Environmental Life Cycle Costs in the Australian Food Packaging Supply Chain

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Abstract

There is increasing evidence that external and internal pressures are being placed upon companies to acknowledge, characterise and analyse environmental issues, impacts and costs. It has been argued that companies will increasingly be faced with responsibilities extending outside the factory gate to point of sale and beyond. Companies will need to adopt a life cycle perspective into the decision-making framework, to support managements' decisions regarding the environmental impacts and costs of activities and products.

The aim of this thesis is to explore the environmental impacts and environmental costs recognition and management within companies in the Australian food packaging supply chain. A grounded theory approach is used to develop propositions from the findings that can be tested in further research. A qualitative case study approach is undertaken using face-to-face interviews with Environmental Managers of twenty-seven companies that operate within the Australian food packaging supply chain.

The findings from the research span a broad range of issues. They demonstrate that the current environmental issues in the Australian food packaging supply chain are legislation (in particular the National Packaging Covenant - NPC), and management and minimisation of solid waste and emissions to air, land and water. The main drivers for companies to sign the NPC are to avoid the alternative (legislation) and to avoid the National Environment Protection Measure for Used Packaging Materials. The management and reduction of greenhouse gas emissions is a current and future issue to be addressed by companies and the main drivers for companies to sign the Greenhouse Challenge Program are to demonstrate public commitment and receive public recognition for reducing greenhouse gas emissions. Compared with voluntary programs such as the NPC and GHCP, the regulatory National Pollutant Inventory (NPI) program is seen to have a minimal effect upon the organisations, being more a compliance issue and part of normal management and reporting. This may be associated with the 'flexibility' that is provided within the frameworks of voluntary programs compared with the 'rigidity' of regulatory frameworks.

Companies generally provide environmental information in the company annual report before implementing an environmental management system and/or a stand-alone environmental report. Life cycle assessment is used by a small number of companies to collect environmental information about products and processes, though the findings of the LCA are not integrated back within the company. The use of environmental accounting techniques is limited and there is no consistent connection between actions taken on environmental issues and allocation of environmental costs. In terms of specific techniques, activity based costing is used more widely than value chain analysis and life cycle costing.

The thesis concludes by synthesising the findings into a series of propositions. These propositions can be used to further research into environmental life cycle costs within the Australian food packaging supply chain which may lead to the refinement of existing theories and generation of new theories.

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In loving memory of

Pop

Pa

Nana

Dr. Roger Coldwell

and

Ben Parsons

Declaration

I hereby declare that the work presented in this thesis is my own and has been carried out through the School of Accounting and Finance (Footscray Campus) and the Centre for Packaging, Transportation and Storage (Werribee Campus) both at Victoria University, during my candidature as a PhD student. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other institution, and to the best of my knowledge contains no material previously published or written by another person, except where due reference is made.

Signed

Karli L. James

Date

March 2003

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Abbreviations

ABC	Activity based costing
ACF	Australian Conservation Foundation
AFGC	Australian Food and Grocery Council
AGO	Australian Greenhouse Office
ANZECC	Australian New Zealand Environment and Conservation Council
AUD	Australian dollar
CEO	Chief Executive Officer
CO2	Carbon dioxide
df	degrees of freedom
EMS	Environmental management system
EPA	Environment Protection Authority
EU	European Union
FCA	Full cost accounting
GHCP	Greenhouse Challenge Program
ISO	International Organisations of Standardisation
KPI	Key performance indicators
LCA	Life cycle assessment
LCC	Life cycle costing
NEPC	National Environment Protection Council
NEPM	National Environmental Protection Measure
NPC	National Packaging Covenant
NPCC	National Packaging Covenant Council

NPI	National Pollutant Inventory
P	Probability
PCA	Packaging Council of Australia
PET	Polyethylene terephthalate
R&D	Research and development
SME	Small and medium sized enterprises
TCA	Total cost assessment
UK	United Kingdom
UN	United Nations
US	United States
US EPA	United States Environment Protection Agency
VCA	Value chain analysis
χ^2	Chi-square

1 INTRODUCTION

1.1 Background to the research

In recent decades an awareness of environmental issues has increased within society. People are becoming more aware of the impact that human activity is having upon the natural environment. An example of this is the recent meeting of the United Nations in Johannesburg (August-September 2002) for the World Summit on Sustainable Development and the standing of the Australian Federal government in relation to their current position in not signing the Kyoto Protocol for greenhouse gas emissions. There is also increasing evidence that external and internal pressures are being placed upon companies to acknowledge, characterise, analyse and report upon environmental issues, impacts and costs. International market pressures, customer requests for information, government regulations and policies, and social and environmental reporting requirements are examples of external influences. Elkington (1997a) in his book *"Cannibals with Forks: The triple bottom line of 21st century business"* presents seven dimensions for a sustainable future. They are markets, values, transparency, partnerships, time and corporate governance and life cycle technology where (Elkington 1997a, 9) stated:

> *"companies are being challenged about the triple bottom line implications of either industrial or agricultural activities far back down the supply chain, or of their products in transit, in use, and, increasingly, after their useful life has ended. Here we are seeing a shift from companies focusing on the acceptability of their products at the point of sale to their performance from cradle to grave and, increasingly, from cradle to cradle; i.e., from the extraction of raw materials right through to recycling and disposal".*

Elkington (1997a, 10) goes on to talk about the current "blind-spot" that exists within today's business leaders regarding life cycle issues:

> *"the worst blind-spot today's business leaders in companies suffer from in this area is the assumption that their responsibilities end at the factory fence, and that any triple bottom line impacts of their operations, products, or services will be sorted out in the 'normal course of events'. New forms of 'X-ray environment' can switch on without warning, illuminating activities, processes, and companies way back down a value chain".*

No longer will companies be able to produce a product without considering, for example, the type of material it is manufactured from or how the consumer will be able to recycle or dispose of it. The general trend will be that businesses will need to take more responsibility for their actions, products and processes. Understanding internal operations and recognising and working towards continual improvement of supply chain environmental impacts should be a prime objective. In addition to better understanding where the product has come from and where it is going, companies will increasingly be faced with the pressure and requirements to report on how their activities are impacting upon the environment, in qualitative and quantitative and in financial and non-financial terms.

The packaging industry has for several decades been faced with pressures from stakeholders to improve its environmental performance. The industry has been faced with debates on the use of one-way versus returnable packaging systems, the credentials of materials such as plastics, paper and metals, the recyclability of these packaging materials, the collection systems for post-consumer packaging waste and the light-weighting of packaging materials. Regulations and voluntary agreements have been developed, for instance, in Europe (Perchard 1997), Japan (Hunkeler *et al.* 1998) and Australia (Environment Australia 2001a), to address the environmental impacts of packaging systems. Packaging systems have been the focus of over 50% of life cycle assessment studies (LCA) that have been conducted since the 1960s with the first LCA study conducted by the Coca-Cola Company (Norris 1998).

When considering the environmental impacts of packaging it is imperative to acknowledge and understand the functions of packaging. Packaging is fundamental for the orderly and economic distribution of essentially every product grown and manufactured (Kelsey 1989) such as food, beverages, consumer products, electronic goods, automobile parts and building materials (Twede and Goddard 1998). The functions include containment of the contents, protection and preservation of the product from external factors such as micro-organisms, water and oxygen, communication of content (ingredients and nutritional) and logistical information, efficiency in filling and closing operations, and convenience in use when holding, opening and dispensing the product (Kelsey 1989; Selke 1990; Paine and Paine 1992; Erlov *et al.* 2000). Packaging also plays a role in waste reduction (Kelsey 1989), particularly in the food distribution chain.

The dominant application (approximately 70%) of packaging in Australia is for consumer food and beverage products (BIS Shrapnel 1999). The focus of this thesis is packaging used in the food and beverage sectors. Globally, the packaging material industry is estimated to have an annual turnover of US $475 billion (AUD $950 billion) (Packforsk 1999) and the Australian packaging market was estimated to have had a value of AUD $7.3 billion for the year 2000 (BIS Shrapnel 2001).

A complex interaction exists between environmental, economic, social, political and technological contexts (Allenby 1998; Ruth 1998) and several studies (Keoleian 1996; Klausner *et al.* 1998; Ruth 1998; Van Beukering and Duraiappah 1998) have confirmed this. There is no easy way to respond to these complex interactions. Evidence (Bennett and James 1998c; Ditz *et al.* 1998) suggests that environmental costs can be significant to the 'bottom line' and that accounting systems need to recognise and take account of this. In addition, the allocation of the occurring costs to the responsible products and processes through appropriate environmental management accounting approaches is essential for many reasons (Porter and van der Linde 1995; Epstein and Roy 1997; Quarles and Stratton 1998; Schaltegger and Muller 1998; Stuart *et al.* 1999; Schaltegger and Burritt 2000; Wilmshurst and Frost 2001). It has been suggested and demonstrated (Bennett and James 1998a; Ditz *et al.* 1998; US EPA 1998b; Schaltegger and Burritt 2000; Gray 2001) that by adopting an improved environmental

management accounting system, managers gain a better understanding of the impact that environmental-related activities have on the balance sheet. In addition managers are better able to identify risks and opportunities, improve costing of products and act upon opportunities for improvements in efficiency and cost reductions.

1.2 Justification for the research

Companies in the packaging supply chain need to consider many issues, including environmental issues, and factor them into their decision making with respect to their products and processes. They also need to consider environmental issues in the context of demographic and life style changes, technological changes, consumer demands and supply chain relationships (Williams 2001; PCA 2002). Consumption of energy and raw materials, the generation of emissions and effluents from production processes, pollution caused by transportation and litter and waste generation are examples of such issues (Goddard 1997; Erlov *et al.* 2000; Perchard 2002). As Elkington (1997a) highlighted, companies now operate in an X-ray environment and scrutiny of activities and actions by stakeholders will continue to increase.

