within an organization. This can motivate managers and employees of the affected processes or products to search for ways of reducing environmental costs and enhancing profitability.⁴⁵ Proper environmental cost allocation can also enhance the effectiveness of other essential business activities, such as performance monitoring and incentives and reward systems. Cost allocation therefore not only reports the environmental costs of an organization more accurately, but can also be a "behaviour influencing tool", changing the attitudes and behaviour of managers toward environmentally sensitive and resource and energy efficient products and processes.⁴⁶

In summary, the steps in environmental cost allocation are as follows:

- Identify the scale and scope of environmental costs to be investigated
- Identify the environmental costs (use a register of environmental impacts or environmental cost inventory)
- Allocate these costs to the responsible process, product or system⁴⁷

Environmental cost allocation forms the backbone of an EA project. An EA project uses the same basic approach of defining boundaries, identifying the relevant environmental costs, and analysing these costs to understand how they originate. The process of identifying environmental costs through an EA project will be discussed next.

⁴⁵ UA EPA (1995b) (op cit.) p. 20.

⁴⁶ Burritt, R.L. (1998) Cost Allocation: An Active Tool for Environmental Management Accounting? in Bennet, M. & P. James (eds.) (1998a) (op cit.) p. 155.

⁴⁷ US EPA (1995b) (op cit.) p. 21.

5 The process of identifying environmental costs

Having defined environmental costs and benefits, the process of identifying environmental costs can now be explored. Firstly, the scale and scope of the environmental costs that will be considered must be determined. Secondly, the potential sources of environmental cost information must be identified. Thirdly, methods of identifying and tracking the environmental costs must be developed and applied.

5.1 Determining the scale and scope of the EA project

EA can be implemented at different scales of use and different scopes of coverage.⁴⁸ Depending on the objectives of the EA project, EA can be applied at different scales, such as:

- The entire company
- A company division or department
- A single site
- A product or product line
- A system, such as hazardous waste disposal

An EA project can also have varying degrees of scope, which refer to the types of costs that the investigation includes. Broadly speaking, scope refers to whether only internal environmental costs are considered, or whether external costs are considered as well. Supplementary to the definitions in section 3.2, internal environmental costs can be grouped into different categories according to the degree of difficulty of identifying and measuring the costs, which gives an indication of the depth of the EA project. The easiest costs to identify are conventional or business-integrated costs, while relationship/image costs are the most difficult:

- Conventional costs
- Hidden costs
- Contingent costs
- Relationship/image costs

The possible scale and scope of an EA project are summarized in table 2 of the EA review model, section 8.2.3 on page 45.

5.2 Identifying sources of environmental cost information

As described in figure 1, EA has both a financial and a non-financial focus. The financial sources of environmental cost information are the general ledger, income statement and balance sheet. Non-financial sources of environmental

⁴⁸ US EPA (1995b) (op cit.) p. 13.

information could be any form of recordkeeping or estimations on the flow of materials, energy and wastes through the organization. A good source for such information would be an energy and materials balance sheet. Where this is not available, and organization's environmental management system may provide information, for example through the register of environmental effects, or the environmental objectives and targets. Other potential sources of environmental information are environmental monitoring records, environmental training records, or maintenance records for environmental equipment⁴⁹. Potential sources of environmental information are summarized in table 4 of the EA Review Model, section 8.2.5 on page 48.

5.3 Identifying environmental costs

5.3.1 Conventional environmental costs

Conventional environmental costs are a good starting place for identifying environmental costs, since these costs are closely associated with the normal operations of a facility, and are therefore easy to trace and identify. Conventional costs typically include costs such as capital equipment, supplies, raw materials and wastes. In order to identify conventional environmental costs, a company must be aware of the flows of materials, energy and wastes through its facilities. It must be aware of the different products or processes that have significant environmental aspects. This may include:

- Processes or products that consume high quantities of resources or energy
- Processes or products that produce high quantities of wastes
- Processes or products that produce wastes of an environmentally hazardous nature
- Processes or products that consume resources or energy in inefficient amounts

If a company already has an environmental management system in place, it should have a register of its environmental aspects and associated impacts. (Industry standards for environmental management such as ISO 14001 require a register of environmental aspects and impacts as part of an environmental management system.) If not, it should start with identifying the most significant environmental aspects of its activities. This can be done by investigating the processes or products listed above.

⁴⁹ Ranganathan, J. & D. Ditz (1996) Environmental accounting: a tool for better management. *Management Accounting*, February 1996, p. 40.

5.3.1.1 Environmental balance sheets

An effective way of identifying and presenting the significant environmental aspects of an organization's activities is to draw up an environmental balance sheet. An environmental balance sheet traces the flows of energy and materials, through the different processes, to the products and wastes that leave the facility. An effective environmental balance sheet provides an overview of the material and energy flows through a facility, so that the inputs (raw materials and energy) equal the outputs (products and wastes). The balance sheets can then provide insight into which processes and products consume the highest proportion of resources, and produce the highest quantity or environmentally most hazardous wastes. Figure 4 provides an example of an environmental balance sheet.

	Products		Wastes		Etc. →
	Petrol	Lubricants	Airborne emissions	Solid waste	
Energy					
Electricity					
Material					
Coal	X	X	X	X	
Natural gas	X		X		
Water			X		
Chemical 1	X	X	X	X	
Chemical 2		X		X	
Etc. ↓					

Figure 4: Example of an environmental balance sheet for petroleum refinery

In this environmental balance sheet, the inputs into the company, such as materials and energy, are listed vertically. The outputs, such as finished products or wastes, are listed horizontally. The cells marked with x indicate that an input (or part thereof) has been processed into a specific output, such as a product or waste material. The cells marked with x would indicate both the quantity of and the type of product or waste produced.

Complementary to information from environmental balance sheets, organizations can also obtain information on conventional environmental costs from their general ledger and financial statements. Typically, conventional costs are addressed in cost accounting and capital budgeting, but are not always considered as environmental costs. These costs are therefore easy to identify, the challenge though is to determine which proportion of these costs should be considered environmental, as discussed in section 3.2.1.2 on page 14. Typical

conventional environmental costs are summarized in table 5 of the EA Review Model, section 8.2.6 on page 49.

5.3.2 Potentially hidden environmental costs

Direct environmental costs, such as the costs of environmental monitoring, may not be allocated to environmental accounts in the general ledger. As discussed in section 4.3.1, these expenses may be pooled into overhead or administrative accounts, and may thus be hidden as environmental costs. Tables 6 to 11 of the EA Review Model, sections 8.2.6-11 on pages 45 – 48, contain detailed checklists with examples of typical potentially hidden environmental costs, which can be grouped into the following categories⁵⁰:

- Upfront and back-end costs, i.e. costs associated with the establishment and closure of facilities
- Regulatory costs, i.e. costs of compliance with environmental laws and regulations
- Voluntary costs, i.e. costs associated with environmental initiatives that goes beyond the standards required by regulation
- Contingent costs, i.e. costs that might be incurred in the future through, for example, changes in environmental regulations, possible environmental incidents, or remediation of environmental damage.
- Image and relationship costs, i.e. costs incurred to improve relationships with stakeholders, such as annual environmental reports or community relations activities. This category may also include the costs of failure, i.e. economic loss due to a perceived poor environmental performance of an organization by stakeholders.

Depending on the scope of an EA project, the checklists contained in these categories can be used to assist in identifying and tracing potentially hidden environmental costs.

⁵⁰ US EPA (1995b) (op cit.) p. 9.

5.3.2.1 Contingent and image and relationship costs

Contingent costs or environmental liabilities are difficult to identify and quantify due to their uncertain and probabilistic nature. The same applies to image and relationships costs. One way of assessing environmental risks and liabilities is to consider how possible future changes will affect the organization's current activities with significant environmental impact. For each significant impact, analyse the potential future cost and benefit implications of possible changes in:

- Government policies (e.g. on greenhouse gas emissions)
- Environmental legislation and regulation (e.g. more extensive pollution taxes)
- Supply conditions (e.g. higher resource costs)
- Demand conditions (e.g. customer demand for greener products)
- Social attitudes (e.g. increased public opposition to environmentally hazardous processes or substances)
- Competitor strategies (e.g. developing greener products and processes)⁵¹

The results of this analysis will illustrate the risks of ignoring or underestimating the future financial implications of increased environmental pressures. It is therefore also a useful exercise to do for organizations that are unsure whether an EA project will be of use to them, as it gives possible future environmental scenarios against which the potential contribution of EA can be evaluated. The process of assessing the environmental risks and liabilities of a company is presented in table

⁵¹ Bennet, M. & P. James (1998b) *Implementing Environment-Related Management Accounting* in Bennet, M. & P. James (eds.) (1998a) *The Green Bottom Line: Environmental Accounting for Management*. Greenleaf Publishing, Sheffield, p. 392.

6 Incorporating environmental considerations into business decisions

The previous section described the process of gathering environmental data from financial and non-financial sources. The basic “format” of this data is insight into the extent and sources of environmental costs. How can this information now be made useful to the normal business operations of a company? A number of techniques are available that can assist management in analysing this environmental data and in applying and integrating environmental information into normal business procedures.

6.1 Existing systems that can support EA

Traditional or existing information systems can be an important source of information for EA. These include:

- Environmental management systems
- Environmental reporting systems
- Financial accounting and reporting systems

EA can also provide important information to the business functions of environmental and financial management. More accurate environmental cost information can assist both financial and environmental managers in understanding and managing environmental impacts and costs better. It is therefore important that an EA project is linked and integrated as far as possible with the existing environmental and financial management systems.

When implementing EA, companies should first investigate what environmental information is available from their existing information systems. The focus of an environmental management system is on the operational management of environmental impacts, and not on gathering environmental data for accounting and managerial purposes. For these purposes, new techniques for energy and materials accounting have been developed. Examples of such techniques are:

- Environmental balance sheets (which track materials and energy flows through a facility)
- Environmental financial statements (which itemise and report environmental costs and savings)

Existing business systems that can support EA are summarized in table 11 of the EA Review Model, section 8.2.12 on page 52.

6.2 Supporting techniques for processing environmental data into information for management purposes

A number of management accounting techniques are available that can assist management in processing financial and non-financial environmental data into

information for management use, and are therefore useful for an EA project. Some techniques are concerned with the analysis and interpretation of existing environmental data (such as performance measurement, budgeting, internal auditing and costing), while others (such as demand forecasting, shareholder value analysis and investment appraisal) aim to make projections into the future.⁵²

6.2.1 Life-cycle assessments

Life-cycle assessments identifies the environmental impacts of a product or activity through its entire life cycle, including the supply chain, customers and the disposal of products and identifies opportunities for achieving environmental improvements. Related to this, product takeback programs have been developed to address the issue of the disposal of products (the manufacturer assumes responsibility for the disposal or recycling of discarded products). Design for the environment programs considers life-cycle environmental impacts in the planning and design phases of new products or projects.

6.2.2 Performance measurement

Non-financial performance measurement, such as quality control, has become increasingly important in business and methods have been developed to facilitate performance measurement. EA is dependent on the non-financial data that is generated by environmental and operational management. Environmental performance measurement, through the use of methods such as material balance sheets, can therefore be of much value to an EA project.

6.2.3 Operational budgeting and control

Once environmental costs have been identified and allocated to specific products, materials or activities, budgeting can be used as an incentive to promote costs savings and avoidance. For example, the budgets of activities and processes that have high environmental impacts may be limited in order to motivate managers to find environmentally more costs effective alternatives.

6.2.4 Internal auditing

The internal financial auditing function can assist EA by validating the accuracy of information generated by the EA project, and by assisting in developing

⁵² Bennet, M. & P. James (1998c) (op cit.) p. 45.

valuation techniques of data that are difficult to quantify, such as environmental liabilities or estimations of image and relationship costs.

6.2.5 Costing

A variety of costing techniques can complement an EA project:

- *Activity based costing* (cost allocation without an environmental focus) can assist in the allocation of environmental costs and the redesign of cost systems to provide more meaningful cost and environmental information
- The *cost-of-quality* approach, through its emphasis on prevention rather than monitoring or failure, can assist in identifying the costs of resource and energy inefficiency. For example, waste management costs are to a degree costs of inefficiency, since it might in some cases be more cost effective to design new processes that waste less than to continue producing inefficiently
- More accurate *product costing* (not having some products with high environmental costs cross-subsidise others with lower costs) can motivate managers to look for cost reduction opportunities
- *Life cycle costing* identifies environmental costs in all stages of a product's life cycle, from buying, manufacture through to using and disposal. Since environmental costs are increasing in all these areas, it is wise to consider these costs too
- *Cost projection* attempts to anticipate future costs, and since environmental pressures and regulation are likely to increase in future, environmental cost projection will be of important strategic value
- *Strategic costing* is a tool used to encourage or discourage certain options through influencing relative prices, such as placing internal taxes or levies on energy consumption
- Adequate *cost analysis* as described above may identify opportunities where small extra spending by a company may have huge increase in value for customers, which can then be reflected in an increased selling price. An example of this is packaging redesign that decreases disposal costs for customers.

6.2.6 Demand forecasting

Environmental factors are already influencing markets, such as through the ban on the use of CFC's. This creates opportunities for eco-efficient products and processes to gain an advantage over others. Demand forecasting attempts to anticipate future revenue streams from green products.

6.2.7 Investment appraisal

Through the consideration of environmental costs and benefits, appraisal techniques can be modified to incorporate the assessment of environmental impacts in the capital budgeting process.

6.2.8 Shareholder value analysis

Shareholder value can be defined as the present value of a company's future cash flows, discounted at a rate that reflects the risks involved. As environmental liabilities and risks can influence future expenses, revenues, and the costs of capital, it is an important element to consider in the shareholder value analysis. Recent studies have provided evidence that a link already exists between environment and shareholder value.⁵³

6.2.9 Environmental value analysis

Environmental value analysis measures the relationship between an organization's economic value added and its environmental impacts. This indicates how efficiently an organization is using environmental resources, and how sustainable its activities are. Few organizations have used this technique to date, but it may become an important tool for measuring environmental performance and promoting sustainable business in future.

These examples are not exhaustive, but do indicate that there are opportunities to link an EA project to other business initiatives in mutually enhancing partnerships. The supporting techniques for processing data into information for management purposes are summarized in table 12, section 8.2.13 on page 53.

⁵³ Bennet, M. & P. James (1998c) (op cit.) p. 51.

7 Overview evaluation of an EA project

This section describes a number of elements that are important to the EA project as a whole. Firstly, important elements of the process of implementing an EA project are discussed. Secondly, some of the probable findings of such a project are discussed. Thirdly, general considerations on Integrating EA information into business decisions and processes and on the goals of effective environmental cost management within an EA project are discussed.

7.1 Implementation of an EA project

A number of elements are critical to the success of an EA project. Management must ensure that enough resources are available to the project, the EA project team must be carefully selected, and the process of gathering data must be well organised.⁵⁴

7.1.1 Committing adequate resources to the project

Adequate resources (staff and time) should be available to the project team to conduct the study. This will indicate clear top management support for the project to the whole company, which will ensure company wide support and co-operation. It also ensures that the project's recommendations receive serious consideration. The scale and scope of the EA project (as discussed in section 5.1) will determine what resources are needed. The bigger the scale of the project and the broader the scope of environmental costs are that will be investigated, the more staff, time and financial resources will have to be committed to the project.