Consumers, governments, the media, non-government organisations and financial institutes are such stakeholders that are increasingly placing pressure upon industry to improve its' environmental performance. Lovins *et al* (1999, 146) writes:

> *"the earth's ability to sustain life, and therefore economic activity, is threatened by the way we extract, process, transport, and dispose of a vast flow of resources - some 220 billion tons a year. With dangerously narrow focus, our industries look only at the exploitable resources of the earth's ecosystems - its oceans, forests, and plains - and not at the larger service that those system provide for free".*

Companies first need to acknowledge that their activities and products impact on the environment. Second, they need the methods and techniques to help them understand how these impacts occur. Third, they need to implement changes to activities and products to reduce environmental impact. The fourth step involves continual review and refinement of activities and products to maintain and reduce

impacts. By performing these processes companies will not only reduce environmental impact but will be rewarded with cost savings.

Developments in social and environmental accounting have improved our understanding of the contribution of environmental impacts and costs within organisations. This has led to companies using these techniques and methods to determine which of their products and processes contribute to environmental impacts. In the 1990s, Xerox Ltd undertook an analysis of its logistic chain and assessed the costs and savings of implementing a returnable packaging system for its products compared with the current polystyrene non-returnable packaging. The results indicated that (Bennett and James 1998b, 359):

> *"in total, the investment of $4-5 million in totes[1] is estimated to have generated directly quantifiable annual savings of $1.2 million".*

The above example illustrates the savings that can be achieved with the re-design of a packaging system and its logistics across the supply chain (i.e., value chain). Another example shows how reducing the demand for resource consumption down the supply chain can create vast savings upstream (Lovins *et al.* 1999, 150):

> *"if it takes, for example, three pounds of harvested trees to produce one pound of product, then saving one pound of product will save three pounds of trees - plus all the environmental damage avoided by not having to cut them down in the first place".*

In recent years the Australian packaging supply chain has been faced with pressure from government to voluntarily improve its environmental performance and product stewardship or face regulatory measures. A self-regulatory voluntary National Packaging Covenant (NPC) (Section 2.7.2.1) was developed between industry and the Australian government, which was officially launched in August 1999. The Australian packaging supply chain is at a critical point of recognising and actioning upon product stewardship and life cycle management of products in light of the implementation of the NPC. It is important to improve our understanding of whether and how Australian food and packaging companies are increasingly taking a 'life cycle' perspective on their activities and products and

[1] Totes = term used to describe returnable packaging system

the contribution that voluntary programs, such as the NPC, have in reducing environmental impacts.

The type of research to be presented in this thesis has not been done before in the Australian food packaging supply chain. The main focus of the research is exploratory and covers a broad range of issues with the collection of a diversity of data in the field of environmental management and environmental accounting. This research is important for three main reasons. First; to better understand environmental issues relevant to the Australian food packaging supply chain; second to gain insights into how accounting systems are being used by management to identify and report environmental costs; and third to begin to develop a theoretical base which may be used to elucidate the importance of identifying and reporting environmental issues in the Australian food packaging supply chain.

1.3 Research aims and objectives

The broad aim of this thesis is to identify and explore how companies in the Australian food packaging supply chain treat environmental impacts and how they account for and manage environmental costs. A grounded theory approach is used to develop a series of propositions that can be tested in further research.

The specific objectives of the research are:

- To determine the current and future environmental issues faced by companies in the Australian food and packaging supply chain.
- To understand why these companies produce environmental reports and implement environmental management systems.
- To understand the motivating drivers for these companies to participate with government in voluntary environmental agreements.
- To determine if there are differences in the impact within the organisation of voluntary environmental agreements compared with regulatory measures.

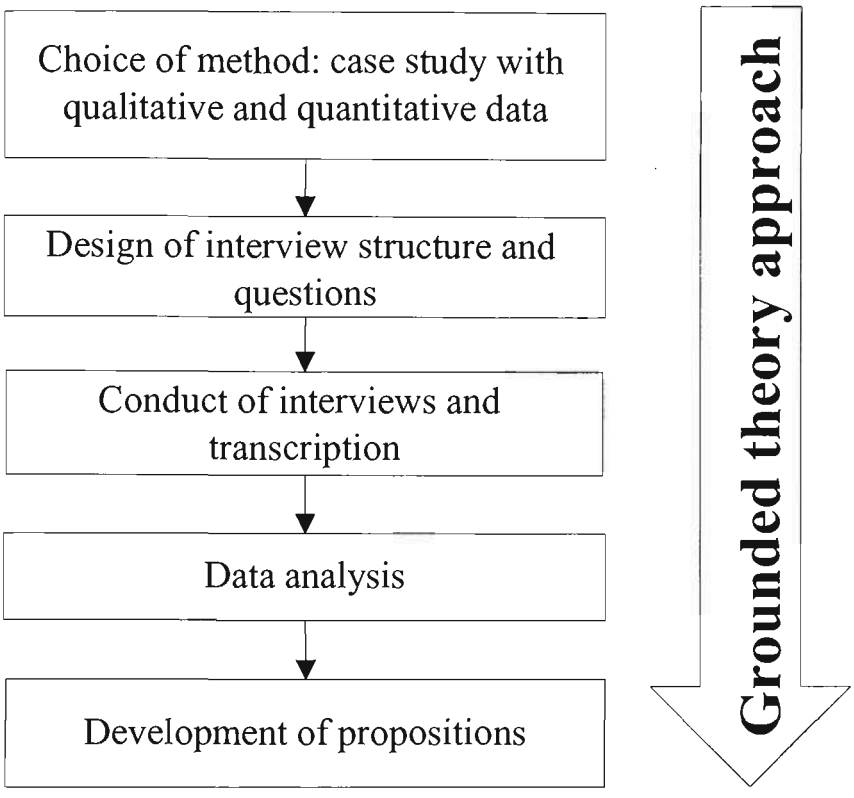
- To determine the level at which these companies investigate the environmental "life cycle" of their products and processes.
- To determine the level of adoption of accounting approaches, their benefits and applicability to be used in conjunction with the methodology of life cycle assessment.
- To understand how these companies acknowledge and allocate environmental costs in the organisation.

1.4 Methodology

A grounded theory approach was taken employing an exploratory qualitative case study technique. Grounded theory is a qualitative research analysis technique whereby theory is generated from the collected data (Punch 1998; Taylor and Bogdan 1998; Charmaz 2000; Ryan and Bernard 2000; Locke 2001). Inductive processes are used to collect and analyse the data (Punch 1998; Charmaz 2000), and theories, concepts, hypotheses and propositions are developed from the collected data and not from prior theories, assumptions or other research (Glaser and Strauss 1978; Taylor and Bogdan 1998; Locke 2001).

Face-to-face interviews employing a structured questionnaire with open and closed questions was the primary data collection technique. The interviews were conducted with environmental managers (or equivalent) in twenty-seven Australian food and packaging companies. The interviews were audio-taped and subsequently transcribed. The transcribed data was analysed using coding of key words and themes. Further discussion and detail on the methodology is presented in Chapter 4. Figure 1.1 presents an overview of the research methodology.

Figure 1.1 Overview of research methodology



1.5 Outline of the thesis

This thesis contains nine chapters, a bibliography, and eight appendices. The aim of Chapter 2 is to develop an understanding of the packaging industry and its characteristics. Chapter 2 begins with a discussion of what the functions of packaging are and the size of the international packaging industry. The chapter also includes a presentation of industry environmental challenges and a discussion of related regulations, in particular the National Pollutant Inventory (NPI). This is followed by a discussion of voluntary environmental agreements using examples of the National Packaging Covenant (NPC) and the Greenhouse Challenge Program (GHCP). The chapter concludes with a presentation of key environmental issues identified by food and grocery companies in Australia.

Chapter 3 reviews the literature on environmental accounting, environmental reporting, environmental management systems, environmental costs and life cycle assessment. The focus of the chapter then turns to a discussion of three relevant accounting approaches - life cycle costing (LCC), value chain analysis (VCA) and activity based costing (ABC). The applications and limitations of the

methodology of life cycle assessment (LCA) are also discussed. This review leads to the identification of the research questions to be answered in this thesis.

The methodological approach adopted for this research is presented in Chapter 4. The chapter begins with a discussion of grounded theory and is followed by a discussion of research validity, reliability and ethical considerations of the research. The justification for why an exploratory qualitative case study approach employing interviewing techniques was chosen is then discussed. Data collection procedures, how companies were selected to participate in the interviews, how the interviews were conducted, and how the transcripts of the interviews were prepared are detailed. The discussion of data analysis techniques concludes the chapter.

Chapters 5 - 8 report the findings of the research. After the presentation of company background information such as company size, ownership and turnover, Chapter 5 deals with environmental issues. The environmental issues relate to environmental statements, current environmental issues, environmental reporting, environmental management systems, voluntary programs and future environmental information.

The drivers to sign voluntary environmental agreements are presented in Chapter 6. Specific examples of agreements that are investigated are the National Packaging Covenant (NPC) and the Greenhouse Challenge Program (GHCP). In addition the effects (changes that have occurred) within the companies that are signatories to these two voluntary agreements are presented. The effects of the voluntary NPC and GHCP are contrasted with the regulatory National Pollutant Inventory (NPI) and they conclude this chapter.