7.1.2 Selection of the EA team

An EA project is a multi-disciplinary exercise. It is important that the EA project team should be a multidisciplinary team with members from different company departments and/or levels. This team, depending on the scale and scope of the project, should ideally include representatives from environmental management, engineering, accountancy and financial management. The EA team should work towards better co-operation and integration between the different company departments, specifically between the environmental and financial management functions.

⁵⁴ Ditz, D., J. Ranganathan & R.D. Banks (1995b) (op cit.) pp. 30-37.

7.1.3 Gathering data

Gathering and analysing environmental data is one of the most important elements of the EA process. The following actions will simplify and increase the efficiency of the data gathering process:⁵⁵

- Determine which data is needed to thoroughly assess the financial implications, now and in future, of environmental pressures
- Determine how much of this data is being collected already and from what sources, and whether it could be processed and presented in formats more suitable to the project
- Determine standardised definitions of environmental costs and data collection procedures that are suited to the objectives of the project
- Consider whether modifications to the general ledger codes will provide better environmental cost and benefit data, or whether separate environmental cost data systems should be developed
- Consider which non-financial data, from which sources, is needed and available for the project and whether this data can be reported and presented in more suitable ways
- Find ways of simplifying the reporting and presentation of data, such as matrices and checklists, that can communicate environmental cost and benefit information more effectively through the organization

Table 14 in section 8.2.15 on page 55 summarizes the guidelines on the implementation of an EA project.

7.2 Findings and recommendations of an environmental accounting project

Case studies show a wide variety of findings for EA projects, reflecting the differences in the businesses analysed and their specific needs and challenges. In general, the variety of findings could lead in three directions. The findings could indicate:

- Potential reductions in environmental costs, such as lower-cost waste management alternatives or more cost effective raw materials
- The need for changes in the organization's environmental, accounting or managerial practices in order to generate environmental cost information more effectively, such as a revision of the cost allocation system
- The benefits of the EA project should be extended to other departments, facilities or the whole organization⁵⁶

⁵⁵ Bennet, M. & P. James (1998b) (op cit.) pp. 393-395.

⁵⁶ Ditz, D., J. Ranganathan & R.D. Banks (1995b) (op cit.) pp. 36-37.

If an EA project has identified such opportunities for improvement, companies should consider what actions they could take to realize the potential benefits of EA. The next section discusses some examples of how EA information can be integrated into business decisions and processes.

7.3 Integrating EA information into business decisions and processes

EA aims not only to improve our understanding of environmental costs, but also to use that knowledge to better manage environmental costs. The following examples⁵⁷ illustrate how EA information can be applied to influence business decisions and processes towards the goals of EA, such as integrating environmental considerations into business decision-making, optimising environmental and economic performance and promoting more sustainable business practices.

7.3.1 Informing decision-makers

EA should inform decision-makers about the environmental costs that they generate. As far as possible, environmental costs should be tracked and allocated to processes & products. By separating environmental cost data from general cost data, the potential strategic significance of environmental management and environmental cost control will become more apparent. Regular summaries of environmental cost information should then be made available to management, so that managers can focus their attention on controlling and reducing environmental costs.

An EA case study at S.C. Johnson Wax, a producer of chemical products for the home and workplace, illustrates the benefits of separating environmental cost data from general cost data. A number of the company's products can be provided in water-based or solvent-based formulations. Solvent-based formulations contribute to environmental issues at the plant and thus have greater environmental costs than water-based products. The company's cost accounting system did not reveal this bias because it focused on product lines, grouping water-based and solvent-based products together. The EA case study analysed the company's products according to formulation, revealing that water-based products have proportionally less environmental impacts and costs than solvent based ones. The EA case study provided the company's management with better insight into where and how environmental costs are generated in the company. The company can now focus on promoting and marketing water-based

⁵⁷ Ditz, D., J. Ranganathan & R.D. Banks (1995b) (op cit.) pp. 38-44.

products for their customers, knowing that these products are environmentally and economically less costly.⁵⁸

7.3.2 Making managers accountable

As EA provides insight into where environmental costs are generated within a company, managers should be encouraged to assume responsibility for those costs and to search for ways of reducing environmental costs. An example of how managers can be held accountable for the environmental costs they generate is the use of full costs or surcharges for waste management & energy consumption. Many firms levy internal charges for the use of on-site environmental facilities such as wastewater treatment, ensuring that the managers and departments that use these facilities are aware of the costs involved. Some companies levy internal charges that are higher than the cost of operating and maintaining the environmental facilities, called surcharges. These levies reflect the cost of off-site commercial waste treatment rates and provide an added incentive for the company's managers to reduce their environmental costs.

7.3.3 Improving environmental performance

Providing environmental information and incentives and rewards for reducing environmental costs should lead to increased environmental performance, since a reduction in environmental costs implies a reduction in environmental impacts. To focus exclusively on the reduction of environmental costs may also have a negative influence on environmental performance. Certain environmental expenses, such as environmentally related maintenance or research and development, are important activities for long-term environmental management. When companies develop incentive schemes, both the goals of reducing environmental costs and of improving environmental management in the long term should be considered.

7.3.4 Anticipating future environmental costs

As discussed in section 3.1, companies can expect environmental pressures and environmental costs to increase in future. Future changes in environmental regulation and other environmental pressures are uncertain and difficult to predict. The challenge for industry is to find ways of conducting their existing operations without incurring future environmental costs and liabilities. Companies must find ways of anticipating future environmental costs. One way of doing this is to supplement cost accounting with materials accounting – the assessment of

⁵⁸ Ditz, D., J. Ranganathan & R.D. Banks (1995b.) (op cit.) p. 38.

the input, use and release of materials with significant environmental impacts. The potential future environmental costs or liabilities associated with these significant environmental impacts can then be estimated. Dow Chemical, for example, uses a solvent in the manufacturing of one of its coating materials that is released as a volatile organic air pollutant. The solvent makes up only 1 percent of the cost of the coating material, so that it was an insignificant factor from a cost accounting perspective. As a volatile organic pollutant the solvent is a significant factor though, because it is likely to be a bigger cost factor in the future, due to anticipated regulatory changes and public concern over the release of volatile organic compounds.⁵⁹ From the perspective of materials accounting, the solvent is, as a potential future liability, already a significant environmental concern.

7.3.5 Integrating environmental considerations into business processes

To ensure that environmental considerations are integrated into core business decisions, EA should be practised on an ongoing basis. The process of identifying, understanding and managing environmental costs can be a very long one. Rather than relying on the information obtained from an EA project or pilot study, companies should aim to practice EA on an ongoing basis and try to integrate EA practices with their existing business practices and procedures. Strategic planning efforts, such as capital budgeting, new product development or the development of a corporate environmental strategy offers excellent opportunities for using EA to incorporate environmental cost information into business decisions.

Table 16 in section 8.2.17 on page 56 summarizes the guidelines on integrating EA information into business decisions and processes. In the next section the EA Review Model will be presented. The EA Review Model summarizes the main elements of an EA project as it was discussed in sections 3 to 7.

⁵⁹ Maindiratta, A. & R. Todd (1995) in Ditz, D., J. Ranganathan & R.D. Banks (1995a) *Green Ledgers: Case Studies in Corporate Environmental Accounting*. World Resources Institute, Washington D.C., p. 117.

8 The EA Review Model

8.1 Introduction

The purpose of the EA Review Model is to present guidelines against which the adequacy of an EA project can be assessed. As a secondary objective, the EA Review Model may serve as a guide for companies on how to approach EA.

8.1.1 Overview

Broadly speaking, two phases can be identified in an EA project:

- The generation and analysis of environmental information
- The use of that information in order to integrate environmental considerations in decision-making, optimise environmental and economic performance and promote environmental sustainability

The first part of the EA Review Model will describe the process of generating environmental information and the second part the process of applying that information.

8.1.1.1 Generating environmental information

Firstly the objectives of an EA project and the potential uses of EA for a company must be considered. What is the company's vision and needs regarding EA? Depending on the objectives identified the scale and scope of the EA project must be decided. This will in turn determine the types of environmental costs that will need to be investigated. Then potential sources of environmental information need to be identified. Once these steps have been taken, the process of identifying, tracing and allocating environmental costs can begin.

8.1.1.2 Integrating environmental considerations into business decisions.

Two of the main sources for environmental information should be the existing financial and environmental information and management systems, and any systems complementary to those, such as environmental financial statements. Methods must be developed to extract environmental cost information from the general cost information of the financial information system. Non-financial environmental information must be obtained from the environmental management system and supporting systems and if possible, quantified, monetised or put in a format that is useful as input into the decision-making process. The process of generating environmental information should be

integrated with the existing systems. One of the aims of the EA project should be to integrate environmental and economic considerations into information for management purposes.

EA may also complement and be used in conjunction with other business systems, strategies or approaches that seek to improve and optimise economic and/or environmental performance. For instance, environmental information can give significant strategic insight into the appraisal of new capital investments or the measurement of the financial and environmental performance of a company.

The tables in the EA Review Model have been developed to assess the extent to which an EA project satisfies or achieves these basic processes. The EA Review Model also includes guidelines on overall considerations that are important in the EA process and on interpreting the findings or recommendations of an EA project.

Before the tables of the EA Review Model are presented, the system of evaluation used in the EA Review Model must be explained.

8.1.1.3 Evaluating the relevance of elements of the checklists

The significance that elements or aspects of the checklists have for the EA projects of the case studies are ranked on a scale of 3:

- 3: Considered to be very important or relevant
- 2: Considered to be of medium importance or relevance
- 1: Not considered to be relevant
- 0: No information available in the case study on this element or aspect (This could be because 1) the element or aspect falls outside the scale and scope of the EA project discussed in the case study; 2) the element or aspect falls outside the focus of the case study itself; or 3) the aspect or element is relevant to the EA project but the case study does not contain information on it.)

Explanatory notes are used to motivate and explain the rankings given to aspects or elements of tables applied to a case study. Not all the rankings are motivated, but rather the ones that provide most insight into the case study or ones where doubt may exist about how an aspect or element should be ranked.

8.2 Presentation of the EA Review Model

8.2.1 Table 1 of the EA Review Model: Potential uses and objectives of Environmental Accounting

POTENTIAL USES OF EA	Scale of relevance (Ranking)			
	High	Medium	Low	Not applicable
	3	2	1	0
Management incentives				
Integrating environmental considerations into business decisions and management				
Improving the management performance evaluation process				
Safeguarding investment decisions for the future				
Striving for competitive advantage				
Financial incentives				
Improved management of environmental costs				
Short term cost savings				
Assessing and reducing environmental risks and liabilities				
Improving market share through greener products and services				
Supporting sustainable business				
Measuring eco-efficiency				
Improving environmental performance				
Developing greener products, processes & services				
Greater emphasis on environmental considerations in decision making process				
Internalising external environmental costs				
Providing environmental cost information				
Identifying hidden environmental costs				
Identifying cost reduction opportunities				
Improving cost control				
Reducing the cost of inefficiency				
More accurate costing and pricing of products				
Guiding product mix and development decisions				
Comparing costs across facilities				
Evaluating alternative manufacturing inputs				
Improve resource allocation decisions				
Serve as basis for budgeting				

Table 1 continues on the next page

8.2.2 Table 1 of the EA Review Model (continued): Potential uses and objectives of Environmental Accounting

Potential uses of EA	Ranking
More cost effective environmental management	
Prioritising environmental initiatives	
Assessing opportunities for pollution prevention	
Evaluating waste management and energy efficiency options	
Improving environmental, health and safety performance	
Supporting the development of an environmental management system	
Improving environmental compliance strategies	
Decision making	
Applying EA to cost allocation	
Applying EA to capital budgeting	
Applying EA to process & product design	

8.2.2.1 Interpretation of table 1

Table 1 is based on the discussion of the potential uses of EA in section 4.2 on pages 19 – 21. The table does not present a final list of all the potential uses of EA, but aims to identify common themes on the uses of EA found in the literature study. The potential uses are grouped into categories (such as Decision making) representing shared fields of application.

Applied to an EA project, table 1 is not so much an evaluation tool as one that simply represents what a company's vision and understanding of EA is. There are no "right answers" to table 1. Depending on the scale and scope of an EA project, the potential uses relevant to a specific EA project might vary. Table 1 is more useful when it is compared to the other tables in the EA Review Model. For example, if an EA project scores highly in table 1, one would also expect to see high scores in tables 3 (types of environmental costs) and 12 (techniques for processing & applying environmental data). A wide range of objectives for EA would require the investigation of a wide range of environmental costs, and integration of the generated information with a wide range of business activities, strategies and systems.

Table 1 can also evaluate the consistency or thoroughness of an EA project's approach: if an EA project is initiated on the grounds of financial incentives, the project should aim to achieve at least some of the following objectives: improve the management of environmental costs; identify potential short term cost savings; assess and reduce environmental risks and liabilities; or improve market share through the development of greener products and services.

8.2.3 Table 2 of the EA Review Model: Scale & scope of the environmental accounting exercise

Scale	Ranking	Scope (types of costs included)	Ranking
Process (e.g. production line)		Conventional costs	
System (e.g. wastewater treatment)		Hidden costs	
Product or product line		Contingent costs	
Facility, department or location		Relationship / Image costs	
Regional groups of departments or facilities		Societal / External costs	
Corporate division or entire company			

See end of table 3 for interpretation

8.2.4 Table 3 of the EA Review Model: Environmental costs and benefits

Types of cost or benefit	Examples	Identified?
Internal environmental costs		
Direct environmental expenses	General	
	Costs of failure or remediation	
	Costs of monitoring	
	Costs of prevention	
	Costs of proactive environmental programs	
Business-integrated environmental expenses / Conventional costs	Incremental costs of environmental considerations influencing normal business decisions	
	Costs of time that staff spend on environmental management	
Resource expenses / Opportunity costs	Costs of resources	
	Costs of resource inefficiency	
Other		
External environmental costs		
External environmental costs	Costs of environmental impacts and resource use borne by society and not the organization	
Internal environmental benefits		
Revenues	Reduce, re-use and recycle schemes	
	Products and services sold primarily on the basis of environmental considerations	
Savings and cost avoidance	Cost savings resulting from environmental actions, e.g. reduced waste disposal costs	
Intangible benefits	Enhanced public image and customer perceptions	
	Improved staff morale	
Reduction of environment-related financial risks	Risk of major environmental incidents	
	Adverse environmental impacts over time, e.g. hazardous waste leakage	
	Damage to public image and reputation	
	Risk of loss of business profitability through e.g. environmental taxes, if the business process is environmentally unsustainable	
Other		

8.2.4.1 Interpretation of tables 2 and 3

The definitions in table 2 are based on the discussion on the scale and scope of an EA project in section 5.1 on page 26 and give an overview of the possible scale and scope of environmental costs. Table 3 provides a different analysis of types of environmental costs, based on the discussion of environmental costs in section 3.2 on pages 13 – 15. Applied to an EA project, these tables should be evaluated in conjunction with table 1. Generally, the broader the aims of an EA project are, the broader the scope of environmental costs investigated should be. For instance, if an EA project aims to support sustainable business, one would expect that external environmental impacts and possibly the reduction of environmental risks would be investigated. If an EA project's main aim is to identify cost reduction opportunities, only conventional and potentially hidden environmental costs might be investigated.

University of Cape Town

8.2.5 Table 4 of the EA Review Model: Non-financial sources of environmental cost information

Estimated environmental costs from non-financial information sources	Information sources	Ranking
Energy and materials	Energy and materials tracking	
	Operational process records	
	Product specifications and profiles	
Energy and materials (ISO 14001 EMS)	Environmental impact assessments	
	Register of environmental aspects	
	Environmental objectives and targets	
	Environmental management program	
Non-product output	Emissions estimates	
	Production logs	
Maintaining environmental equipment	Maintenance logs	
	Service contracts	
Process-penalties/shut-downs	Operating research	
Monitoring	Engineering estimates	
	Management estimates	
Environmental training	Personnel, EH&S records	
	Management estimates	

8.2.5.1 Interpretation of table 4

Table 4 is base on the discussion of non-financial information in section 5.2 on page 27. The table evaluates the extent to which non-financial environmental data is investigated in an EA project, and whether any systems, such as materials accounting, have been implemented to apply environmental data.

8.2.6 Table 5 of the EA Review Model: Conventional environmental costs

Conventional costs	Ranking	Data source (if not general ledger)
Capital equipment		
Materials		
Energy		
Labour		
Supplies		
Utilities		
Structures		
Salvage value		
Other		

See end of table 10 for interpretation

8.2.7 Table 6 of the EA Review Model: Potentially hidden environmental costs (upfront and back-end)

Potentially hidden environmental costs		
Upfront costs	Identified?	Data source (if not general ledger)
Site studies		
Site preparation		
Permitting		
R&D		
Engineering and procurement		
Installation		
Other		
Back-end costs	Identified?	Data source (if not general ledger)
Closure/ decommissioning		
Disposal of inventory		
Post-closure care		
Site survey		
Other		

See end of table 10 for interpretation

8.2.8 Table 7 of the EA Review Model: Potentially hidden environmental costs (regulatory)

Potentially hidden environmental costs		
Regulatory costs	Identified?	Data source (if not general ledger)
Notification		
Reporting		
Monitoring/testing		
Studies/modelling		
Remediation		
Recordkeeping		
Plans		
Training		
Inspections		
Manifesting		
Labelling		
Preparedness		
Protective equipment		
Medical surveillance		
Environmental insurance		
Financial assurance		
Pollution control		
Spill response		
Stormwater management		
Waste management		
Taxes/fees		
Other		

See end of table 10 for interpretation

8.2.9 Table 8 of the EA Review Model: Potentially hidden environmental costs (voluntary)

Potentially hidden environmental costs		
Voluntary costs	Identified?	Data source (if not general ledger)
Community relations/outreach		
Monitoring/testing		
Training		
Audits		
Qualifying suppliers		
Reports (e.g. annual environmental reports)		
Insurance		
Planning		
Feasibility studies		
Remediation		
Recycling		
Environmental studies		
R & D		
Habitat and wetland protection		
Landscaping		
Other environmental projects		
Financial support to environmental groups and/or researchers		

See end of table 10 for interpretation

8.2.10 Table 9 of the EA Review Model: Potentially hidden environmental costs (contingent)

Potentially hidden environmental costs		
Contingent costs	Identified?	Data source (if not general ledger)
Future compliance costs		
Penalties / fines		
Response to future releases		
Remediation		
Property damage		
Personal injury damage		
Legal expenses		
Natural resource damages		
Economic loss damages		
Other		

See end of table 10 for interpretation

8.2.11 Table 10 of the EA Review Model: Potentially hidden environmental costs (intangible)

Potentially hidden environmental costs		
Image and relationship costs	Identified?	Data source (if not general ledger)
Corporate image		
Relationship with customers		
Relationship with investors		
Relationship with insurers		
Relationship with professional staff		
Relationship with workers		
Relationship with suppliers		
Relationship with lenders		
Relationship with host communities		
Relationship with regulators		
Other		

8.2.11.1 Interpretation of tables 5 – 10

These tables are based on examples of environmental costs defined by the US EPA.⁶⁰ The application of these tables to an EA project is to evaluate the thoroughness of environmental cost inventories, environmental balance sheets, or other tools that are used to assist in the identification of potentially hidden environmental costs. The detailed tables can be used to assess if important categories of materials, activities or processes are being overlooked in the process of identifying environmental costs.

8.2.12 Table 11 of the EA Review Model: Business systems used to support environmental accounting

Approach	Ranking
Environmental management system	
Existing financial reporting system	
Existing environmental reporting system	
Environmental or material balance sheets	
Environmental financial statements	

8.2.12.1 Interpretation of table 11

This table is base on the discussion on business systems that can support EA in section 6.1 on page 32. The application of this table to case studies is to evaluate

⁶⁰ US EPA (1995b) (op cit.) p. 9.

the extent to which an EA project is integrated with the financial and environmental functions within the organization. It is also an indicator of whether the environmental and financial expertise is being used together effectively in the EA project. Ideally, one would like to see all EA projects rank the environmental and financial management systems as of high relevance to the project.

8.2.13 Table 12 of the EA Review Model: Techniques for processing environmental data into information for management purposes

Techniques	Examples	Ranking
Performance measurement	Eco-balance	
Budget setting & control		
Internal auditing		
Life-cycle assessment		
Design for environment / Life-cycle design		
Costing	Environmental cost allocation	
	Activity based costing	
	Quality costing	
	Product costing	
	Life-cycle costing	
	Cost projection	
Pricing	Strategic costing	
Demand forecasting		
Investment appraisal / Capital budgeting		
Shareholder value analysis		
Environmental value analysis		

8.2.13.1 Interpretation of table 12

The table is based on the discussion of supporting techniques for processing data into information for management purposes in section 6.2 on page 32. Table 12 evaluates the extent to which an EA project is integrated with other business processes and strategies in a company. The environmental information generated by the EA project should not stand alone, but should be utilised in the general decision-making processes of a company. The examples may be more typical of larger corporations and may not be as relevant to smaller EA projects or EA pilot studies.

8.2.14 Table 13 of the EA Review Model: Assessing the strategic significance of an organization's environmental impacts

Actions		Ranking
Use the organization's register of environmental aspects and associated impacts, or		
Identify the organization's significant environmental aspects and associated impacts		
For each impact, analyse the potential future cost and benefit implications of possible changes in:	<i>Government policies</i> (e.g. on greenhouse gas emissions)	
	<i>Environmental legislation and regulation</i> (e.g. more extensive pollution taxes)	
	<i>Supply conditions</i> (e.g. higher resource costs)	
	<i>Demand conditions</i> (e.g. customer demand for greener products)	
	<i>Social attitudes</i> (e.g. increased public opposition to environmentally hazardous processes or substances)	
	<i>Competitor strategies</i> (e.g. developing greener products and processes)	
If the potential future cost and benefit implications are significant:		
Prepare a summary document to communicate the findings to top management		
Develop a "high environmental pressure" scenario to illustrate the risks of ignoring or underestimating the future financial implications of increased environmental pressures		
Evaluate the usefulness of implementing an EA system, or conducting an EA pilot project, in order to properly manage the future financial implications of increased environmental pressures		

8.2.14.1 Interpretation of table 13

Table 13 is based on the discussion of contingent costs in section 5.3.2.1 on page 31. It evaluates the thoroughness with which a company has assessed the strategic significance and potential liabilities of its environmental impacts. Most companies embarking on an EA project would have done this already, since this is one of the requirements of a good environmental management system (as prescribed by industry standards for environmental management systems). This table is included as a guideline rather than an evaluation tool. Companies that are unsure about the scope of environmental costs they should include in their EA project, can use the guidelines in table 13 to assess the strategic significance of their environmental impacts, and use that information in determining the scope of environmental costs for their project.

8.2.15 Table 14 of the EA Review Model: Implementation of an environmental accounting project

Committing resources to the EA project	Ranking
Provide adequate resources (staff and time)	
Indicate clear top management support to the whole company	
Ensure company wide support and co-operation	
Ensure serious consideration of the project's recommendations	
Selection of the EA team	Ranking
Select a multidisciplinary EA team with members from different company departments and/or levels	
Work toward better co-operation and integration between the environmental and financial management functions	
Educate financial managers about environmental management	
Educate environmental managers about financial management	
Gathering data	Ranking
Determine what data is needed to thoroughly assess the financial implications, now and in future, of environmental pressures	
Determine how much of this data is being collected already and from what sources, and whether it could be processed and presented in formats more suitable to the project	
Determine standardised definitions of environmental costs and data collection procedures that are suited to the objectives of the project	
Consider whether modifications to the general ledger codes will provide better environmental cost and benefit data, or whether separate environmental cost data systems should be developed	
Consider what non-financial data, from which sources, is needed and available for the project and whether this data can be reported and presented in more suitable ways	
Find ways of simplifying the reporting and presentation of data, such as matrices and checklists, that can communicate environmental cost and benefit information more effectively through the organization	

8.2.15.1 Interpretation of table 14

Table 14 is based on the discussion on the implementation of an EA project in section 7.1 on page 36. Applied to an EA project, the table evaluates the effectiveness and thoroughness with which the EA project was or is being conducted. The guidelines in the table describe important elements of the process of EA. An EA project that scores very well against these guidelines would have a good chance of being successful.

8.2.16 Table 15 of the EA Review Model: Findings and recommendations of an environmental accounting project

Findings	Examples	Ranking
Potential reductions in environmental costs	More cost effective waste management alternatives or raw materials	
Need for changes in the organization's environmental, accounting or managerial practices	Biases in the allocation of environmental costs	
Benefits should be extended to other departments, facilities or the whole organization		

8.2.16.1 Interpretation of table 15

Table 15 is based on the discussion of findings of an EA project in section 7.2 on page 37. EA projects will have many findings and recommendations. The findings in table 15 are generic findings that, if confirmed, indicate at least a reasonable degree of success for the EA project. If an EA project scores well against the guidelines of table 15, it is an indication that the EA project could be carried out on an ongoing basis.

8.2.17 Table 16 of the EA Review Model: Evaluation of environmental cost management

Goals	Procedures	Ranking
Informing decision makers	Regular summaries of environmental cost information available to management	
	Environmental cost information tracked and allocated to processes & products	
Making managers accountable	Managers held accountable for environmental costs they generate	
	Full costs or surcharges charged for waste management & energy consumption	
Improving environmental performance	Devise incentives for encouraging more effective management of environmental costs	
Anticipating future environmental costs	Cost accounting supplemented with materials accounting – assessment of input, use and release of materials with significant environmental impact	
	Potential future environmental costs or liabilities associated with significant environmental impacts are estimated	
Integrating environmental considerations into business processes	Environmental accounting practised on an ongoing basis	
	Environmental cost information integrated into routine business activities such as capital budgeting and product development	

8.2.17.1 *Interpretation of table 16*

Table 16 is based on the discussion on integrating EA information into business decisions and processes in section 7.3 on page 38. Applied to an EA project, this table evaluates how well EA information is being utilised by and integrated with the general business decisions of a company. The guidelines in this table focus on the general process of integrating EA information within a company, whereas table 12 of the EA Review Model focused more on the visible results of such integration, such as linking up with other business systems or strategies.

In the next section, the EA Review Model will be applied to EA case studies to evaluate the EA projects of three companies.

University of Cape Town

9 EA case study: Full cost accounting for decision-making at Ontario Hydro

9.1 Introduction

Ontario Hydro is a large electric utility in North America. Its supply system includes nuclear, fossil fuelled and hydroelectric energy stations. In the 1990s, the company underwent major restructuring designed to contain costs, stabilise electricity rates and gain greater efficiency.

Ontario Hydro is committed to sustainable environmental development. Part of the company's sustainable energy development strategy is to integrate the environment and economics in decision-making and to adopt full-cost accounting.

Ontario Hydro has been considering internal and external environmental costs and impacts for many years. Recently the company has made a commitment to full-cost accounting (FCA) and started developing and applying EA under the FCA framework.

Ontario Hydro calls its approach to integrating environmental considerations into business decisions FCA, which it defines as:

FCA is a means by which environmental considerations can be integrated into business decisions. FCA incorporates environmental and other internal costs, with external impacts and costs/benefits of Ontario Hydro's activities on the environment and on human health. In cases where the external impacts cannot be monetised, qualitative evaluations are used.⁶¹

What Ontario Hydro defines as full-cost accounting is similar to EA as it is defined in this thesis, therefore references to FCS in this section can be interpreted as describing Ontario Hydro's EA project.

⁶¹ US EPA (1996) *Full cost accounting for decision-making at Ontario Hydro*. (EPA 742-R-95-004; Washington, DC: EPA), p. 6. The report can be found on the EPA's EA website at www.epa.gov/opptintr/acctg/.

9.2 Chronology

This case study was undertaken in February 1996. Ontario Hydro's investigation into the potential use of FCA started in 1993 as part of the company's program of Sustainable Energy Development. A FCA team was drawn up to:

- Define FCA
- Identify data requirements and provide estimates of environmental costs
- Determine how environmental costs (internal and external) could be integrated into an FCA framework
- Examine the potential applications of FCA in the company⁶²

A division called the Environment and Sustainable Development Division was created to act as an institutional foundation for FCA. Building on the FCA team's report, the division developed corporate guidelines for implementing FCA in Ontario Hydro in 1995. When the case study was done, the FCA project was in its implementation stage.

⁶² US EPA (1996) (op cit.) p. 18.

9.3 Application of the EA Review Model to the Ontario Hydro EA case study

9.3.1 Table 2 of the EA Review Model Application to Ontario Hydro: Potential uses and objectives of Environmental Accounting

POTENTIAL USES OF EA	Relevance
Management incentives	3
Integrating environmental considerations into business decisions and management	3a
Improving the management performance evaluation process	3b
Safeguarding investment decisions for the future	2
Striving for competitive advantage	3
Financial incentives	3
Improved management of environmental costs	3
Short term cost savings	2
Assessing and reducing environmental risks and liabilities	3
Improving market share through greener products and services	3
Supporting sustainable business	3
Measuring eco-efficiency	3b
Improving environmental performance	3
Developing greener products, processes & services	3
Greater emphasis on environmental considerations in decision making process	3a
Internalising external environmental costs	1c
Providing environmental cost information	3
Identifying hidden environmental costs	3a
Identifying cost reduction opportunities	3a
Improving cost control	3a
Reducing the cost of inefficiency	2a
More accurate costing and pricing of products	1a
Guiding product mix and development decisions	0
Comparing costs across facilities	0
Evaluating alternative manufacturing inputs	0
Improve resource allocation decisions	3
Serve as basis for budgeting	0

TABLE CONTINUES ON THE NEXT PAGE

**9.3.2 Table 1 of the EA Review Model Application to Ontario Hydro:
Potential uses and objectives of Environmental Accounting
(continued)**

POTENTIAL USES OF EA	Relevance
More cost effective environmental management	3
Prioritising environmental initiatives	3
Assessing opportunities for pollution prevention	3
Evaluating waste management and energy efficiency options	3
Improving environmental, health and safety performance	0
Supporting the development of an environmental management system	3d
Improving environmental compliance strategies	2
Decision making	3
Applying EA to cost allocation	3
Applying EA to capital budgeting	3e
Applying EA to process & product design	2

9.3.2.1 Comments

(a) Ontario Hydro's main goal is to use full-cost information as an input to its decision making. Full-cost pricing (having full-cost information reflected in product prices) is not a goal of Ontario Hydro's FCA approach. The goal is to generate full-cost information that can be used to change management behaviour to consider environmental impacts in planning and decision-making. The company has been estimating its environmental expenditures for more than a decade. The company's FCA project is therefore strongly based on the company's experience in investigating and interpreting environmental costs.