The adoption level of life cycle assessment (LCA), the drivers for using LCA and the features of LCA studies are presented in Chapter 7. The chapter also includes a discussion of the reasons why companies have not used LCA.

Chapter 8 deals with the adoption levels and benefits of three accounting approaches and how environmental costs are identified and allocated within companies. The chapter begins with the presentation of findings related to life cycle costing (LCC). This is followed by the findings related to value chain analysis (VCA) and activity based costing (ABC). The chapter then presents

findings on how companies identify environmental costs, how they treat them within the accounting system and how these costs are allocated.

In Chapter 9 the overall findings in response to the research questions are presented. The theoretical implications - the developed propositions - of the research are then presented. A discussion of opportunities for future research and constraints of the methodology are noted. The chapter concludes with a discussion on the significance of the findings of the investigation.

2 PACKAGING FUNCTIONS, ENVIRONMENTAL ISSUES AND INDUSTRY CHALLENGES

2.1 Introduction

This chapter provides a description of the functions of packaging and the packaging supply chain as background for the remainder of the thesis. The chapter is divided into two sections. First, a description and overview of the numerous functions that a packaging system employs is presented, accompanied by an insight into the complexities of the packaging life cycle. An overview of the international and Australian packaging industry markets follows. The second section consists of a discussion of:

i) general environmental issues;

ii) environmental challenges for the packaging supply chain;

iii) discussion of regulations using the example of the National Pollutant Inventory (NPI);

iv) discussion of voluntary environmental initiatives with the National Packaging Covenant (NPC) and Greenhouse Challenge Program (GHCP) used as examples, and;

v) discussion of the key environmental issues in the Australian food and grocery industry.

The chapter concludes with a summary of the issues presented.

2.2 The functions of packaging

Packaging has evolved over the centuries from using natural materials like leaves and bark (Kelsey 1989) to glass, plastic (in flexible and rigid forms), metal, and paperboard. Packaging is fundamental for the orderly and economic distribution of essentially every product grown and manufactured (Kelsey 1989) such as food,

beverages, consumer products, electronic goods, automobile parts and building materials (Twede and Goddard 1998). In fact, a series of packages are used to distribute most products from their raw material transformation to points of consumption (Kelsey 1989; Twede and Goddard 1998).

The dominant application (approximately 70%) of packaging in Australia is for consumer food and beverage products (BIS Shrapnel 1999). The focus of this thesis is on packaging used in the food and beverage sectors.

Packaging performs a variety of functions including containment of the contents, protection and preservation of the product from external factors such as micro-organisms, water and oxygen, communication of content (ingredients and nutritional) and logistical information, efficiency in filling and closing operations, and convenience in use when holding, opening and dispensing the product (Kelsey 1989; Selke 1990; Paine and Paine 1992; Erlov *et al.* 2000).

Packaging also plays a role in waste reduction (Kelsey 1989), particularly in the food distribution chain. For example, efficient packaging ensures fresh fruits and vegetables are delivered to the point of sale with minimal loss of product therefore reducing the environmental burdens associated with the product loss (Erlov *et al.* 2000). The packaging system and the product are an integrated unit. The properties of the package and the product each determine the other (Cage 1991). For example, a light sensitive product will require a packaging system with an effective light barrier. Other driving factors upon packaging design are market demographics (e.g., single person households, older population), social and cultural characteristics, required convenience level (e.g., easy to open and dispense; recloseable; quick and easy to prepare foods), and product/package safety (e.g., child resistant and tamper evident features) (Cage 1991; Erlov *et al.* 2000; PCA 2002a). A description of what constituents a packaging system is given in the next section.

2.3 The packaging system

Consumers use packaging everyday. A recent study conducted in Sweden found that a single consumer, on average, handles 22 different packages a day (Soras 2001). For example, a plastic bottle containing shampoo, a liquidpaperboard carton containing milk, a steel can preserving seasonal fruits, an aluminium can containing soft drink, and a glass bottle filled with red wine. These are all forms of what is known as *primary* packaging (or *consumer* packaging).

In addition to primary packaging, there is *secondary* packaging (e.g., corrugated cardboard box containing primary packaged units of shampoo), which is also known as *distribution* packaging. Then there is *tertiary* packaging (e.g., shrink wrap plastic around a pallet load of packaged shampoo containers), also known as *transportation* packaging. This includes intermediate bulk containers such as pallet bins for liquids and pallet shippers for bulk packaging of non-liquids.

The three levels of packaging are interdependent in that, when there is a reduction in the protection of one level of packaging, the protection performance of another level will need to be increased otherwise there will be an increase in the number of damaged products (Erlov *et al.* 2000).

2.4 The packaging life cycle

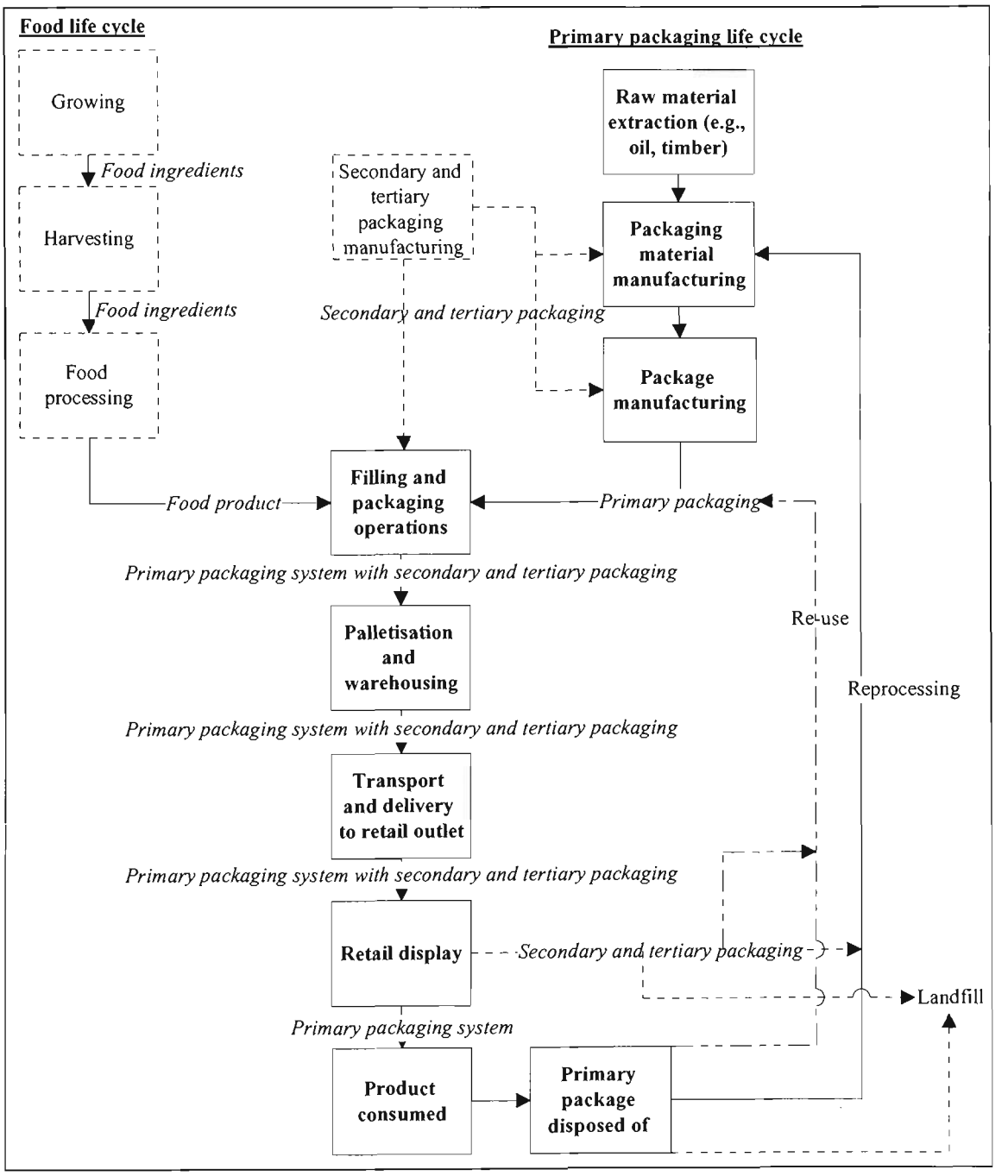
Packaging is part of a product supply system and includes an array of inter-linked processes which is known as the packaging supply chain and consists of the following processes (Selke 1990):

- Extraction of raw materials;
- Production of packaging materials;
- Manufacture of materials and packages;
- Production operations such as filling and sealing, including all levels of packaging;
- Distribution of the packaged products;

- Retail sale of the packaged products;
- Use of the packaged product; and
- Disposal/recycling of the package.

Figure 2.1 illustrates the life cycle of a primary food packaging system.