The company's internal environmental cost research aims to identify and allocate all environmental costs to specific business units. Only costs for which fees cannot be reasonably charged are pooled in overhead accounts.

- (b) Ontario Hydro publishes an annual sustainable development and environmental performance report.
- (c) Ontario Hydro's goal is not to internalise environmental costs, but to take the external environmental impacts of its activities into account in its decision making.
- (d) The company believes that FCA will assist in developing its environmental policy and internal environmental regulations and standards.
- (e) Estimates on environmental expenditure are done for all major capital initiatives.

9.3.2.2 Evaluation of table 1

Ontario Hydro considers most of the potential uses of FCA (EA) listed in table 1 as of high relevance to the company. FCA is relevant as a management incentive and as input into the decision-making process because the company desires to integrate environmental and economic considerations in the decision-making process. It is considered relevant as a financial incentive because Ontario Hydro believes that they will benefit economically from the implementation of FCA. The company is committed to sustainable energy development and sees FCA as an important tool in working towards this goal. The FCA project was built upon previous research into environmental costs, and is seen as an effective tool to use to understand and manage environmental costs. The FCA guidelines can be linked to the company's environmental management system, and can therefore facilitate the improvement of the environmental management system. The predominantly high scores in the subcategories of the categories listed above indicate that the company understands how its FCA efforts link up with other company processes, and understands how to reach the goals and realize the potential that FCA has to offer.

According to the EA Review Model's guidelines, Ontario Hydro has an excellent understanding of the wide range of potential uses that FCA offers, and a good strategy for how to achieve this.

9.3.3 Table 2 of the EA Review Model Application to Ontario Hydro: Scale & scope of the environmental accounting exercise

Scale	Ranking	Scope (types of costs included)	Ranking
Process (e.g. production line)	0	Conventional costs	3
System (e.g. wastewater treatment)	0	Hidden costs	3
Product or product line	0	Contingent costs	2a
Facility, department or location	0	Relationship / Image costs	2a
Regional groups of departments or facilities	0	Societal / External costs	3
Corporate division or entire company	3		

9.3.3.1 Comments on table 2

(a) Contingent environmental costs and potential liabilities do not receive as much attention as current environmental costs, but the FCA project also investigates the risk factor of environmental costs and potential future liabilities. Opportunities for managing these risks are also identified, such as low-cost waste management and recycling options and partnerships (sharing expertise) with other service providers. Likewise, image and relationship costs are not a high priority, but the company's FCA guidelines make provision for considering stakeholder perceptions on the environmental performance of the company.

9.3.3.2 Evaluation of table 2

The scale of the FCA project is on the entire company. This indicates a serious commitment from the company's top management to implementing FCA. The scope of the company's FCA incorporates all the types of environmental costs listed in the table. Contingent and image and relationship costs are considered less important. This is understandable, since these costs are most difficult to estimate and quantify and are likely to be incurred in future. The company's consideration of external environmental costs illustrates that it is serious about its environmental responsibility to society.

According to the guidelines of the EA Review Model, Ontario Hydro understands the magnitude and extent of its environmental costs and has chosen to investigate its environmental costs in full.

**9.3.4 Table 3 of the EA Review Model Application to Ontario Hydro:
Environmental costs and benefits**

Types of cost or benefit	Examples	Identified?
Internal environmental costs		
Direct environmental expenses	General	2
	Costs of failure or remediation	0
	Costs of monitoring	0
	Costs of prevention	2
	Costs of proactive environmental programs	3b
Business-integrated environmental expenses / Conventional costs	Incremental costs of environmental considerations influencing normal business decisions	3
	Costs of time that staff spend on environmental management	0
Resource expenses / Opportunity costs	Costs of resources	3
	Costs of resource inefficiency	3
Other		
External environmental costs		
External environmental costs	Costs of environmental impacts and resource use borne by society and not the company	3a
Internal environmental benefits		
Revenues	Reduce, re-use and recycle schemes	3
	Products and services sold primarily on the basis of environmental considerations	0
Savings and cost avoidance	Cost savings resulting from environmental actions, e.g. reduced waste disposal costs	3
Intangible benefits	Enhanced public image and customer perceptions	3
	Improved staff morale	0
Reduction of environment-related financial risks	Risk of major environmental incidents	0
	Adverse environmental impacts over time, e.g. hazardous waste leakage	3
	Damage to public image and reputation	3
	Risk of loss of business profitability through e.g. environmental taxes, if the business process is environmentally unsustainable	0

9.3.4.1 *Comments on table 3*

- (a) Ontario Hydro distinguishes between external impacts for which it has developed monetary values (monetised impacts) and external impacts which can only be described qualitatively (non-monetised impacts).
- (b) The company's demand-side management strategy is a good example of a proactive environmental program. This strategy helps customers to increase their energy efficiency, which reduces the demand for electricity generation and thus saves resources and cuts down on pollution.
- (c) Ontario Hydro defines all its energy-efficiency expenditures as internal environmental costs, which can be interpreted as costs of prevention.

9.3.4.2 *Evaluation of table 3*

Although little detail was available on the specific cost categories used in the company's environmental cost analysis, the table indicates that all the major types of environmental costs, both internal and external, as well as environmental benefits, are receiving attention.

This table complements table 3 and confirms that Ontario Hydro understands the extent and magnitude of its environmental costs and the significance of investigating it.

9.3.5 Table 4 of the EA Review Model Application to Ontario Hydro: Non-financial sources of environmental cost information

Estimated environmental costs from non-financial information sources	Information sources	Ranking
Energy and materials	Energy and materials tracking	0
	Operational process records	0
	Product specifications and profiles	0
Energy and materials (ISO 14001 EMS)	Environmental impact assessments	3a
	Register of environmental aspects	0
	Environmental objectives and targets	2
	Environmental management program	2
Non-product output	Emissions estimates	0
	Production logs	0
Maintaining environmental equipment	Maintenance logs	0
	Service contracts	0
Process-penalties/shut-downs	Operating research	0
Monitoring	Engineering estimates	0
	Management estimates	0
Environmental training	Personnel, EH&S records	0
	Management estimates	0

9.3.5.1 Comments on table 4

- (a) Environmental impact assessments are an important source of information for the company's FCA project, because external environmental impacts are considered in decision-making. Unfortunately the case study did not contain detail on other sources of environmental cost information apart from reference to the environmental management system. Reference was made to available physical data sources and interviews with personnel, but the sources were not specified.

9.3.5.2 Evaluation of table 4

Table 4 indicates that non-financial data sources are an important source of information for external environmental costs, because environmental impact assessments play an important part in the company's investigation of external environmental costs. Non-financial sources of information also seem to be important for the determination of internal environmental costs, since the FCA project is linked to the environmental management system, but the case study did not contain enough information to judge how adequately this has been done.

What can be inferred from table 4 is Ontario Hydro does realize the importance of gathering environmental data from non-financial data sources.

9.3.6 Tables 5 to 10 of the EA Review Model: Potentially hidden environmental costs

Tables 5 to 10 of the EA Review Model could not be applied to the Ontario Hydro case study. These tables list the types and subcategories of conventional and potentially hidden environmental costs that can be identified from financial data sources. The Ontario Hydro case study did not contain any more information on environmental costs than those presented in tables 2 and 3. It is clear from the FCA guidelines and references to the investigation of environmental costs in the case study that Ontario Hydro has put effort into identifying potentially hidden environmental costs and allocating these costs to the original sources. Unfortunately no detail was supplied on the costs categories that were used.

9.3.7 Table 5 of the EA Review Model Application to Ontario Hydro: Business systems used to support environmental accounting

Approach	Ranking
Environmental management system	3b
Existing financial reporting system	2
Existing environmental reporting system	3
Environmental or material balance sheets	0
Environmental financial statements	2
Other: Sustainable energy development	3a
Other: Multi-criteria analysis	3c

9.3.7.1 Comments on table 5

- (a) Ontario Hydro has a policy and program for sustainable energy development. The FCA project is conducted within this framework.
- (b) FCA is seen as an important component of the company's overall environmental management system and FCA guidelines are linked to the environmental management system.
- (c) Ontario Hydro understands FCA as multi-disciplinary in its very nature, and therefore employs the approach of multi-criteria analysis in its decision-making processes.

9.3.7.2 Evaluation of table 5

Table 5 indicates that Ontario Hydro's FCA project is well integrated with and supported by other initiatives from the contexts of environmental and financial management. Of particular importance is the Sustainable Energy Development strategy, which supplies a supportive basic framework for FCA (one which strives to integrate environmental considerations into business decisions). The use of multi-criteria analysis in decision-making is also significant. This approach encourages a multi-disciplinary approach to problem solving and since EA is by nature multi-disciplinary, multi-criteria analysis combines well with the company's FCA project.

In summary: Ontario Hydro's FCA project is well integrated with and supported by other business systems and techniques.

9.3.8 Table 6 of the EA Review Model Application to Ontario Hydro: Techniques for processing environmental data into information for management purposes

Techniques	Examples	Ranking
Performance measurement	Eco-balance	2c
Budget setting & control		0
Internal auditing		0
Life-cycle assessment		2e
Design for environment / Life-cycle design		2e
Costing	Full-cost accounting	3
	Activity based costing	2b
	Quality costing	0
	Product costing	0
	Life-cycle costing	0
	Cost projection	3a
	Strategic costing	3a
Pricing		0
Demand forecasting		2f
Investment appraisal / Capital budgeting		3a
Shareholder value analysis		0
Environmental value analysis		2d

9.3.8.1 Comments on table 6

- (a) Estimates on environmental expenditure are done for all major capital initiatives.
- (b) Some business units are employing Activity Based Costing, which facilitates the identification and allocation of environmental costs.
- (c) FCA is also used to evaluate the company's environmental performance.

- (d) One of the goals of the FCA project is to assist in the development of more sustainable energy production and to report the company's progress to stakeholders.
- (e) Since Ontario Hydro is a service provider and does not sell products, life-cycle assessment and design is not often used. However, in the design of new facilities and new systems, environmental impacts and costs are considered for all the life-stages of these developments.
- (f) The company's demand side management strategy, which aims to sell energy-efficiency technology rather than more energy, is a good example of demand forecasting.

9.3.8.2 Evaluation of table 6

Table 6 indicates that the information generated by the FCA project is being integrated and applied together with other business functions. The FCA project is successful in facilitating the consideration of environmental issues in the company's decision-making.

9.3.9 Table 13 of the EA Review Model: Assessing the strategic significance of environmental impacts

Table 13 of the EA Review Model is not relevant to the Ontario Hydro case study. The company has been investigating its environmental impacts and costs since 1989, so the strategic significance of its environmental costs was known before the FCA project was initiated.

9.3.10 Table 7 of the EA Review Model Application to Ontario Hydro: Implementation of an environmental accounting project

Committing resources to the EA project	2/3
Provide adequate resources (staff and time)	3
Indicate clear top management support to the whole company	3
Ensure company wide support and co-operation	2
Ensure serious consideration of the project's recommendations	2
Selection of the EA team	3
Select a multidisciplinary EA team with members from different company departments and/or levels	3
Work toward better co-operation and integration between the environmental and financial management functions	3
Educate financial managers about environmental management	3
Educate environmental managers about financial management	3
Gathering data	3
Determine what data is needed to thoroughly assess the financial implications, now and in future, of environmental pressures	3
Determine how much of this data is being collected already and from what sources, and whether it could be processed and presented in formats more suitable to the project	3
Determine standardised definitions of environmental costs and data collection procedures that are suited to the objectives of the project	3
Consider whether modifications to the general ledger codes will provide better environmental cost and benefit data, or whether separate environmental cost data systems should be developed	3
Consider what non-financial data, from which sources, is needed and available for the project and whether this data can be reported and presented in more suitable ways	3
Find ways of simplifying the reporting and presentation of data, such as matrices and checklists, that can communicate environmental cost and benefit information more effectively through the company	0

9.3.10.1 *Comments on table 7*

When Ontario Hydro had finalised its corporate guidelines for EA, a public workshop was held where stakeholders were given the opportunity to raise any issues of concerns they had with the guidelines. This is an example that other companies implementing EA could consider as well.

- (a) Ontario Hydro understands the importance of company-wide support for FCA and of the FCA guidelines receiving serious attention. Efforts to motivate the right behaviour of managers and decision-makers through training and communication are being put in action, but since the FCA project is in the early stages of its implementation phase, it is too soon to evaluate how effective these efforts are.

9.3.10.2 Evaluation of table 7

Except for the entry for the presentation of data, of which the case study did not supply any detail, Ontario Hydro met all the guidelines for implementation of a FCA project as presented by table 7. This is probably due to the company's prior experience in investigating environmental costs. Ontario Hydro is doing the necessary to ensure that the FCA guidelines are implemented successfully.

9.3.11 Table 8 of the EA Review Model Application to Ontario Hydro: Evaluation of environmental cost management

Goals	Procedures	Ranking
Informing decision makers	Regular summaries of environmental cost information available to management	0a
	Environmental cost information tracked and allocated to processes & products	3
Making managers accountable	Managers held accountable for environmental costs they generate	0
	Full costs or surcharges charged for waste management & energy consumption	0
Improving environmental performance	Devise incentives for encouraging more effective management of environmental costs	2b
Anticipating future environmental costs	Cost accounting supplemented with materials accounting – assessment of input, use and release of materials with significant environmental impact	2c
	Potential future environmental costs or liabilities associated with significant environmental impacts are estimated	2
Integrating environmental considerations into business processes	Environmental accounting practised on an ongoing basis	3
	Environmental cost information integrated into routine business activities such as capital budgeting and product development	3

9.3.11.1 Comments on table 8

- (a) At the time the case study was done, the FCA team was still developing an education and communication program to report and communicate environmental cost information to managers and staff members.
- (b) The case study did not mention any incentives or reward schemes for environmental performance within the company. However, the corporate guidelines for FCA and the Sustainable Energy Development Strategy are strong incentives for managers and divisions in the company to take environmental considerations seriously.
- (c) Impact assessments are used to determine the company's external environmental impacts. No information was available in the case study on

how internal impacts are assessed and whether material balance sheets or similar techniques are used.

9.3.11.2 Evaluation of table 8

Table 8 indicates that Ontario Hydro is serious about integrating environmental considerations into their business decisions on an ongoing basis. However, it seems that the commitment to and knowledge of FCA reside more in top management and the levels of corporate guidelines and strategy than on the “shop floor” at present. The company must ensure that the managers and senior staff members of all company divisions are educated and trained in FCA.

9.3.12 Table 9 of the EA Review Model Application to Ontario Hydro: Findings and recommendations of an environmental accounting project

Findings	Examples	Ranking
Potential reductions in environmental costs	More cost effective waste management alternatives or raw materials	3a
Need for changes in the company's environmental, accounting or managerial practices	Biases in the allocation of environmental costs	3b
Benefits should be extended to other departments, facilities or the whole company		3c

9.3.12.1 Comments on table 9

- (a) Pilot studies done at specific plants as part of the FCA project revealed potential cost savings.
- (b) The current accounting system was to be modified into a FCA system. Sustainable Energy Development decision criteria were also developed that provided a framework for integrating economic and environmental information into the company's decision-making.
- (c) The focus of the project was on the entire company from the outset.

9.3.12.2 Evaluation of table 9

The findings of the FCA project highlight two points:

- The investigation into environmental costs revealed potential cost savings
- The implementation of FCA requires a modification of the way the company accounted for environmental costs

9.3.13 Conclusion

9.3.13.1 Vision

Ontario Hydro's FCA project reflects a thorough understanding of the potential uses of FCA. The company scored well against the EA Review Model's guidelines for the uses of EA. The company's extensive and thorough approach to FCA was confirmed by also scoring well against the EA Review Model's guidelines for the scale, scope and types of environmental costs investigated. The company understands that FCA has implications and applications for all of its activities. The FCA guidelines indicate that the company's top management wants economic and environmental considerations to be integrated in all decision-making processes in the company.

9.3.13.2 Process

The process followed by Ontario Hydro's FCA team was very thorough and scored well against the EA Review Model's guidelines for the implementation of EA. The FCA project also makes use of and links up well with the existing financial and environmental management systems in the company, as well as with other initiatives that support the aim of integrating environmental and economic information in decision-making. The EA Review Model does reveal that much work still needs to be done to educate the managers and staff on all levels throughout the company. This is understandable since the FCA project is still in its implementation phase.

9.3.13.3 Tools, techniques and feedback

The FCA team has produced extensive guidelines on how FCA should be implemented within the company, and this effort is supported by the company's strategy of Sustainable Energy Development. At the time the case study was conducted, no feedback was received from management and staff in the different company divisions on difficulties experienced with implementing FCA. While the company is committed to practising FCA on an ongoing basis, feedback mechanisms to address difficulties experienced with the implementation of FCA should be incorporated to ensure that the implementation of FCA successful.

Overall, Ontario Hydro scores very well against the EA Review Model's guidelines. Against the guidelines of the EA Review Model, the company's FCA project can be judged as a good example of how to approach EA.

10 EA Case study: Green Accounting at AT&T

10.1 Introduction

10.1.1 Background

AT&T is a major multinational high-technology company. AT&T has begun developing EA, which it calls "Green Accounting". The US Environmental Protection Agency did a case study on AT&T's development of EA entitled "Green Accounting at AT&T"⁶³. In this section the developed model for evaluating EA will be applied to AT&T's EA project, as represented in the case study.

10.1.2 AT&T's progress in EA

AT&T had a clear commitment from senior management to their EA project (called Green Accounting by AT&T). A multi-functional team with global representation was established to develop and implement EA. AT&T developed its own definition of EA (Green Accounting): "Identifying and measuring the costs of environmental materials and activities and using this information for environmental management decisions. The purpose is to recognise and seek to mitigate the negative environmental effects of activities and systems."⁶⁴ The Green Accounting team was expected to:

1. develop methods and tools,
2. identify environmental costs and related activities, and
3. implement this understanding throughout AT&T.

The Green Accounting team developed a literature review process and prepared a Green Accounting glossary. An EA "self assessment" tool was developed for AT&T facilities, which included a protocol, status survey, environmental activities dictionary, and data matrix. The Green Accounting self assessment tool was implemented and reviewed by three AT&T facilities and revised accordingly. The EA project was linked to other AT&T initiatives such as Total Quality Management, Design for the Environment, Pollution Prevention and Activity-Based Costing and Management.

10.1.3 Chronology

This case study was done from February 1994 to July 1995. During this time, AT&T designed and reviewed the tools designed for their Green Accounting project. Field tests of the designed tools were scheduled to start in April 1995, and the results thereof incorporated into the Green Accounting tools. The case study thus reviews the process of designing the Green Accounting tools, and the objectives, methods, techniques, expectations and desired achievements of the

⁶³ US Environmental Protection Agency (EPA) (1995a) *Environmental Accounting Case Study: Green Accounting at AT&T*. Washington DC, EPA. The full report can be read at the US EPA's EA website at www.epa.gov/opptintr/acctgf/.

⁶⁴ US EPA (1995a) (op cit.) p. 2.

Green Accounting project. The implementation of Green Accounting throughout AT&T post-dated the case study and no information of the success thereof is available in the case study.

10.1.4 Related AT&T initiatives

Activities and programs are already in place in AT&T that can support and enhance EA. These include Total Quality Management, Design for the Environment, and Activity-Based Costing and Management. On account of these programs, AT&T had activities in place at the time of designing the Green Accounting tools that can provide data, information and skills essential to EA.

10.1.5 Limitations of the case study

The focus of the case study is on the design of Green Accounting and not on its implementation. The case study provides much detail on process of developing the EA tools. The tools itself are not discussed in detail though. For example, of the Environmental Activities/Resources Matrix, only a few examples were mentioned (the Activities/Resources Matrix is the tool developed to assist in identifying and tracking environmental costs). These details would be more relevant during the implementation phase of the project. Since very little information on the identified sources of environmental cost information was available, the checklists on sources of environmental cost information were omitted.

10.1.6 Potential bias in AT&T's valuation of EA

A distinction should be made between benefits that have already been achieved through the EA project and its supporting programs, and benefits that are expected to be realized in future. For example, the EA team concluded that it made sense for AT&T to implement EA for, amongst others, the following reasons:

- to control/improve process costs,
- to trace costs to green activities,
- for investment decisions/trade-offs,
- to assess design impacts, now and in the future.⁶⁵

Through its Design for the Environment program, AT&T is already assessing its design impacts and considering the environmental benefits and trade-offs of different investment decisions. Other expected benefits of the EA project, such as improved costs control through tracing costs to green activities, will only be achieved once the recommendations of the Green Accounting team are implemented in the different AT&T divisions and departments. This case study was done during the time that AT&T was in the process of developing its EA methodology, techniques and definitions. The evaluation of this case study therefore reflects the desired, planned and expected benefits of AT&T's EA

⁶⁵ US EPA, (1995a) (op cit.) p. 13.

project. Due to practical limitations, some of those benefits may be difficult to achieve in the implementation stage of the EA project. The case study therefore reflects what AT&T hopes to achieve with its EA project, and not necessarily what AT&T have already achieved or even what it will eventually achieve. As a result, the evaluation of the AT&T case study may be biased in favour of EA (for example AT&T recognises many potential benefits of EA, but not all of those will be easily achieved in practice).

10.2 Application of the EA Review Model to the AT&T EA case study

10.2.1 Table 1 of the EA Review Model Application to AT&T: Objectives and potential uses of Environmental Accounting

Potential uses of EA	Ranking
Management incentives	2
Integrating environmental considerations into business decisions and management	3a
Improving the management performance evaluation process	2d
Safeguarding investment decisions for the future	2
Striving for competitive advantage	2
Financial incentives	3
Improved management of environmental costs	3
Short term cost savings	2
Assessing and reducing environmental risks and liabilities	3
Improving market share through greener products and services	3b
Supporting sustainable business	3
Measuring eco-efficiency	2f
Improving environmental performance	3
Developing greener products, processes & services	3
Greater emphasis on environmental considerations in decision making process	3a
Internalising external environmental costs	1
Providing environmental cost information	2/3
Identifying hidden environmental costs	3c
Identifying cost reduction opportunities	3c
Improving cost control	3
Reducing the cost of inefficiency	3c
More accurate costing and pricing of products	2c
Guiding product mix and development decisions	2e
Comparing costs across facilities	0
Evaluating alternative manufacturing inputs	2e
Improve resource allocation decisions	2e
Serve as basis for budgeting	1

Table 1 continues on 78

10.2.1.1 *Comments on Table 1*

- (a) AT&T follows a Design for the Environment philosophy that attempts to integrate environmental considerations into business decisions and activities.
- (b) AT&T believes that through addressing social concerns about its impact on the environment, it increases value for its customers and enhances company competitiveness.
- (c) Through Activity Based Costing and Management, AT&T wants to identify hidden environmental costs and search for ways of reducing these costs.
- (d) The Green Accounting project, specifically through Activity Based Costing and Management, supplies AT&T with data that can be used for performance measurement indicators.
- (e) One of the uses of EA for AT&T is to assess current and future design impacts with regard to resources, processes and products.
- (f) Through EA, AT&T desires to improve the understanding impact of the company's activities on the future.

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10.2.2 Table 1 of the EA Review Model Application to AT&T: Objectives and potential uses of Environmental Accounting (continued)

POTENTIAL USES OF EA	Ranking
More cost effective environmental management	2/3
Prioritising environmental initiatives	2
Assessing opportunities for pollution prevention	3
Evaluating waste management and energy efficiency options	3
Improving environmental, health and safety performance	3
Supporting the development of an environmental management system	2
Improving environmental compliance strategies	2
Decision making	3
Applying EA to cost allocation	3a
Applying EA to capital budgeting	0
Applying EA to process & product design	3b
Other	3
Raising employee awareness of environmental issues & responsibility	3
Provide evidence of compliance with environmental regulations and/or expectations of stakeholders	3c
Providing information that can drive environmental responsible behaviour throughout the organization	3

10.2.2.1 Comments on Table 1 (continued)

- (a) Through Activity Based Costing and Management, the “cause drivers” of environmental activities and their associated costs are identified, and attempts can then be made to reduce or eliminate these costs.
- (b) AT&T is committed to a Design for the Environment philosophy which calls for environmental considerations to be incorporated into product design from the outset.
- (c) AT&T sees customer expectations as a driver for improving environmental performance.

10.2.2.2 Evaluation of Table 1

In general, AT&T scored well against the guidelines of the EA Review Model in table 1. The relative importance of EA was considered to be high in all categories or aspects relating to the potential of EA: decision making, more cost effective environmental management, providing environmental cost information, supporting sustainable business, financial incentives, and management incentives. This could be attributed to the fact that AT&T already had other programs in place that attempt to integrate environmental considerations into business decisions, such as the Design for the Environment and Activity Based Costing programs. Top management has already decided that environmental

considerations are important for business decisions and accordingly, top management had high expectations of the potential benefits of EA. AT&T also scored well in the sub-categories of table 1, indicating that the company has an understanding of how to achieve the overarching or broader goals of implementing EA.

10.2.3 Table 2 of the EA Review Model Application to AT&T: Scale & scope of the environmental accounting exercise

Scale	Ranking	Scope (types of costs included)	Ranking
Process (e.g. production line)	0	Conventional costs	3
System (e.g. wastewater treatment)	0	Hidden costs	3
Product or product line	0	Contingent costs	1
Facility, department or location	3a	Relationship / Image costs	0
Regional groups of departments or facilities	3a	Societal / External costs	2b
Corporate division or entire company	3a		

10.2.3.1 Comments on table 2

- (a) The findings and recommendations of the EA project were intended for consideration and implementation throughout AT&T. The first phase of the EA project was aimed at developing tools and techniques for EA, which could then be tried and implemented by the different AT&T divisions and departments themselves.
- (b) Although the focus of the EA project is firstly on internal costs, the issue of external costs is also addressed through initiatives such as the Takeback Program, Supply Line Management, and Life Cycle Analysis.

10.2.3.2 Evaluation of table 2

AT&T does not consider the investigation of contingent or image and relationship costs as important at present. However, the company's external environmental impacts and costs are considered through initiatives such as Life Cycle Analysis. And the Takeback Program. These efforts do address contingent costs and image or relationship costs to some extent. Both the scale and the scope of the Green Accounting project are broad. This indicates that AT&T is investigating its environmental costs extensively enough to achieve the broad aims of its EA project as shown in table 1.

10.2.4 Table 3 of the EA Review Model Application to AT&T: Definitions of internal environmental costs and benefits

Types of cost or benefit	Examples	Ranking
Internal environmental costs		
Direct environmental expenses	General	3a
	Costs of failure or remediation	0
	Costs of monitoring	0
	Costs of prevention	0
	Costs of proactive environmental programs	3
Business-integrated environmental expenses	Incremental costs of environmental considerations influencing normal business decisions	2
	Costs of time that staff spend on environmental management	3
Resource expenses	Costs of resources	3
	Costs of resource inefficiency	2
Other		0
Internal environmental benefits		
Revenues	Reduce, re-use and recycle schemes	2
	Products and services sold primarily on the basis of environmental considerations	0
Savings and cost avoidance	Cost savings resulting from environmental actions, e.g. reduced waste disposal costs	2
Intangible benefits	Enhanced public image and customer perceptions	0
	Improved staff morale	0
Reduction of environment-related financial risks		2b
	Risk of major environmental incidents	0
	Adverse environmental impacts over time, e.g. hazardous waste leakage	0
	Damage to public image and reputation	2
	Risk of loss of business profitability through e.g. environmental taxes, if the business process is environmentally unsustainable	0
Other		0
External environmental costs		
Life cycle costs		2c
Product takeback		2c
Supply line management		2c
External environmental benefits		
Design for the environment		2c

10.2.4.1 *Comments on table 3*

- (a) The focus of AT&T's EA project has been on conventional and potentially hidden environmental costs. The case study did not provide enough information to further analyse these costs.
- (b) Enough detail was not available to further break down this category.
- (c) AT&T is a proponent of the Design for the Environment approach, which aims to integrate life-cycle environmental impacts into all business decisions. Priority areas for the development of AT&T's Design for the Environment program is life cycle analysis, supply line management and product takeback. Through these initiatives, AT&T are attempting to identify and estimate the value of their external environmental costs. AT&T believes that EA can support these initiatives by developing methods and tools to identify and value external environmental costs.

10.2.4.2 *Evaluation*

To date, AT&T has focused more on internal environmental costs and benefits than on external costs. Internal benefits have received less attention than internal costs, probably because these are more difficult to identify and quantify. The EA Review Model guidelines in table 3 reveal a weakness in AT&T's approach to environmental costs. The relevance of contingent environmental costs (the reduction of environmental risks) is acknowledged, as well as the importance of the company's public image on environmental issues. However, the focus of the company's EA project does not include contingent and image and relationship costs at present. The need for and methods of investigating and managing contingent and image and relationship costs could be developed further. At present these concerns are addressed mainly through the initiatives on managing external environmental costs, and are not receiving due attention.

10.2.5 Table 3 of the EA Review Model: Non-financial sources of environmental cost information

The case study did not contain any information on the non-financial sources of environmental cost information. No mention was made of potential sources of environmental cost information other than the financial information system.