Figure 2.1 A primary food packaging system life cycle



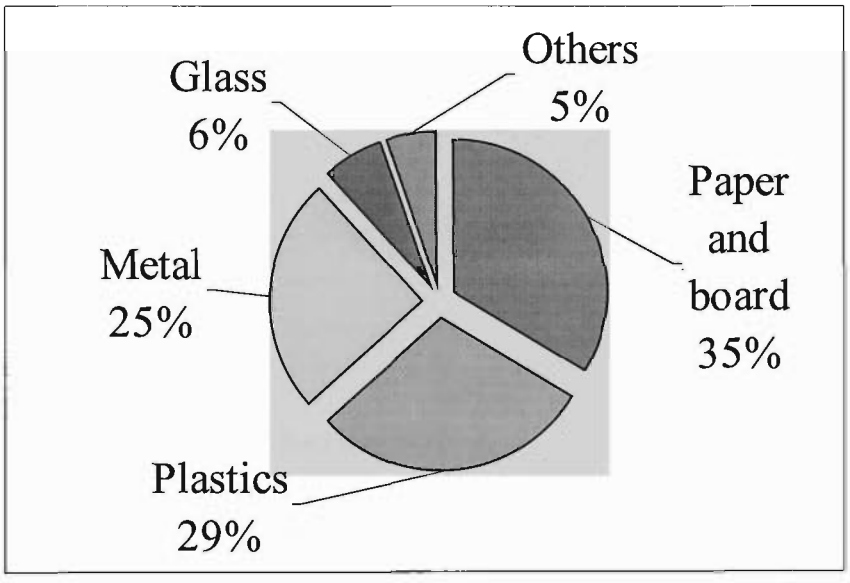
Source: Adapted from Paine and Paine (1992).

Figure 2.1 also identifies the players within the packaging supply chain. In principle there are many options for selecting a packaging system. Product, distribution, consumer, economical and environmental requirements often determine the ultimate choice of packaging system.

2.5 A world of packaging - the market

To provide an economic perspective, market statistics of the international and Australian packaging industries are presented. Globally, the packaging material industry is estimated to have an annual turnover of US $475 billion (AUD $950 billion) (Packforsk 1999). A breakdown of the global packaging market per material, by value is presented in Figure 2.2.

Figure 2.2 Global packaging market per material, by value, 1998

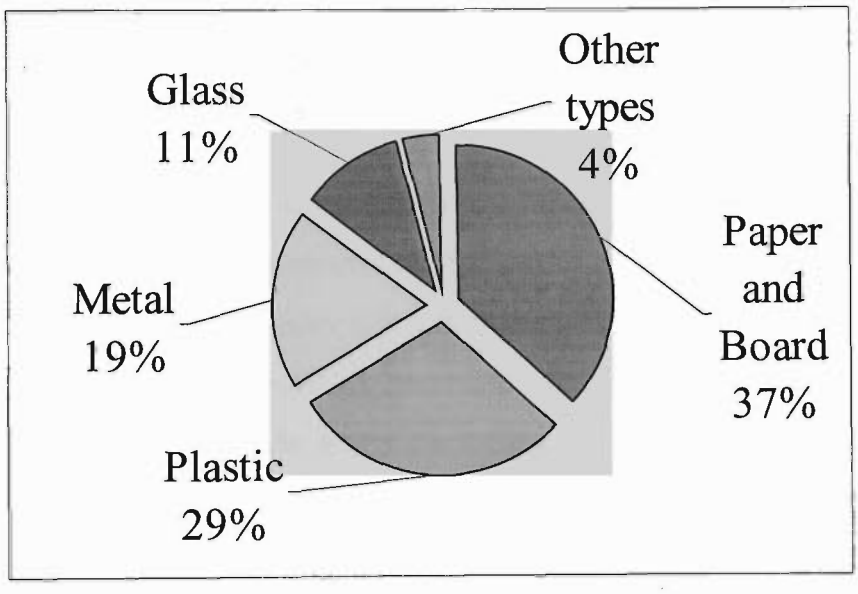


Source: (BIS Shrapnel 1999; Packforsk 1999).

In the global packaging market, industrial packaging applications account for 30% and consumer packaging accounts for 70% (BIS Shrapnel 1999). The United States of America by market value is the largest supplier of packaging throughout the world. It is estimated that over 95% of the total value of consumer packaging sales is attributed to a combination of the Americas, Europe and Asia (BIS Shrapnel 1999).

The Australian packaging market[2], on a world scale, is small though it was estimated to have had a value of AUD $7.3 billion for the year 2000 (BIS Shrapnel 2001). The major packaging materials used are glass, metals (aluminium and steel), paper/board (cartons and corrugated) and plastics (such as high density polyethylene, polyethylene terephthalate, polyvinyl chloride, polypropylene and polystyrene) (PCA 2002a). A breakdown of the materials as a percentage of the market value is presented in Figure 2.3 with nearly 70% of packaging being used for food and beverage applications (BIS Shrapnel 1999).

Figure 2.3 Australian packaging market per material, by value, 2000.



Source: (BIS Shrapnel 2001).

In the Australian packaging industry there are a small number of big companies that have the majority of the market though there is a substantial proportion of small and medium sized enterprises (SME's) (PCA 2002a).

Table 2.1 provides an overview of end-user applications per type of material in the Australian market in 1998.

[2] Definition of packaging market excludes the value of imported packaging containing products, and re-used packaging (such as reconditioned drums and second-hand cartons). Other exclusions – value of packaging equipment, some ancillary items such as inks, staples, glues and some materials handling products (e.g., bulk bins, wire crates and wooden pallets). Disposable packaging for fast food and takeaways, household bags and wraps are also excluded from the definition.

Table 2.1 End-user applications per type of material in the Australian market in 1998 (% of total value)

Material category	Applications (% of total value)			
	Food	Beverages	Consumer non-durables	Industrial products and other users (*)
Paper and board	42	20	20	18
Plastics	38	25	7	30
Metal	45	34	6	15
Glass	14	81	5	-
Other	17	54	6	23
% of total	37.2	32.2	11.4	19.2
Total $ million	2,469	2,133	756	1,274

Source: (BIS Shrapnel 1999). (*) Includes retail applications

Clearly applications for food and beverages dominate each material category. In the paper category, corrugated containers are the major packaging type used for food applications. Flexible plastics play a larger role in food applications, whereas rigid plastics (e.g., bottles) are dominant for beverages. For beverages, aluminium cans are used, whereas steel cans are the major packaging material used in food packaging applications. The major beverage product that is packaged in glass is beer.

In 1997, 40.6% of the Australian packaging production was located in Victoria. This is followed by New South Wales with (32.4%) of production, Queensland (12.6%), South Australia (7.6%), Western Australia (6.2%) and Tasmania (0.6%) (BIS Shrapnel 1999). These figures clearly indicate that Victoria and New South Wales play an important role for the location of the packaging production facilities throughout Australia.

2.6 Environmental issues and business

Global environmental issues that society faces range from the depletion of the ozone layer to species extinction and habitat destruction. As Lester Brown argues in his recent book *Eco-Economy: Building an Economy for the Earth*, there is a stressed

relationship between the economy and the earth's ecosystem, which is evident by (Brown 2001, 4):

> *"Collapsing fisheries, shrinking forests, eroding soils, deteriorating range-lands, expanding deserts, rising carbon dioxide (CO_2) levels, falling water tables, rising temperatures, more destructive storms, melting glaciers, rising sea levels, dying coral reefs and disappearing species".*

In 1998 the World Business Council for Sustainable Development (WBSCD) identified a list of emerging business trends that included Product Stewardship, Extended Producer Responsibility and Trade and the Environment (Willums and WBCSD 1998). In line with the same thinking *Business and the Environment* identified "*grappling with the sustainability development challenge*" and "*the integration of the environment with business strategy to add value*" (BATE 1998b, 2) as two of a list of key trends critical for the business world to adopt.

In various industries, companies are realising the benefits of considering and adopting numerous environmental techniques and methodologies to further their understanding and manage the environmental aspects and impacts of their products, processes and systems (Klopffer 1998). Voluntary agreements, eco-labelling, contaminated land, returnable containers, recycling, energy efficiency, ethical investment, taxes and tradable pollution permits (Gray *et al.* 1993) are a selection of issues that industry, government and society need to address.

Organizations will also need to monitor (Gray *et al.* 1993):

- existing and forthcoming international agreements and national laws;
- the activities of water, land, air and noise pollution agencies, changing methods and levels of enforcement, changing levels of fines and increasing tightness of consents;
- the changes in thinking about environmental issues, public opinion and the attitudes and actions of the pressure groups; and
- industry agreements.

It has been argued that companies will increasingly be faced with responsibilities extending beyond the factory gate to point of sale. They will have to take more 'cradle to grave' responsibility (Elkington 1997a).

Managers need to look at environmental problems and issues, not as a standalone discipline but integrated like any other business issue (Gray *et al.* 1993; Porter and van der Linde 1995; Hart 1997; Reinhardt 1999; Schaltegger and Burritt 2000). Product differentiation, managing competitors, saving costs, managing environmental risk and redefining competition in their markets (Reinhardt 1999) are approaches that have been suggested for companies to help integrate the environment into business thinking. By doing this it has been argued that companies can gain competitive advantage (Porter and van der Linde 1995) by linking the environment with strategy and technology development (Hart 1997).

The Age/Sydney Morning Herald - Good Reputation Index (GRI) examines the reputations of Australia's top 100 companies from the Business Review Weekly's (BRW's) annual list of the top 1000 enterprises in Australia and New Zealand (Kerr 2001). The Australian Conservation Foundation (ACF) contributed to the GRI by providing its perception of one of the six categories - company's environmental performance. The criterion within this category was a company's environmental strategies, environmental footprint and its focus on sustainability. The ACF developed five perceptions on the companies' environmental performance. These perceptions for the 2001 report were analysed against the previous year and it was

found that none of the five perceptions had changed. The perceptions are (Kerr 2001, 1):

- *"In the main, corporate Australia is failing to fulfill its environmental performance.*
- *There are positive signs that corporate Australia's poor environmental performance could be reversed in the coming years.*
- *Many companies, indeed entire corporate sectors, have failed to recognise and act on their environmental responsibilities.*
- *Many companies have failed to fully translate what on paper appear to be best practice environmental strategies to their 'on the ground' environmental performance.*
- *Many Australian companies have failed to bring in the same standards of environmental strategies and initiatives as those used by their overseas parent companies".*

Factors motivating companies on their environmental performance and improvements include stakeholder pressures, economic opportunities, ethical motives, legislation, and competitive advantage (Townsend 1998; Bansal and Roth 2000). A survey conducted in Canada by KPMG in 1994 found that (Harrison 1999, 67):

> *"95% of firms cited compliance with regulations as one of the top five factors motivating their environmental improvements. The next most frequently cited factor at 69% was director's liability, whereas factors such as cost savings, customer requirements and public pressure were all cited by less than half of the respondents".*

Townsend (1998) in a study of 30 companies involved in the development of "green" products found that the top five motivating factors that these companies considered important in influencing the "greening" of their companies were:

- market opportunities (23 responses);
- environmental concern/awareness of CEO or other key individuals (13);

- savings from waste minimisation and resource recovery (9);
- regulatory pressures (including legal liabilities) (8), and;
- desire for a good corporate image (8).

The three motivations that induce corporate ecological responsiveness (in descending order of level of concern) that Bansal and Roth (2000) concluded from their interviews with 88 environmental managers of UK and Japanese companies were:

- legitimacy (desire of a firm to improve the appropriateness of its actions within an established set of regulations, norms, values or beliefs);
- competitiveness (the potential for ecological responsiveness to improve long-term profitability), and;
- ecological responsibility (stems from a concern that a firm has for its social obligations and values).

As the above lists identify, there is a large number of environmental issues and considerations that business in general need to acknowledge and address. This provides a background of some environmental issues for industry in general and the following section will focus upon issues and challenges specifically within the packaging industry supply chain.

2.7 Environmental challenges for the packaging industry

Companies in all sectors of the packaging supply chain are faced with acknowledging, understanding, addressing and managing a range of issues affecting the use of packaging including those with an environmental focus. Decisions that need to be made include the use of renewable and non-renewable resources, the impacts associated with the extraction, transport and processing of materials, the generation and release of greenhouse gases, ozone depleting substances and other chemicals, and the disposal of products after their useful life. As Goddard (1997) discusses, the packaging industry is faced with dealing with issues such as litter, returnable packaging, biodegradable materials and recycling.

Further, firms in the packaging supply chain need to consider issues that include regulations, material and transport costs, new techniques and taxes (Erlov *et al.* 2000) with respect to current and future packaging systems. Companies need to manage competitive pressures and the likely key influences upon the Australian packaging industry over the following decade include (Williams 2001; PCA 2002a):

- *Demographic and life-style changes* which will see an increase in an ageing population, single households, and smaller families that will have an influence upon the types of packaging used for products;
- *Technological changes* where there is expected to be an increase in the growth in electronic and home shopping via the internet that will introduce new demands upon the packaging system;
- *Environmental issues* will remain a major driver including litter and landfilling, with the success of the National Packaging Covenant essential;
- *Consumer demands* will force market segmentation allowing products to be packaged dependent upon the demands of a particular group (such as microwaveable products, salad kits, modified atmosphere packaging, pre-cut, pre-portioned, smaller ready to consume products); and
- *Supply chain management* will require a quicker more flexible response throughout the entire supply chain with a willingness to share information and develop long-term relationships.

However, there will be conflicts between commercial and environmental demands (Williams 2001). For example, a balance is needed between delivering a reduced amount of packaging and the increasing need to provide safe products i.e., through tamper evident packaging. In other cases the requirement to provide convenience foods in portion packs will increase the quantity of packaging per unit of food. There is also some evidence suggesting that the increasing range of packaging material being used is less compatible with the existing post-consumer recycling systems (PCA 2002a).

The review now centres upon regulatory and voluntary environmental measures applicable to the packaging industry. In Section 2.7.1 a discussion of regulations affecting the packaging supply chain in general is followed by a review of the National Pollutant Inventory. Voluntary environmental agreements are presented in Section 2.7.2 and discussion is held on the National Packaging Covenant and the Greenhouse Challenge Program.

2.7.1 Regulations

In attempts to reduce the environmental impacts associated with packaging, there has been a continual move by governments worldwide to impose regulations and legislation (Goddard 1997) in the packaging supply chain. Mechanisms include the banning of certain types of materials and packs (e.g., Danish can ban); introduction of quantitative recycling targets (e.g., European Directive for Packaging and Packaging Waste); and implementation of taxes and deposit systems (e.g., beverage containers in South Australia).

Regulations have been a means by which governments have enforced requirements upon industry to improve its environmental performance. Along with advances in technology and improved information, industry has been able to improve its management of discharges to air, water and land (Gibson 1999). Regulations can have a positive influence on reducing environmental emissions, discharges and waste that industry generates, though as Porter and van der Linde (1995) suggest it can also deter the benefits of innovations if not designed correctly, therefore, reducing the opportunities for resource productivity and competitiveness.

Regulations addressing solid waste generation from packaging materials are in place throughout the world. Examples include the Packaging Covenant in the Netherlands enforced since 1991, the Japanese Packaging Law enforced since 1995 (Hunkeler *et al.* 1998), and the European Directive of Packaging and Packaging Waste, which has been in force since 1995 (Perchard 1997). Another regulatory measure is the collection, by governments throughout the world, of emission data from companies, which can be accessed publicly. This is described in the following section using the example of the National Pollutant Inventory.

2.7.1.1 The Australian National Pollutant Inventory

Developed by the National Environment Protection Council (NEPC), a draft National Environment Protection (National Pollutant Inventory) Measure was implemented in 1996 and was based upon the United States Toxic Release Inventory (TRI) (US EPA 2002). The regulatory National Pollutant Inventory (NPI) (Environment Australia 2002a) is an internet database, accessible to the community, industry and government, which has been designed to provide information on the types and amounts of certain substances that are being emitted in Australia to the environmental compartments of air, land and water (Environment Australia 2002d). The draft NPI National Environment Protection Measure (NEPM) underwent modifications following consultations between the National Environmental Protection Council (NEPC) and industry, environment and community groups and individuals. On the 1st of July 1998, the revised NEPM came into effect (Cunningham and Gadenne 2002). Similar inventory initiatives are in place in:

- Canada (known as the National Pollutant Release Inventory) (Environment Canada 2002);
- the United Kingdom (the Pollutant Inventory) (Environment Agency 2002); and
- in Mexico (Registro de Emisiones y Transferencia de Contaminantes (RETC)) (Instituto Nacional de Ecologia 2002).

The idea behind the NPI had (Rae 2002, 9):

> *"its roots in popular support for legislation to support 'community right to know', in this instance the right of access to information about the storage of hazardous substances and emissions that posed risks to human health and the environment".*

Input data for the NPI is *estimated* and is obtained in three ways (Environment Australia 2002b):

- *"Larger industrial facilities estimate and report their emissions to the government.*
- *State and Territory governments estimate emissions from smaller companies.*
- *State and Territory governments estimate emissions from mobile and non-industrial sources (such as emissions from activities like driving to work and mowing the lawn), and other sources of pollutants".*

Only companies that exceed certain threshold levels of the substances as listed on the NPI list are required to directly provide information to the relevant state environment authority (by 30 September each year). The three sets of data are compiled by the State governments and then sent to Environment Australia (the federal government authority) (by 30th of November each year) to aggregate the values and put them on the internet (by 31st of January in the following year) (Environment Australia 2002c). The first set of data was available on the internet from 1st of February 2000 (Environment Australia 1999). Each substance on the NPI list has a specific set threshold level according to its nature and is classified under one of three categories (Environment Australia 2001b):

- Category 1 based on NPI substance use;
- Category 2 based on energy/fuel consumption and;
- Category 3 based on emissions of total nitrogen and total phosphorus to air and water.

The number of chemical substances that companies are required to report and the reporting periods are presented in Table 2.2.

Table 2.2 Reporting periods for the NPI and the number of chemical substances to be reported

Reporting year	Activity[1]	Number of substances to be reported against[2]
1 July 1998-30 June 1999	First voluntary year	36
1 July 1999-30 June 2000	Second voluntary year	36
1 July 2000-30 June 2001	First mandatory year	36
1 July 2001-30 June 2002	Second mandatory year	90

Source: (Environment Australia 2002c).

Notes:

(1) In the first two years companies could voluntarily supply information, though it became mandatory for the reporting period of 1 July 2000-30 June 2001.

(2) The number of substances to be reported is different across countries. For example, in Australia it is 90, in Finland 50 and in the United States 643 (Rae 2002).

The number of facilities that were required to report for the 1998-1999 period were 1,200 and in 1999-2000 this had increased to 1,967. The number of industry sectors reporting in 1998-1999 was 23 and in 1999-2000 there was an increase to 67 sectors (Environment Australia 2001b). The emission estimates on the internet are accompanied by contextual information. This information includes the chemical characteristics and intrinsic properties of these emitted substances, the health and environmental effects of the substance, including toxicity profiles, environmental impacts, likely fate and transport of the substance in the environment, and descriptions of the main activities of the facilities, the location of the facilities and how the data was calculated (i.e., using the agreed estimation techniques or another method).

Concerns were expressed within particular industry and industry associations with respect to the NPI. The concerns included the use of the term 'pollutant', the possible threat to commercial-in-confidence through the identification of individual facilities, the potential negative public reaction, and the imposed economic cost burdens upon

organisations as a result of an increase in compliance and a loss of competitive advantage (Cunningham and Gadenne 2002).