10.2.6 Tables 5 to 10 of the EA Review Model: Conventional and potentially hidden environmental costs

Tables 5 to 10 of the EA Review Model could not be applied to the AT&T case study. These tables list the types and subcategories of conventional and potentially hidden environmental costs that can be identified from financial data sources. The AT&T case study did not contain any more information on environmental costs than these presented in tables 2 and 3. It is clear from the references to the investigation of environmental costs in the case study that AT&T has put effort into identifying potentially hidden environmental costs and allocating these costs to the original sources. Unfortunately no detail was supplied on the costs categories that were used.

10.2.7 Table 4 of the EA Review Model Application to AT&T: Implementing an environmental accounting project

Committing resources to the EA project	3
Provide adequate resources (staff and time)	3
Indicate clear top management support to the whole company	3
Ensure company wide support and co-operation	3
Ensure serious consideration of the project's recommendations	3
Selection of the EA team	3
Select a multidisciplinary EA team with members from different company departments and/or levels	3
Work toward better co-operation and integration between the environmental and financial management functions	3a
Educate financial managers about environmental management	3a
Educate environmental managers about financial management	3a
Gathering data	3
Determine what data is needed to thoroughly assess the financial implications, now and in future, of environmental pressures	3b
Determine how much of this data is being collected already and from what sources, and whether it could be processed and presented in formats more suitable to the project	3b
Determine standardised definitions of environmental costs and data collection procedures that are suited to the objectives of the project	3
Consider whether modifications to the general ledger codes will provide better environmental cost and benefit data, or whether separate environmental cost data systems should be developed	2b
Consider what non-financial data, from which sources, is needed and available for the project and whether this data can be reported and presented in more suitable ways	1b
Find ways of simplifying the reporting and presentation of data, such as matrices and checklists	3c
Communicate environmental cost and benefit information effectively through the organization	3
Other	
A literature review process was conducted by the EA team to gather theoretical knowledge on EA relevant to the AT&T project.	3
An EA Glossary was developed to define key EA terms	3
An EA Self Assessment Tool for the implementation of EA throughout AT&T was developed	3

10.2.7.1 *Comments on table 4*

- (a) A multi-functional team with global representation was established to develop and implement EA. The team included members from traditionally separate functions such as environmental, accounting, finance, process/product design, research and development, and marketing. Through the selection of a multi-functional team, the whole organization could be involved and prepared for implementing Environmental Accounting.
- (b) The Activities/Resources matrix can be used to determine which data is needed and available. While it was recommended that the current accounting

system's capabilities should be assessed, no mention was made of other (non-financial) potential data sources.

(c) The EA team developed a Self Assessment Tool to be used throughout AT&T for the implementation of EA. The Self Assessment Tool included a:

1. Status Survey (to evaluate the current status of decision-making processes and accounting systems, and to drive behaviour in the desired direction).
2. Environmental Activities Dictionary (to identify environmental activities that could serve as a basis from which to initiate EA).
3. Activities/Resources Matrix (to identify, for the different environmental activities, the potential resource categories that might be utilised). See the example in figure 5 below.
4. Protocol (a set of guidelines for implementing and adapting the Self Assessment Tool).

Activities	Resource costs with environmental focus			
	People	Materials	Consulting fees	Energy, etc. →
Training	Relevant data			
Permits				
Monitoring				
Reengineering				
Recycling				
Etc. ↓				

Figure 5: AT&T's activities/resources matrix

The matrix lists the most important (from an environmental point of view) activities of AT&T and several major resource categories. The matrix is used to determine which data is needed for the investigation of environmental costs. For example, for the cell corresponding to permits and materials the user would investigate which materials in the division or plant require permits. Once the relevant data requirements have been identified, it must be determined if the data is available. Where data is required but unavailable, the financial and environmental information systems need to be modified in order to supply the appropriate data.

10.2.7.2 Evaluation

Measured against the guidelines of the EA Review Model, the process AT&T followed in developing their EA project was very thorough. Enough resources were committed to the project to ensure that the EA team could function properly and that the rest of the company understood the importance of the project. The team selection involved people from different departments and levels of the company, so that the project could benefit from multi-disciplinary work methods.

The issues surrounding data collection also received due attention with the development of the Green Accounting Self Assessment Tool. Unfortunately the case study did not include detailed information on the Activities/Resources Matrix of the Self Assessment Tool. The matrix is potentially very useful in facilitating the identification and prioritising of environmental activities and resources that are the main environmental cost drivers. The EA team recommended that this tool be further developed through feedback from different sites during the implementation stage of the project.

10.2.8 Table 5 of the EA Review Model Application to AT&T: Business systems used to support environmental accounting

Approach	Ranking
Environmental management system	3a
Existing financial reporting system	3
Existing environmental reporting system	0
Environmental or material balance sheets	0
Environmental financial statements	0
Other: AT&T EA self assessment tool	3b

10.2.8.1 Comments on table 5

- (a) AT&T believes that improved environmental management strategies are important in three ways:
- They enhance customer satisfaction through meeting the environmental expectations of customers.
 - They increase organizational effectiveness by involving everyone in the mission to improve environmental quality.
 - They increase company competitiveness, because improving AT&T's environmental performance significantly increases value for its customers.
- (b) AT&T understands the importance of integrating the financial and environmental information and systems in the process of identifying and analysing environmental costs. The company did not have a single cost accounting or environmental support system in place at the time the case study was done. Investigations into environmental costs were being done by some company divisions, but no common methods existed. This is illustrated in table 5, which shows no information systems apart from the traditional environmental and financial ones. To address the problem the EA team developed the Green Accounting Tools to establish a common understanding and approach to environmental costs.

10.2.8.2 Evaluation of table 5

The existing financial and environmental information systems are not ideally suited to provide environmental cost information. The EA Self Assessment Tool may assist management throughout the company in identifying, allocating and analysing environmental cost information. The tool has the potential of being used in conjunction with both the financial and environmental information systems, utilising both financial and non-financial data sources. Against the guidelines of table 5 of the EA Review Model, AT&T has the potential (tools) to identify, allocate and analyse environmental costs and to integrate financial and environmental considerations in the process. The tool must still be implemented and revised if necessary though.

10.2.9 Table 6 of the EA Review Model Application to AT&T: Techniques for processing environmental data into information for management purposes

Techniques	Examples	Ranking
Performance measurement	Eco-balance	2a
Budget setting & control		0
Internal auditing		0
Full-cost accounting		0
Life-cycle assessment		3
Design for environment / Life-cycle design		3
Costing	Environmental cost allocation	3
	Activity based costing	3
	Quality costing	2
	Product costing	2
	Life-cycle costing	1b
	Cost projection	0
	Strategic costing	0
Pricing		0
Demand forecasting		0
Investment appraisal / Capital budgeting		0
Shareholder value analysis		2c
Environmental value analysis		0
Total quality management / Total quality environmental management		3d
Business process re-engineering / Cost reduction		2e
Cost of quality model / Cost of environmental quality model		3d
Other		
Product take back program		3
Pollution prevention program		3
Supply line management		3

10.2.9.1 *Comments on table 6*

- (a) The EA team suggested that the tools of the Green Accounting project should be used by facilities to test the extent to which environmental considerations are being integrated into their business decisions. No tools for the tracking of materials and energy through the organization have been developed yet, but the Resources/Activities matrix of the EA project tools might be useful in this regard.
- (b) Life cycle impacts are being considered by AT&T through the Design for the Environment program, but the techniques for costing these impacts must be developed further.
- (c) AT&T acknowledges the importance of meeting the environmental expectations of customers, but formalised procedures for estimating and analysing such expectations are not in place yet.
- (d) Total quality management principles and a cost of quality model are used to support AT&T's environmental goals. Through these approaches priorities are focused on prevention by source reduction first, followed by reuse, recycling and treatment, and disposal as the last option.
- (e) This approach is not explicitly mentioned, but is implied by the Design for the Environment program.

10.2.9.2 *Evaluation of table 6*

AT&T has many programs in place that can support EA, such as Design for the Environment, Life Cycle Assessment, and Activity Based Costing. The Activity Based Costing system still needs to be adapted to prioritise the identification and allocation of environmental costs. The process of environmental cost allocation should combine well with activity based costing. The EA Self Assessment Toolkit could be useful in this regard. AT&T is very strong in considering the environmental impacts in its supply and customer chain, with programs for life-cycle assessment and design, product takeback and supply-line management in place.

Measured against the guidelines of the table 6 of the EA Review Model, AT&T scores well since it has many mutually supportive programs that aim to integrate environmental considerations into business decisions.

10.2.10 Table 7 of the EA Review Model Application to AT&T: Checklist for evaluating the overall performance of environmental cost management

Goals	Procedures	Ranking
Informing decision makers	Regular summaries of environmental cost information available to management	2a
	Environmental cost information tracked and allocated to processes & products	3b
Making managers accountable	Managers held accountable for environmental costs they generate	0
	Full costs or surcharges charged for waste management & energy consumption	0
Improving environmental performance	Devise incentives for encouraging more effective management of environmental costs	3
Anticipating future environmental costs	Cost accounting supplemented with materials accounting – assessment of input, use and release of materials with significant environmental impact	2c
	Potential future environmental costs or liabilities associated with significant environmental impacts are estimated	0
Integrating environmental considerations into business processes	Environmental accounting practised on an ongoing basis	3
	Environmental cost information integrated into routine business activities such as capital budgeting and product development	3

10.2.10.1 Comments on table 7

- (a) No procedures are in place yet to achieve this, but the EA team has made it clear that EA should be practised on an ongoing basis and that the information generated should be made available to all decision-makers.
- (b) Some company divisions have started applying environmental cost allocation, for the company as a whole the tools needed to implement cost allocation have been developed, but must still be implemented.
- (c) AT&T is not doing materials accounting yet, but it is one possible application of the EA Self Assessment Toolkit.

10.2.10.2 Evaluation of table 7

Compared to the EA Review Model's guidelines, AT&T has a good understanding of the importance of identifying and tracking environmental costs, and of integrating environmental considerations into business decisions. They also acknowledge the need of incentives to encourage the desired behaviour throughout the company. In devising incentives, AT&T could consider finding ways in which different business units and/or managers could be made responsible for the environmental costs that they generate, such as charging full

costs for wastes generated and energy consumed. Since the EA tools have not been implemented yet at the time the case study was conducted, no plans have been formulated on how to hold managers responsible for the environmental costs they generate.

10.2.11 Table 8 of the EA Review Model Application to AT&T: Findings and recommendations of an environmental accounting project

Findings	Examples	Ranking
Potential reductions in environmental costs	More cost effective waste management alternatives or raw materials	0a
Benefits should be extended to other departments, facilities or the whole organization	Assessment package to be distributed to other AT&T business units	3
Need for changes in the organization's environmental, accounting or managerial practices	Biases in the allocation of environmental costs	2
	No single cost accounting system or environmental management system in use across the corporation	3
Other	Develop guidelines for the most important environmental activities and methods for assigning costs	3
	Create incentives to drive the desired environmental behaviour	3

10.2.11.1 Comments

(a) Since the EA project had not yet reached its implementation phase, the anticipated reductions in environmental costs could not yet be confirmed or denied.

10.2.11.2 Evaluation

AT&T's top management is certain that EA will provide many benefits to the company. Thus environmental cost savings are anticipated and the EA tools are intended for implementation in the whole company. As could be expected, the EA team concluded that changes in the company's organizational, environmental, financial and managerial practices could be expected. The EA team recognised that, apart from the Self Assessment Tool, further guidelines, such as for identifying the most important environmental activities and for methods of assigning costs, should be developed to facilitate the necessary changes.

10.2.12 Conclusion

10.2.12.1 Vision

AT&T's Green Accounting project reflects a good understanding of the philosophy and practice of EA. This may be because environmental

considerations are already influencing AT&T's business decisions, through programs such as Design for the Environment. Therefore AT&T believes that EA has many potential benefits to offer AT&T and the Green Accounting team identified many areas throughout AT&T where EA could be successfully applied.

10.2.12.2 Process

The process the EA team followed during the planning stage of its EA project is a good example for others to follow. The expectations AT&T's management had of EA were effectively put into practice through the establishment of the Green Accounting team. Adequate resources were allocated to the project to signal the commitment of AT&T's top management to EA. The team worked on a multi-disciplinary basis, involving people from different divisions in the company. This ensured that the tools designed by the team were suited to the specific needs and constraints of AT&T. The Green Accounting team's broad representation of the different AT&T divisions would also ease the implementation of the designed EA tools.

10.2.12.3 Tools, methods and techniques

The Green Accounting team developed effective tools for communicating the theory and practice of EA throughout the company. The tools provide the different divisions in the company with methods that can, step by step, assist in the implementation of EA. Some of the tools, such as the Environmental Activities/Resources Matrix, will need to be developed further, but this can only be effectively done with feedback from the different divisions during the implementation stage of the EA project. The EA project also has the potential of linking up well with other business techniques and systems in place throughout the company. Through such programs as life cycle assessment, environmental costs have already been investigated and that information has been integrated into the decision-making processes. This will ease the implementation of EA.

10.2.12.4 Shortcomings

AT&T might consider to pay more attention to contingent environmental costs and image and relationship costs as well. Part of the motivation for AT&T to implement EA is to support sustainable business and to indicate the company's commitment to environmental concerns to stakeholders. Investigating potential environmental liabilities and the environmental perceptions and expectations of stakeholders could help the company to achieve this.

The activities/resources matrix of the EA tools will provide insight and information on the flow of materials, energy and wastes through the company. However this

tool only addresses certain activities and resources. AT&T should evaluate whether the information provided is adequate, and whether it might not be more useful to develop a comprehensive material and energy balance sheet.

10.2.12.5 Feedback and continuous improvement of the Green Accounting tools

The Green Accounting team acknowledged that EA is an ongoing activity and an iterative process. Accordingly they saw their role not as that of imposing EA on the rest of the organization, but rather to “facilitate Green Accounting throughout AT&T by communication, education, and development of approaches and tools that can be used to foster accountability and better management processes for achieving environmental goals”⁶⁶. The different sites or divisions within AT&T will have to adapt, modify and prioritise the Green Accounting tools to suit their specific needs and limitations. To facilitate this, processes for receiving feedback on and continually improving the Green Accounting tools have been planned for the implementation phase of the project.

Through the Green Accounting project, AT&T has developed an effective toolkit to guide the company through the process of implementing EA. Both the process of designing the EA toolkit and the products thereof reflect a very good understanding of the opportunities and challenges presented by EA. Measured against the guidelines of the EA Review Model, AT&T’s EA project scores well and the company can be judged to have a thorough and effective EA project in place.

⁶⁶ US EPA (1995a) (op cit.) p. 12.

11 EA case study: EA at Sulzer Technology Corporation

11.1 Introduction

Sulzer is a Swiss-based technology company, manufacturing a large number of products such as weaving machines, medical technology, compressors, locomotives, power systems and pumps. Sulzer Hydro is a division of Sulzer that manufactures hydroelectric machinery and engineering. The EA pilot project took place at Kriens, a facility of Sulzer Hydro.

The objective of the EA pilot project was to develop and test new methods of environmental cost management in order to identify opportunities for environmental protection and potential cost savings.⁶⁷ Hence the focus of this EA project is not as broad as the that of AT&T and Ontario Hydro.