2.7.2 Voluntary environmental agreements

The evolution of governmental environmental policy over recent decades has changed from command and control regulation focus in the 1970s and 1980s, through to market-based regulations in the late 1980s, and voluntary initiatives as part of the process in the 1990s (Karamanos 2001). The first voluntary agreements came about in the 1960s and 1970s in Japan, France and Canada and in the European Union (EU) in the 1980s (Karamanos 2001). There exist a number of differing definitions and terminology to describe voluntary environmental agreements (Karamanos 2001) though the basis is that it is an agreement between two or more parties (e.g., corporate, government, non-government organisations) (Gibson 1999; Paton 2000; Karamanos 2001) towards environmental improvement for the specific issue(s). Voluntary environmental agreements are being implemented to address particular issues in place of or as supplements to regulatory measures (Glasbergen 1998; Gibson 1999; Harrison 1999; Karamanos 2001) and some believe they allow industry to be more flexible in their approach to adopting and implementing the measures in line with their processes, priorities and corporate goals (Gibson 1999).

The aims of voluntary initiatives and agreements are to improve the environmental performance of industry beyond current legal requirements (Paton 2000) and with the objectives to improve environmental conditions as, for example, air, land and water pollution, energy efficiency, waste management, natural resource management and/or biodiversity protection (Karamanos 2001). Voluntary initiatives can take numerous forms (Harrison 1999; Dowling 2002) such as a contract, a memorandum of understanding, a letter of intent, a covenant (Karamanos 2001), unilateral initiatives, private codes, voluntary challenges and negotiation agreements (Paton 2000) and each will consist of a range of objectives, incentives and procedures.

Other characteristics include that they are voluntary - no requirement to participate, no penalties for non-participation and no penalties for terminating participation. Progress reporting is the most common way of reporting, and verification is generally

via self-assessment. From an analysis of the partners of 66 voluntary environmental initiatives, Karamanos (2001) discovered that over 45% were between corporate and government partners (Table 2.3).

Table 2.3 Partners of 66 voluntary environmental initiatives

Partners	Percentage of 66 voluntary environmental agreements
Corporate and government	45%
Corporate, government and non-government organisations	39%
Government and non-government organisations	9%
Corporate and non-government organisations	6%

Source: (Karamanos 2001, 74).

With respect to the main objectives of these 66 agreements, 44% were multi-purpose, 29% related specifically to air, 14% to natural resource and wildlife management, and 6% to water and land respectively. Voluntary programs can increase the flow of data between government and industry and promote awareness of practices between the two parties (Paton 2000). An obligation of signing a voluntary agreement is the promise to make an effort towards achieving the set goals of the agreement (Glasbergen 1998). With voluntary environmental initiatives it has been suggested that there is a greater reliance upon industry to do the right thing (Gibson 1999). For a program to be successful there must be incentives to ensure sufficient companies sign on to the program and measures such as regulations or other tools to encourage non-signatories to sign. Typically accompanying voluntary agreements is

> "*an explicit or implied threat of regulation or other mandatory instruments should voluntary measures fail*" (Harrison 1999, 56).

It was concluded by Paton (2000) that there exists uncertainty regarding the environmental effectiveness and economic efficiency of voluntary approaches compared with other policy approaches. This for instance is due to in some cases to poorly specified objectives and inadequate performance data or conflicts with other policy instruments.

It has been suggested that voluntary programs can be used to forge links across product chains and due to their flexibility and emphasis on collaboration they may well be suited to approaches that cross different environment media and span the supply chain (Harrison 1999). Threats of regulation or market-based instruments or litigation are the motivating factors according to Harrison (1999) for negotiations of voluntary agreements between industry and government.

Two Australian voluntary initiatives/agreements that have materialised from industry and government discussion are the National Packaging Covenant (NPC) and the Greenhouse Challenge Program (GHCP). The characteristics of these two voluntary initiatives are presented below.

2.7.2.1 The Australian National Packaging Covenant

The National Packaging Covenant (NPC) is a self-regulatory voluntary agreement between commonwealth, state/territory and local government and all sectors of the packaging supply chain. It is based upon the principles of product stewardship and shared responsibility of consumer packaging including the effective design and operation of kerbside recycling systems and establishes a framework for the effective life cycle management of packaging and paper products (ANZECC 1999; Williams 2000; PCA 2002a).

The NPC came about as a result of lengthy discussions between all levels of government and industry regarding the issues surrounding the economics of kerbside collection of packaging materials. In the late 1990s, the economic value of material collected through the kerbside system had fallen resulting in a "gap" when compared with the costs associated with the running of the kerbside collection systems (Williams 1998). Local government was largely funding this "gap" and councils were complaining to the state governments, threatening to stop the kerbside system if their requests for additional funds did not eventuate. These difficulties prompted all governments within the Australian New Zealand Environment and Conservation Council (ANZECC) to develop a longer-term solution that would (Williams 1998, 1):

> *"inter alia: provide greater certainty (a system which anticipates and deals with price fluctuations); involve the entire packaging system chain; and with companies in the chain bearing a greater share of the costs".*

An outcome that was agreed upon between government and industry was required to address the issue because due to general community support for the kerbside collection system it was unlikely that government would stop supporting the kerbside system. It has been argued by many that the Covenant does not have much to do with the environment (Williams 1998, 1):

> *"it is debateable whether the Covenant will produce a better environmental outcome for managing used packaging and the Covenant is much more about economics and funding issues than the merits of recycling".*

The Covenant was launched on August 27, 1999. It is applied throughout the packaging chain, from raw material suppliers and retailers, and through to the ultimate disposal of the packaging waste. Its focus is only upon consumer packaging and household paper (excluding newsprint) and includes imported packaged products.

The Covenant framework is a two-tier system comprising:

1. The Covenant (umbrella document with three schedules); and
2. The National Environment Protection Measure (NEPM) for Used Packaging Materials that forms a regulatory 'safety' net to catch the 'free-rider' companies.

Major features of the National Packaging Covenant

The Covenant is a voluntary national approach to the issue of post-consumer packaging waste management with a regulatory framework back up. No quantitative targets have been established (compare for example the Dutch Packaging Covenant which includes quantitative targets), however there are performance objectives. The Covenant has a five-year duration.

The objectives of the Covenant are (ANZECC 1999, 3):

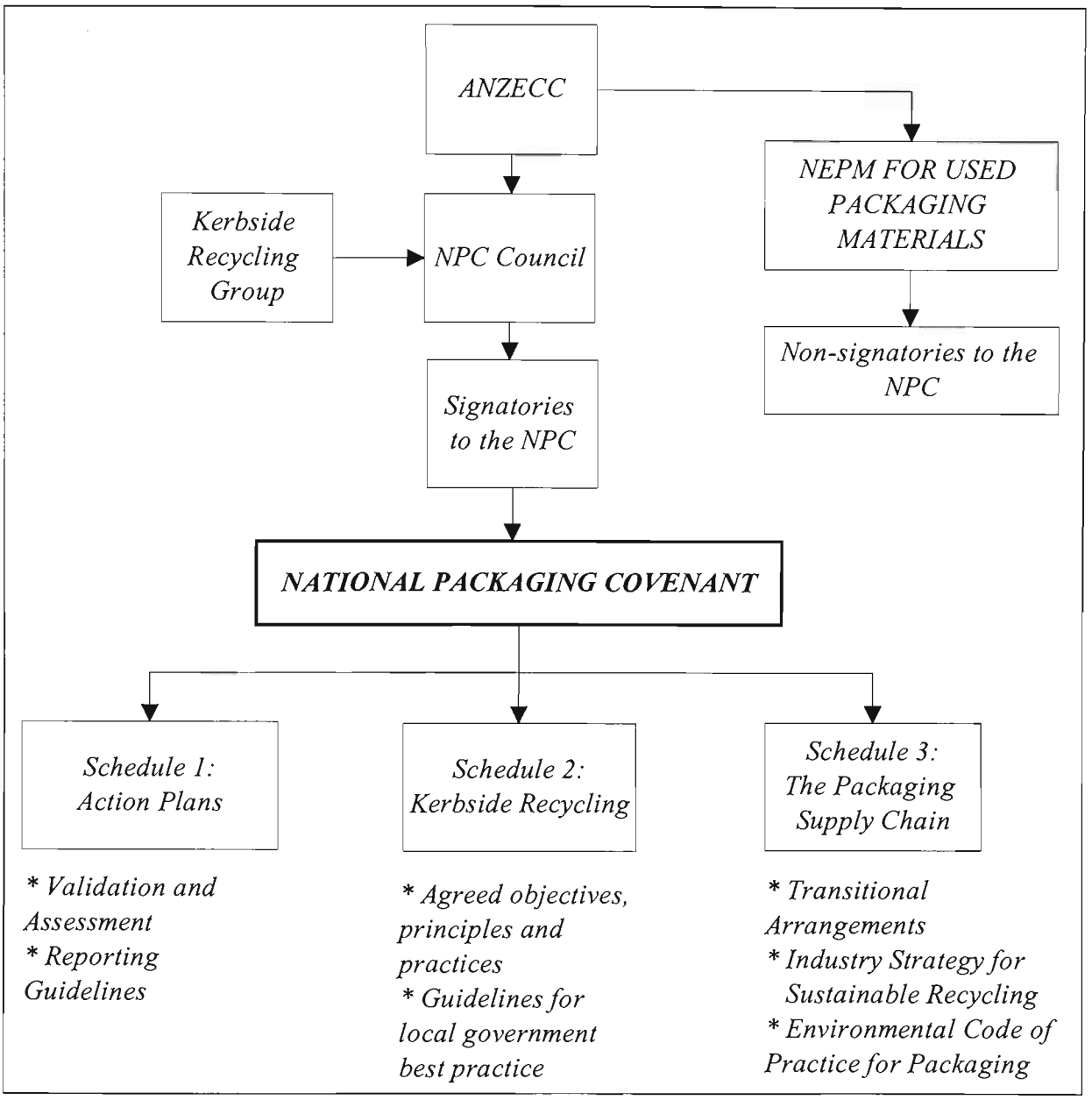
1. *"Establish a framework based on the principles of shared responsibility for the effective lifecycle management of packaging and paper products including their recovery and utilisation;*