11.2 Application of the EA Review Model to the Sulzer case study

11.2.1 Table 1 of the EA Review Model application to Sulzer: Objectives and potential uses of Environmental Accounting

POTENTIAL USES OF EA	Ranking
Management incentives	0
Integrating environmental considerations into business decisions and management	0a
Improving the management performance evaluation process	0a
Safeguarding investment decisions for the future	0a
Striving for competitive advantage	0a
Financial incentives	2
Improved management of environmental costs	3
Short term cost savings	3
Assessing and reducing environmental risks and liabilities	2
Improving market share through greener products and services	0a
Supporting sustainable business	1/2
Measuring eco-efficiency	0a
Improving environmental performance	3
Developing greener products, processes & services	0a
Greater emphasis on environmental considerations in decision making process	2
Internalising external environmental costs	1

Table 1 continues on the next page

⁶⁷ Schroeder, G. & M. Winter (1998) Environmental Accounting at Sulzer Technology Corporation in Bennet, M. & P. James (eds.) (1998a) *The green bottom line. Environmental accounting for management: current practice and future trends*. Greenleaf Publishing, Sheffield, p.333.

11.2.2 Table 1 of the EA Review Model application to Sulzer: Objectives and potential uses of Environmental Accounting (continued)

POTENTIAL USES OF EA	Ranking
Providing environmental cost information	2/3
Identifying hidden environmental costs	3
Identifying cost reduction opportunities	3
Improving cost control	3
Reducing the cost of inefficiency	2
More accurate costing and pricing of products	1
Guiding product mix and development decisions	2
Comparing costs across facilities	0
Evaluating alternative manufacturing inputs	2
Improve resource allocation decisions	0
Serve as basis for budgeting	0
More cost effective environmental management	2/3
Prioritising environmental initiatives	0a
Assessing opportunities for pollution prevention	3
Evaluating waste management and energy efficiency options	3
Improving environmental, health and safety performance	2
Supporting the development of an environmental management system	2
Improving environmental compliance strategies	0a
Decision making	2
Applying EA to cost allocation	3
Applying EA to capital budgeting	0a
Applying EA to process & product design	2

11.2.2.1 *Comments on table 1*

(a) Since the objectives of Sulzer's EA project was only to identify opportunities for environmental protection and potential cost cuts within the boundaries of the Kriens Sulzer site, many of the potential benefits of EA were not considered for this EA project.

11.2.2.2 *Evaluation of table 1*

Measured against the guidelines of the EA Review Model, it is clear that Sulzer EA project is not interested in using EA to promote sustainable business or as input into the general management process. The focus of the project is on improving environmental cost control and identifying opportunities for improving environmental performance and cutting costs. Accordingly, these potential benefits are rated as the ones most relevant to the project. The other potential

benefits that are mentioned, are the ones related to the general activities of the plant, such as assessing pollution prevention opportunities and evaluating waste management and energy efficiency options. Sulzer is, with this EA project, not interested in environmental costs that occur outside of the facility's boundaries. Life cycle or external environmental costs are ignored. The focus is on issues of efficiency, both in terms of environmental management and environmental cost control. In terms of Table 1, Sulzer's EA project aims only to improve environment related financial management and energy and materials accounting.

11.2.3 Table 2 of the EA Review Model application to Sulzer: Scale & scope of the environmental accounting exercise

Scale	Ranking	Scope (types of costs included)	Ranking
Process (e.g. production line)	1a	Conventional costs	3
System (e.g. wastewater treatment)	1a	Hidden costs	2
Product or product line	1a	Contingent costs	0
Facility, department or location	3	Relationship / Image costs	0
Regional groups of departments or facilities	0	Societal / External costs	1b
Corporate division or entire company	0		

11.2.3.1 Comments on table 2

- (a) The focus of the EA project is on the facility; processes, systems or products are analysed to help achieve an integrated assessment of the facility.
- (b) The EA team decided to investigate only costs that occur within the boundaries of the site. External or life cycle costs were ignored.

11.2.3.2 Evaluation of table 2

With the project's focus on improving environment related financial management and energy and materials accounting, the scope of the environmental costs to be investigated is limited to conventional and potentially hidden costs.

11.2.4 Table 3 of the EA Review Model Application to Sulzer: Environmental costs and benefits

Types of cost or benefit	Examples	Ranking
Internal environmental costs		
Direct environmental expenses	General	2a
	Costs of failure or remediation	0
	Costs of monitoring	0
	Costs of prevention	0
	Costs of proactive environmental programs	2
Business-integrated environmental expenses	Incremental costs of environmental considerations influencing normal business decisions	3
	Costs of time that staff spend on environmental management	3
Resource expenses	Costs of resources	3
	Costs of resource inefficiency	1
Other		
External environmental costs		
External environmental costs	Costs of environmental impacts and resource use borne by society and not the organization	0
Internal environmental benefits		
Revenues	Reduce, re-use and recycle schemes	3
	Products and services sold primarily on the basis of environmental considerations	0
Savings and cost avoidance	Cost savings resulting from environmental actions, e.g. reduced waste disposal costs	1
Intangible benefits	Enhanced public image and customer perceptions	0
	Improved staff morale	0
Reduction of environment-related financial risks	Risk of major environmental incidents	2
	Adverse environmental impacts over time, e.g. hazardous waste leakage	0
	Damage to public image and reputation	0
	Risk of loss of business profitability through e.g. environmental taxes, if the business process is environmentally unsustainable	0
Other		0

11.2.4.1 *Comments on table 3*

(a) Sulzer defines some of the types of costs that are defined as direct environmental costs in section 4.2.1, as indirect costs. Examples include the costs of salaries for environmental staff, environmental training, and identifying environmental liabilities. This is because these costs are pooled into overhead accounts and not allocated to environmental accounts.

11.2.4.2 *Evaluation of table 3*

The main focus of Sulzer's EA project is on business-integrated (conventional) environmental costs and resource costs. These costs are related to the flows of materials and energy through the facility. This is a good starting place for implementing EA and investigating new methods of environmental cost management, because if a company has a good picture of its material and energy flows, such as a material balance sheet, these costs are relatively easier to identify. The focus of the EA project could later be broadened to investigate direct environmental costs in depth as well. These costs may be more difficult to trace because it may be hidden in overhead accounts.

11.2.5 Table 4 of the EA Review Model Application to Sulzer: Non-financial sources of environmental cost information

Estimated environmental costs from non-financial information sources	Information sources	Ranking
Energy and materials	Energy and materials tracking	3a
	Operational process records	2
	Product specifications and profiles	2
Energy and materials (ISO 14001 EMS)	Environmental impact assessments	0
	Register of environmental aspects	0
	Environmental objectives and targets	0
	Environmental management program	0
Non-product output	Emissions estimates	3
	Production logs	0b
Maintaining environmental equipment	Maintenance logs	0b
	Service contracts	0b
Process-penalties/shut-downs	Operating research	0
Monitoring	Engineering estimates	0b
	Management estimates	0
Environmental training	Personnel, EH&S records	3
	Management estimates	0

11.2.5.1 *Comments on table 4*

- (a) Sulzer does energy and materials tracking through the use of input-output sheets. These sheets define and record different categories of material and energy inputs and outputs.
- (b) Very little information was available in the case study on the existing information systems used for data collection. When the existing systems could not provide the information that the project required, a process of manually identifying data had to be carried out. Sources other than the existing information systems included: security papers, delivery invoices, disposal proofs, invoices from the disposal company, and statistics on dangerous substances. Unfortunately only examples of these information sources were given and not detailed lists.

11.2.5.2 *Evaluation of table 4*

Compared to the guidelines of the EA Review Model it is clear that the main source of non-financial environmental information was the material balance (input-output) sheets that the EA team developed. The development of input-output sheets enable the team to track all energy and material flows through the facility. The input and output sheets also provide data on material/energy costs, data sources, and data quality. Other data sources were supplementary to this. Little information was made available in the case study on the other data sources utilised, but it is clear that, as far materials accounting is concerned, the EA team has thoroughly gone through the process of identifying different environmental data sources for the project and for future reference.

11.2.6 Table 5 of the EA Review Model Application to Sulzer: Conventional environmental costs

Conventional costs	Ranking	Data source (if not general ledger)
Capital equipment	3	
Materials	3a	Material input-output sheets
Labour	3	
Supplies	3	
Utilities	0	
Structures	0	
Salvage value	0	
Other	0	

11.2.6.1 Comments on table 5

(a) These sheets are material and energy balance sheets that are designed to track all material and energy flows through the facility. (See figure 3 in section 5.3.3.1) A matrix is drawn up with inputs on the vertical axis, for example:

energy and physical substances to produce energy

- electricity
- oil
- petrol, etc.

material

- coolants
- steel sand, etc.

auxiliary material, etc.

Outputs make up the horizontal axis, for example:

products

- HA machines
- HA electronics, etc.

recycling material

- steel and non-ferrous metals
- wood
- glass, etc.

waste, etc.

The resulting matrix displays all the energy and materials that enter the facility, and track these through the different processes to the products and waste that leave the facility. The energy and material data presented in the input-output sheets are then linked to the identified processes, presenting a secondary set of tables that link the main processes to its respective inputs and outputs. This data is then combined with additionally collected financial data to produce tables with aggregated data on environmental costs for different processes.

11.2.6.2 *Evaluation of table 5*

The material input-output sheets are a very effective way of identifying and tracking conventional environmental costs. It enables Sulzer to review its most important environmental costs, to identify the processes where most environmental costs occur and to analyse the relations between different categories of environmental costs.⁶⁸

Environmental cost identification and allocation were also done for capital equipment, labour and supplies, but the case study did not provide details of how the environmental proportion of these4 costs were determined.

11.2.7 Table 6 of the EA Review Model: Potentially hidden environmental costs (upfront and back-end)

This table was not applicable to the case study. These costs fall outside of the scale and scope of Sulzer's EA project, since they deal with planning new or decommissioning old plants, Sulzer's project focussed only on one existing plant.

⁶⁸ Schroeder, G. & M. Winter (1998) (op cit.) p.345.

11.2.8 Table 6 of the EA Review Model Application to Sulzer: Potentially hidden environmental costs (regulatory)

Regulatory costs	Identified?	Data source (if not general ledger)
Notification	0	
Reporting	0	
Monitoring/testing	Yes	
Studies/modelling	0	
Remediation	0	
Recordkeeping	0	
Plans	0	
Training	Yes	
Inspections	0	
Manifesting	0	
Labelling	0	
Preparedness	0	
Protective equipment	0	
Medical surveillance	0	
Environmental insurance	0	
Financial assurance	0	
Pollution control	Yes	
Spill response	0	
Stormwater management	0	
Waste management	Yes	
Taxes/fees	0	
Other	0	

11.2.9 Table 7 of the EA Review Model Application to Sulzer: Potentially hidden environmental costs (voluntary)

Voluntary costs	Identified?	Data source (if not general ledger)
Community relations/outreach	0	
Monitoring/testing	Yes	
Training	Yes	
Audits	0	
Qualifying suppliers	0	
Reports (e.g. annual environmental reports)	0	
Insurance	0	
Planning	0	
Feasibility studies	0	
Remediation	0	
Recycling	Yes	
Environmental studies	0	
R & D	0	
Habitat and wetland protection	0	
Landscaping	0	
Other environmental projects	0	
Financial support to environmental groups and/or researchers	0	

11.2.10 Table 8 of the EA Review Model Application to Sulzer: Potentially hidden environmental costs (contingent)

Contingent costs	Identified?	Data source (if not general ledger)
Future compliance costs	Yes	
Penalties / fines	0	
Response to future releases	0	
Remediation	0	
Property damage	0	
Personal injury damage	0	
Legal expenses	0	
Natural resource damages	0	
Economic loss damages	0	
Other	0	

11.2.11 Table 1C of the EA Review Model: Potentially hidden environmental costs (image and relationship)

These costs fall outside of the focus of Sulzer's EA project.

11.2.11.1 Evaluation of tables 6 to 8 (Potentially hidden environmental costs)

Apart from data available from the material and energy balance sheets, additional financial data on hidden or indirect environmental costs also had to be collected. This data was combined with the data from the input-output sheets in tables. Thus tables of environmental costs were created for example, for the different waste streams, for the different end-of-pipe pollution technologies, or for the different recycling streams.

	Waste 1	Waste 2
Permitting		
Monitoring		
Staff training		
Compliance		
Pollution control		
Recycling		
Waste management		
Etc. ↓		

Figure 6: Potentially hidden costs combine with material balance sheet information

Figure 6 indicates how categories of potentially hidden environmental costs can be used in conjunction with information from material balance sheets. For example: a specific waste stream can be identified and then be checked against the potentially hidden environmental costs categories to see if and where hidden costs occur.

Unfortunately the case study did not contain detailed information on the indirect environmental costs that were identified, but only a few examples, as indicated in tables 6 to 8 on pages 100 - 101 on financial cost information. Therefore it can not be assessed how effectively indirect or potentially hidden environmental costs were traced. The fewer the categories of potentially hidden costs that were used, the higher the likelihood that some hidden costs may have been overlooked. The method that the EA team employed is sound. What is not clear from the case study is which categories of potentially hidden environmental costs were used in conjunction with information from the input-output sheets. How thoroughly potentially hidden environmental costs were investigated can not be judged from the information available in the case study.

The EA project found that direct environmental costs made up 4,47% of total costs, while indirect (or hidden) environmental costs amounted to only 0,33%. The case study did not contain enough detail to determine whether hidden environmental costs do in fact make up such a relatively small proportion of environmental costs, or whether some hidden environmental costs may not have been identified. While the methodology of the EA project ensures that all of the direct or conventional environmental costs are identified and traced, the same can not be said for the indirect or potentially hidden environmental costs.

**11.2.12 Table 9 of the EA Review Model Application to Sulzer:
Business systems used to support environmental accounting**

Approach	Ranking
Environmental management system	0
Existing financial reporting system	0
Existing environmental reporting system	0
Environmental or material balance sheets	3
Environmental financial statements	0

11.2.12.1 Comments on table 9

Apart from the material balance sheets created by the EA team, the case study only mentions that other existing information systems were utilised for gathering environmental information. No detail was provided of which systems exist and were used. Most likely the environmental management system and financial reporting system were used.

11.2.13 Table 4 of the EA Review Model: Techniques for processing environmental data into information for management purposes

This table was not applicable to the case study. Sulzer does not have any other program or technique in place for providing environmental information or analysing this information to inform business decisions. Sulzer's EA project was the company's first attempt at developing environmental cost information and management systems.

11.2.14 Table 13 of the EA Review Model: Assessing the strategic significance of an organization's environmental impacts

This table was not relevant to the case study because the EA project did not investigate contingent costs.