2. *Establish a collaborative approach to ensure that the management of packaging and paper throughout its lifecycle and the implementation of collection systems including kerbside recycling schemes, produces real and sustainable environmental benefits in a cost effective manner; and*

3. *Establish a forum for regular consultation and discussion of issues and problems affecting the recovery, utilisation and disposal of used packaging and paper, including costs".*

The National Packaging Covenant Council (NPCC) has been established to oversee the implementation of the Covenant and consists of 12 members (6 industry, 4 Australian New Zealand Environment Conservation Council members, and 2 local government) (Figure 2.4). Companies, industry associations and governments who sign up to the covenant are known as signatories. Signatories are required to submit yearly action plans (including an annual report of progress), that outlines what activities and programs are going to be undertaken to implement their covenant commitments. The action plans are public documents and are available on the internet (Environment Australia 2001a). Secondly, signatories are required to contribute to the Kerbside Transitional Funding Arrangement. The Kerbside Transitional Funding arrangement consists of levies from signatories, which is matched dollar for dollar by the commonwealth government. The funds are used to support education, infrastructure and research programs into packaging waste management issues.

Figure 2.4 Overview of NPC structure

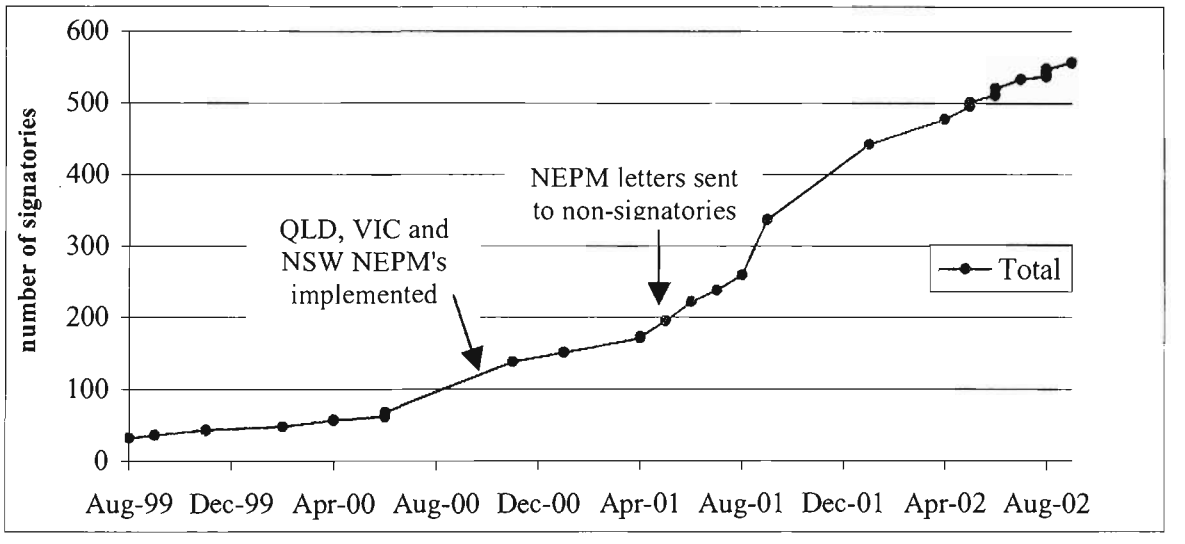


Covenant signatories are exempt from the National Environment Protection Measure (NEPM) on Used Packaging Materials, which has been implemented in most States and Territories to ensure that covenant signatories are not disadvantaged in the market place. The NEPM was released on 2 July 1999. It forms a regulatory 'safety net' affecting those companies who do not sign the NPC (Environment Australia 2001a) and consists of "take back" requirements with the focus on brandowners. The State NEPMs that are in place are: Victoria (on 1st July 2000 as a State Environment

Protection Policy), Queensland (came into effect on 1st July 2000 incorporated into the Environmental Protection Regulation), New South Wales (on 29 September 2000 as the NSW Industry Waste Reduction Plan for Used Packaging Materials) (NPCC 2001b), South Australia (came into effect on 2nd July 1999 as a Policy under the Environment Protection Act 1993) (NPCC 2001a), Tasmania and the Australian Capital Territory.

The founding signatories to the NPC on the 27 August 1999 were 13 companies, 9 industry associations, the commonwealth government, all 7 state governments, and 2 local governments (32 in total). Since the initial signing the number of signatories has continually grown. As of the 4th of October 2002, there were a total of 557 signatories consisting of 521 companies, 17 industry associations, 8 ANZECC members and 11 local government and waste boards. Figure 2.5 illustrates the growth of NPC signatories.

Figure 2.5 Growth in total signatories to the NPC



Source: Packaging Expose newsletters from the Packaging Council of Australia[3].

[3] The PCA is the national association of packaging raw material suppliers, packaging manufacturers, packaging users, retailers and packaging designers/consultants. The Packaging Expose is a monthly newsletter prepared by PCA for its members. http://www.packcoun.com.au/.

There has been a distinct increase in company signatories since June 2000 and in particular since April 2001. There appear to be two major reasons for this significant increase. First, the implementation of the NEPM in Victoria, Queensland and New South Wales, and a notice sent to non-signatories giving them 30 days to sign the covenant or be liable to comply with the requirements of the NEPM. Second, the eventual understanding by many companies in the packaging supply chain (e.g., small and medium size enterprises and companies that initially believed that they were not 'packaging' companies) that they do fall under the requirements of the Covenant.

Changes occurring post NPC implementation

The implementation of the NPC has lead to some significant changes in the Australian packaging chain (Williams 2000; Shmigel 2001):

- Senior company management and non-environmental personnel are becoming involved in the dialogue and covenant process at levels of interaction that have not been seen before;
- For the first time - the entire packaging supply chain is becoming involved in attempting to address the issue of post-consumer packaging waste;
- All entities in the packaging supply chain, from companies to government, are encouraged to think of the wider picture of product stewardship and not just recycling;
- The covenant framework is flexible allowing all to participate in a manner suitable to their circumstances;
- The Covenant Council, a body representing all parties, has been created;
- There is dialogue across the supply chain;
- Signing onto the NPC is a factor to gain "preferred supplier" status; and
- More efficient, less wasteful packaging (including costs, technical and environment) is the agenda that all in the packaging supply chain should be acknowledging and addressing.

Examples of outcomes of programs being implemented by signatories include (Williams 2000; Shmigel 2001):

- Major beverage filler having recycling labelling on all products;
- Prescriptive packaging specifications by major general merchandiser;
- Material shifts on the basis of environmental performance; and
- Consideration of LCA based characteristics of various materials by packaging manufacturers.

Table 2.4 presents examples of changes that are occurring within three companies that have signed onto the NPC. As Table 2.4 illustrates, these food manufacturers' action plans to date have focused upon identification of the characteristics of packaging materials (e.g., recyclability) and waste minimisation and auditing. One important change is the supplier/customer relationship. The first example involves Inghams, the largest vertically integrated poultry producer in Australia, where the customer (i.e., retail chain) specified the type of packaging they wanted for the product (i.e., whole poultry) (Seddon 2002). This resulted in Inghams working with a packaging supplier to eliminate the polystyrene tray and polyvinyl chloride wrap system that the poultry had previously been packaged in and the development of a vacuum-wrapped plastic bag (the e-bag). In the other case, Nestle, the world's largest food company, will be specifying in their Year 2 Action Plan that their suppliers of packaging material are required to be NPC signatories (Carroll 2002). Both are examples of customers specifying requirements to suppliers (either it being suppliers of packaging material or suppliers of packaged product).

Table 2.4 Examples of changes occurring within companies in the supply chain as a result of the NPC

Company	Date signed NPC and lodged action plan	Changes that companies have identified as occurring since signing the NPC
Inghams Enterprises (largest vertically integrated poultry producer in Australia)	*June 2001 signed and lodged action plan in December 2001*	• *Adopted Code of Practice for Packaging.* • *Undertake waste monitoring and reporting.* • *Developed e-bag (vacuum plastic wrap) for whole chickens and eliminated use of 3 million polystyrene trays with PVC wrap.* • *NPC on twice monthly conference agendas.* • *Have added disposal and recycling logos to all retail packaging.* **Source:** (Seddon 2002).
Nestle (world's largest food company)	*September 2000 signed and lodged action plan in September 2001*	*Major initiatives:* • *Environmental evaluation of products and packages* • *Waste minimisation audits at major production sites.* • *Provision of on-pack recyclability and disposal instructions on retail packaging.* *Year 2 action plan initiatives include:* • *Greater focus on suppliers through environmental evaluation and requiring packaging suppliers to be Covenant signatories* • *Full implementation of internal packaging environmental review process.* ***Source:*** (Carroll 2002).
National Foods (milk and diary product manufacturer)	*November 2000 signed, action plan lodged November 2001*	• *Structure: management responsibility, with steering committee and site-based teams* • *Understanding of current performance - 87% of packaging currently recyclable.* • *Review opportunities for using recycled materials.* • *Source reduction focus* **Source:** (Risk 2000).