**11.2.15 Table 10 of the EA Review Model Application to Sulzer:
Implementation of an environmental accounting project**

Committing resources to the EA project	Ranking
Provide adequate resources (staff and time)	3
Indicate clear top management support to the whole company	0a
Ensure company wide support and co-operation	0a
Ensure serious consideration of the project's recommendations	3
Selection of the EA team	Ranking
Select a multidisciplinary EA team with members from different company departments and/or levels	3b
Work toward better co-operation and integration between the environmental and financial management functions	2
Educate financial managers about environmental management	0
Educate environmental managers about financial management	0
Gathering data	Ranking
Determine what data is needed to thoroughly assess the financial implications, now and in future, of environmental pressures	2c
Determine how much of this data is being collected already and from what sources, and whether it could be processed and presented in formats more suitable to the project	3
Determine standardised definitions of environmental costs and data collection procedures that are suited to the objectives of the project	3
Consider whether modifications to the general ledger codes will provide better environmental cost and benefit data, or whether separate environmental cost data systems should be developed	1
Consider what non-financial data, from which sources, is needed and available for the project and whether this data can be reported and presented in more suitable ways	2
Find ways of simplifying the reporting and presentation of data, such as matrices and checklists, that can communicate environmental cost and benefit information more effectively through the organization	3

11.2.15.1 Comments on table 10

- (a) As the scale and scope of the project was small, and the team members were able to gather all the necessary data between them, these issues were not addressed by the EA team.
- (b) The team included an engineer, a financial analyst, the Vice-Director of Environment, an environmental manager and a MIBE research associate.
- (c) The future needs for environmental data were not considered.

11.2.15.2 Evaluation of table 10

Against the EA review Model's guidelines, the communication with the rest of the company was not good. However, this was a small EA project and could be carried out by a small team working on their own. Also, Sulzer wanted only to develop new methods of environmental cost management and identify opportunities for environmental protection and potential cost savings, not to

implement EA on an ongoing basis. Given the objectives of the EA project, the resources committed and team selected were adequate. The data gathering process was adequate compared to the EA Review Model's guidelines. Changes to the accounting system were not considered, because the input-output sheets were developed to provide environmental cost information.

**11.2.16 Table 11 of the EA Review Model Application to Sulzer:
Evaluation of environmental cost management**

Goals	Procedures	Ranking
Informing decision makers	Regular summaries of environmental cost information available to management	0
	Environmental cost information tracked and allocated to processes & products	3
Making managers accountable	Managers held accountable for environmental costs they generate	0
	Full costs or surcharges charged for waste management & energy consumption	0
Improving environmental performance	Devise incentives for encouraging more effective management of environmental costs	0
Anticipating future environmental costs	Cost accounting supplemented with materials accounting – assessment of input, use and release of materials with significant environmental impact	3
	Potential future environmental costs or liabilities associated with significant environmental impacts are estimated	2
Integrating environmental considerations into business processes	Environmental accounting practised on an ongoing basis	0
	Environmental cost information integrated into routine business activities such as capital budgeting and product development	1

11.2.16.1 Evaluation of table 11

The EA team did not make recommendations on how the projects findings (potential cost savings) could be realized in practice. Possible ways of doing this, such as steps to hold managers accountable for the environmental costs they generate, or incentives for increasing environmental performance, were not mentioned in the case study. The case study also did not mention any future plans for the EA project, no indication was given that EA would be practised on an ongoing basis. While cost allocation and materials accounting would still be used, the case study did not mention that Sulzer would use EA to investigate their environmental costs in more detail in future.

**11.2.17 Table 12 of the EA Review Model Application to Sulzer:
Findings and recommendations of an environmental accounting
project**

Findings	Examples	Ranking
Potential reductions in environmental costs	More cost effective waste management alternatives or raw materials	3a
Need for changes in the organization's environmental, accounting or managerial practices	Biases in the allocation of environmental costs	3b
Benefits should be extended to other departments, facilities or the whole organization		0

11.2.17.1 Comments on table 12

- (a) The case study identified potential cost savings that amounted to about 33% of the existing environmental costs.
- (b) The case study found that Sulzer's existing material classifications and categories were not suited to the requirements of an environmental classification, and would need to be changed to improve environmental cost control.

11.2.17.2 Evaluation of table 12

Even though the scale and scope of the case study was small, potential environmental cost savings were identified. This illustrates that EA may realize environmental cost savings and trigger innovations in environmental cost management. Given these findings, it is surprising that Sulzer did not decide to investigate their environmental costs in more depth in future.

11.2.18 Conclusion

This case study illustrates that, even on a small scale and within narrowly defined boundaries with regards to the type of costs that are investigated, EA projects can identify potential environmental cost savings and can improve environmental cost management and environmental performance.

11.2.18.1 Vision

By restricting the boundaries of the EA project to the boundaries of the site, and to environmental cost allocation and cost reduction, many of the potential benefits of EA were overlooked. However, Sulzer was successful in realising its objectives with the project, namely to investigate new ways of environmental cost control and to identify opportunities for environmental cost savings. Hopefully the

success of the pilot project will persuade the company to investigate other applications of EA together with cost allocation.

11.2.18.2 *Process*

The EA team worked effectively, managing to realize the objectives of the EA project. This was partly due to the clear understanding the team had of how to realize their objectives: precise definitions were developed of the boundaries (objectives) of the project, of environmental costs, of the process of physical and financial data collection and of identifying environmental costs and savings. The only shortcoming of the cost identification and allocation process was that it was not done in depth – hidden environmental costs were not thoroughly investigated. However, the focus of the EA pilot project seems to have been on conventional environmental costs, especially the tracking of energy and materials. Within this focus the processes were very efficient.

11.2.18.3 *Tools, methods and techniques*

The tracking of energy and material flows through the development of input-output sheets, the linking of these sheets with processes and environmental costs, and the aggregation of this data in tables, were very innovative. If these same methods and tables are cross-checked against potentially hidden environmental costs such as those contained in tables 7 – 10 of the EA Review Model, more costs savings may be realized.

11.2.18.4 *Feedback and continuous improvement*

While it appears that Sulzer will continue to utilise the new environmental cost control techniques developed by the EA project, the case study did not mention any plans to broaden the scale and scope of the EA pilot study or to practise EA on an ongoing basis. Given the success of the EA pilot study, Sulzer should consider practising EA on an ongoing basis.

Since this case study was not done on as broad a scale and scope as the Ontario Hydro and AT&T case studies, it did not score as well as the others against the EA Review Model guidelines. However, within the boundaries of the EA project as defined by Sulzer, the project can be considered to have been successful.

12 Evaluation of the Usefulness of the EA Review Model

12.1 Strengths of the EA Review Model

12.1.1 Table 1 of the EA Review Model (The potential uses and objectives of EA)

This table provided good insight into why the different companies were conducting EA projects. The objectives of the projects were made clear, as well as linkages between objectives pertaining to similar areas of application, such as those objectives pertaining to providing environmental cost information. This table provided a good framework within which the rest of the tables could be understood and evaluated.

12.1.2 Tables 2 and 3 of the EA Review Model (The scale and scope or types of environmental costs)

These tables provided a good insight into the nature and extent of environmental costs that were investigated in the EA projects. The two tables used slightly different classification systems for environmental costs, but when used complementary to each other this was an advantage and allowed more insight into the environmental costs investigated. Table 2 provided an overview and table 3 a more detailed description of environmental costs.

12.1.3 Links between table 1 and tables 2 and 3 of the EA Review Model

The tables on environmental cost information provided a good feedback mechanism to evaluate table 1. The types of costs investigated mirrored the aims the companies had with implementing EA. For example, in the Sulzer case study the categories of *Financial incentives* and *Providing environmental cost information* were the highest scoring categories in table 1 on pages 92 - 93. In the environmental cost categories (table 2 on page 94), the conventional and hidden cost categories were the only costs considered, confirming the focus of Sulzer on the identification of cost savings opportunities within the boundaries of the plant.

Tables 2 and 3 could also reveal whether a company's stated objectives with an EA project are unrealistic. For example, if a company had an objective such as *Supporting sustainable business* (table 1 on page 43) but did not investigate one or more of contingent costs, relationship/image costs or societal/external costs (table 2 on page 45), one might suspect that the objective was simply wishful

thinking or lip service. One would then need to look at the other tables, in particular tables 11 and 12 (pages 52 and 53) to confirm or deny the suspicion.

12.1.4 Tables 11 and 12 of the EA Review Model (Business systems used to support environmental accounting and techniques for processing environmental data into information for management purposes)

These tables provided a good insight into the extent to which environmental considerations were being integrated into business decisions of the companies. It also linked up well with table 1 and provided further insight into the aims of the companies implementing EA and how serious they were about it. For example: AT&T scored well in the category of supporting sustainable business in table 1 (page 76). The company did not investigate contingent environmental costs or image/relationship costs though, (tables 2 and 3 on pages 79 and 80) which might lead one to question the extent of their commitment to using EA to promote sustainable business. However, table 12 of the EA Review Model (page 86) showed that AT&T had several initiatives, such as design for the environment, life-cycle analysis and product takeback, which indicate a clear commitment to promoting sustainable development.

12.1.5 Table 14 of the EA Review Model: Implementation of an environmental accounting project

Table 14 gave a very good overview of the most important elements of the implementation of EA. It succeeded in describing the implementation as a process built on a few basic principles.

12.1.6 Table 15 of the EA Review Model: Findings and recommendations of an environmental accounting project

This table was useful in allowing a summarised assessment of whether the EA project had some success, even though this table alone can not determine it. It also created a generic framework within which the recommendations made by the EA teams could be interpreted.

12.1.7 Table 16 of the EA Review Model: Evaluation of environmental cost management

Table 16 of the EA Review Model provided insight into the process of integrating EA information into business decisions. For instance, table 16 showed that neither Ontario Hydro nor Sulzer had informed their decision-makers (managers) of the findings of the EA projects. Neither AT&T, Ontario Hydro or Sulzer have put plans into action to make managers more accountable (see tables on pages

71, 88 and 106). This is understandable, since AT&T and Ontario Hydro's EA projects were still in the beginning phase of implementation. Sulzer's project was focused on developing new methods of environmental cost management (by the EA team on its own) and not on implementing EA throughout the company (see comment (a) on table 10 on page 105). Table 16 provided insight into the EA projects through evaluating the extent to which the goals of the EA projects have been achieved.

12.2 Shortcomings of the EA Review Model

12.2.1 Tables 4 to 10 of the EA Review Model

The tables on non-financial and financial sources of environmental data were not successful in shedding more light on the process of identifying environmental costs. On the one hand this is because the case studies did not contain enough information to complete these tables. The level of detail required to complete these tables might be achievable only through applying the EA Review Model to an ongoing EA project.

Another problem with these tables is that they contain too much detail. The tables could theoretically be useful to test for example, the adequacy of the categories of potentially hidden environmental costs identified in a cost inventory (see page 103). However, because of all the detail, the tables bring little focus or guidelines to the process of identifying environmental costs. The strength of tables like Table 16 of the EA Review Model (evaluation of environmental cost management) and Table 14 of the EA Review Model (implementation of an environmental accounting project) is that they are simple and yet grasp essential elements of the processes they describe.

12.2.2 Table 13

Table 13 of the EA Review Model (assessing the strategic significance of an organization's environmental impacts) was not relevant to the focus of the selected case studies. The table could potentially be useful for an EA project that is investigating contingent or image and relationship environmental costs, but there might be many EA projects to which it is not applicable.

12.3 Overall evaluation

The EA Review Model does provide deeper insight into the EA projects to which it was applied. It measures the internal consistency of the EA projects, such as

whether the projects make links between EA and other business initiatives and whether or which of the projects' goals have been achieved.

However, the EA Review Model has a major weakness with regard to synthesizing the insights it generates. In certain instances it even presents contradictions. For example, in the table on the *Implementation of an EA project* on page 70, it is indicated that Ontario Hydro believes it is relevant that company wide support for the EA project is ensured and that the project's recommendation receives serious attention. In the table on the *Evaluation of environmental cost management* on page 71, it is indicated that Ontario Hydro did not provide management with summaries of environmental cost information, nor did the company implement measures to hold managers responsible for the environmental costs they generate, or to provide incentives for environmentally responsible management. These findings appear contradictory. The problem is that the EA Review Model does not distinguish between planned actions and the implementation thereof. Ontario Hydro was developing an education and communication program to communicate environmental cost information to staff, but this program had not been implemented yet. This is not an inherent fault of the EA Review Model, but rather an indication that the EA Review Model was applied to the case studies in an inadequate way. The way the model has been applied groups together insights about planned activities and implemented activities. It is therefore difficult to evaluate the progress of an EA project in reaching its objectives. In order to address this, the model should be applied to EA projects in a way that distinguishes between:

- Planned objectives
- The implementation of actions to achieve those objectives
- An evaluation of the extent to which the implemented actions have achieved the objectives.

12.3.1 Recommended improvements in the application of the EA Review Model

The EA Review Model could be applied to EA projects with a three-fold focus. The model would be applied three times to evaluate an EA project from the following three perspectives:⁶⁹

1. Objectives of the EA project. From this perspective the model would be applied to an EA project with the following questions in mind: What does the company wish to achieve with implementing EA? What is the company's vision and objectives with the EA project?
2. Implementation of the EA project. From this perspective the model would be applied to an EA project with the following questions in mind: How is the company implementing EA? What actions have been taken and what programs or systems have been put into practice to achieve the project's objectives?
3. Performance measurement of the EA project. From this perspective the model would be applied to an EA project with the following questions in mind: what concrete results has the implementation of the EA project achieved? Have the actions taken achieved the desired objectives of the EA project?

When applied in this way, the insights that the model generates would be better synthesized and organized. Inconsistencies or problems, such as actions that have been implemented but have not achieved results, or stated objectives that have not yet been implemented, should be made clear by comparing the results of the evaluations to each other.

12.3.2 Conclusion

The EA Review Model has strengths and weaknesses. The strengths of the EA Review Model indicate that it could be effectively used as a tool to evaluate an EA project, providing insight into:

- The objectives of the EA project
- The corresponding types of costs that should be investigated

⁶⁹ This is based on a simplification of the environmental management system model of ISO 14001. ISO 14001 identifies the following important elements of a management system:

- Policy
- Planning
- Implementation
- Measurement and evaluation
- Review and improvement

These elements are used in a supportive and interactive way with a focus on continual improvement of the whole system.

South African Bureau of Standards (1996) *SABS ISO 14001*. SABS, Pretoria.

- The integration of EA with environmental and financial management systems
- The integration of EA with other business strategies, approaches and data processing techniques
- Important elements of the process of implementing EA
- Important elements of the process of managing environmental costs

However, the tables evaluating the process of identifying environmental costs need to be re-evaluated and redeveloped. The checklists for environmental costs in the EA Review Model are too long to be practical. It would be an improvement if the data could be presented in a more concise format. The examples of the material balance sheet and the activities/resources matrix discussed in the case studies may point the way towards a solution.

The way that the EA Review Model is applied should also be re-evaluated. The model should distinguish between the objectives, actions taken and the results of those actions of an EA project. This would strengthen the EA Review Model's capabilities as a critical evaluation tool that can identify weaknesses in an EA project and recommend where corrective action should be taken.

Overall, the EA Review Model has much potential as a tool for evaluating EA projects. If the EA Review Model is developed further to address the identified problems and if the recommended changes to the way the EA Review Model is applied are made, the EA Review Model could become a very useful evaluative tool.

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