Key learnings that Nestle has achieved from the NPC process internally include (Carroll 2002):

- Need for a central co-ordinator and strong management advocate;
- Need for an empowered, cross-divisional team to develop the plan and co-ordinate ongoing actions;
- Need to better engage the 'marketing' division, and;
- Packaging design environmental evaluation - understanding what it actually means.

A review of the action plans of the NPC signatories was undertaken in mid-late 2002. Though the report has yet to be publicly released some of the main findings of the report, reported by Gavin Williams, CEO of the Packaging Council of Australia, are presented below (PCA 2002b, 1):

> *"The review has made a number of findings about Action Plans: most stated general intent but failed to assign measurable targets; some had simply copied their industry association's action plan template; many companies indicated that they were reluctant to include specific details of actions in plans that were publicly available; there is evidence that companies are beginning to work with suppliers and customers with regard to packaging and the Covenant; a number of companies said they are not given enough credit for current and past environmental achievements; the Environmental Code of Practice[4] did not have a high profile in Action Plans; in most companies senior management is responsible for the Covenant Action Plan".*

[4] The industry self-regulatory Environmental Code of Practice for Packaging (The Code) is designed to provide companies with guidelines to help evaluate the environmental impact of new and existing packaging Environment Australia (2001a). It is part of Schedule 3 of the Covenant.

The future for the NPC

The development of the National Packaging Covenant took several years of debate surrounding the issues of post-consumer packaging waste management. An agreement was reached among industry and government in 1999 upon a voluntary framework that would allow signatories to publicly commit themselves to adopting principles of product stewardship and life cycle management of packaging throughout the supply chain. In just over 3 years since the Covenant came into practice the number of signatories has increased from 32 to 557. It has been suggested (Williams 2000; Shmigel 2001) that for the first time in Australia the entire packaging supply chain, senior company management and non-environmental personnel are becoming involved in addressing environmental issues. New ways of thinking and addressing issues surrounding packaging are being made, strategic alliances are being established and/or strengthened and the Covenant is providing a mechanism for cooperation among suppliers and users across the entire packaging supply chain like never before. Time will tell what the actual achievements and success of the Covenant process will be, though there are encouraging signs.

2.7.2.2 The Australian Greenhouse Challenge Program

In 1992 in Rio de Janeiro, the United Nations (UN) Convention on Climate Change was signed by 37 industrialised countries that were committing to implement measures to reduce their countries' greenhouse gas emissions (Parker 1999). This was re-negotiated in 1997 in Kyoto and became known as the Kyoto Protocol on Climate Change. Following this most countries introduced voluntary programs to reduce their greenhouse gas emissions. As Parker (1999, 63) explains:

> *"rather than using strict regulation to set reduction targets or impose carbon taxes for business, governments in most countries turned to co-regulatory schemes based on voluntary agreements to reduce industrial emissions".*

Australia was no different to many other countries and in 1995 the Australian Greenhouse Challenge Program (GHCP) was launched. This program is a *"joint voluntary initiative between the federal government and industry to abate greenhouse*

gas emissions" (AGO 2000) and is managed by the Australian Greenhouse Office (AGO). The GHCP came about after industry-heard rumours of a possible introduction of a carbon tax or some other strict regulation (Parker 1999). An industry network was formed, consisting of 30 industry associations and companies that approached the federal government of Australia to lobby the government to negotiate towards a voluntary scheme to address the reduction of greenhouse emissions.

Organisations participating in the GHCP are required to enter into an agreement with the government to reduce their emissions through implementation and monitoring of actions to abate emissions (Parker 1999; AGO 2000). The Greenhouse Challenge is one of a broader framework of policies and measures that are in place to assist Australia in meeting its commitments[5] made at the Kyoto Protocol in 1997. GHCP participation (membership) involves three main steps: commitment, co-operative agreement, and on-going results (AGO 2000). In the commitment stage a Letter of Intent (LOI) is completed and submitted to the Federal Minister for Industry, Science and Resources which becomes the official commitment to take up the Greenhouse Challenge (AGO 2000). This Co-operative Agreement includes

> "*an inventory of emissions; an action plan with specific actions to minimise emissions; performance indicators to measure progress; and a forecast of expected abatement of emissions over a set time period*" (AGO 2000).

Examples of actions taken by members in the Challenge Program include reducing energy use, switching to renewable energy sources, using alternative fuels, and capturing fugitive emissions (AGO 2000). Regular monitoring of emissions and reporting of achievements is required. Independent verification is also undertaken on the basis of a random selection of reports (AGO 2000). The program is based entirely upon voluntary agreements and there are no penalties for companies who wish to exit the program.

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[5] As of October 2002, Australia had not ratified the Kyoto Protocol.

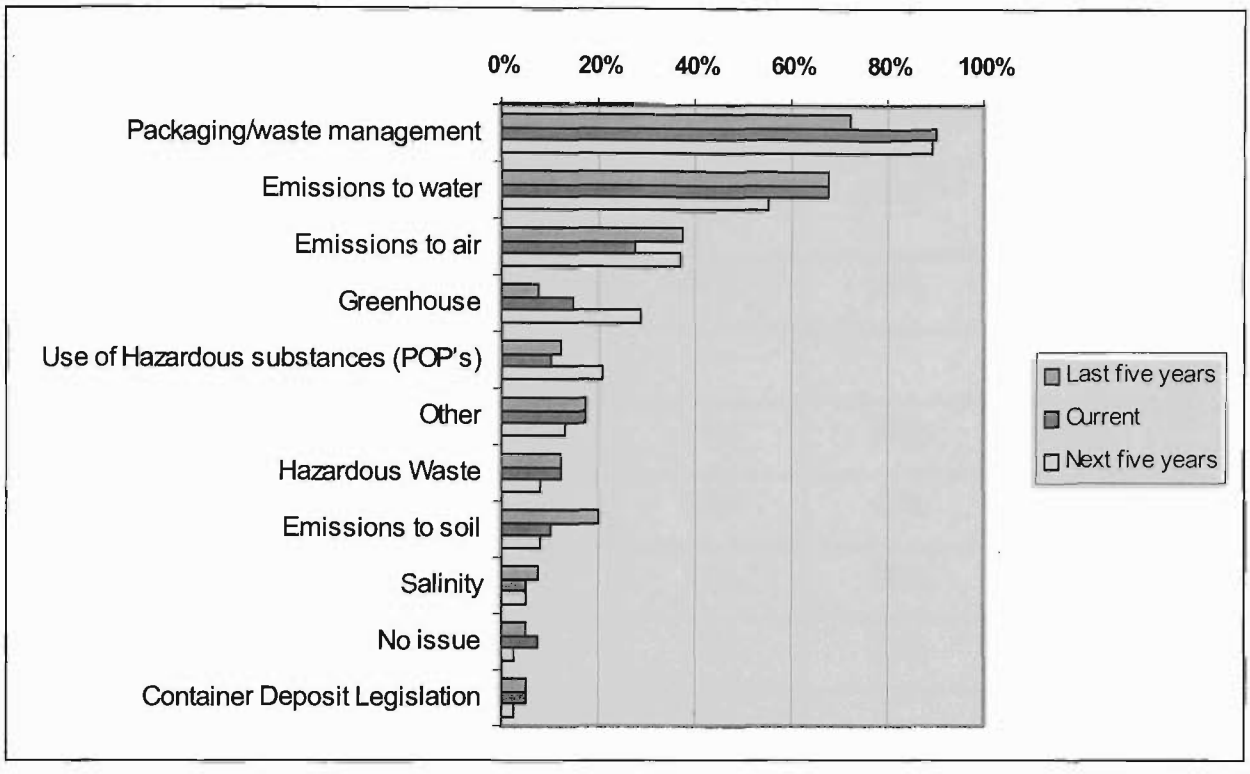
The final section of this chapter reviews findings from the Australian Food and Grocery Industry 2001 Environment Report in order to identify some of the key environmental issues from the perspective of food manufacturing and grocery companies.

2.8 Overview of Australian food and grocery industry environment report

The Australian food and grocery industry has an annual turnover of $54 billion (AFGC 2001). The Australian Food and Grocery Council (AFGC) is the peak national organisation that represents the Australian processed food, drink and grocery products industry and comprises more than 185 companies, subsidiaries and associates. In December 2001, the AFGC released its first public industry environmental report, which presents findings from its August 2001 survey of members along with some of the findings from its 1993 and 1999 surveys. The survey methodology employed in 2001 was an on-line questionnaire with 53 questions and it also required key performance indicators (KPIs) reporting on four key issues (water consumption, energy use, waste generation and post-industrial recycling rates). In 2001, 43 AFGC member companies participated in the survey out of 106 full member companies (40% response rate). A breakdown of the 43 responding companies is as follows: food processors (58%); home and personal care manufacturers (23%); and food ingredient manufacturers (19%).

The key environmental issues as indicated by the responding food and grocery companies are presented in Figure 2.6.

Figure 2.6 Key environmental issues for the Australian food and grocery industry



Source: (AFGC 2001, 12).

From Figure 2.6 it is clear that Australian food and grocery companies see packaging as the most important environmental issue (AFGC 2001, 12):

> *"Packaging and related issues have emerged as the most important environmental issues for food and grocery manufacturing companies in Australia and are expected to remain as significant over the next five years. This is likely to be due to the National Packaging Covenant, whose promotion, adoption and implementation has created stronger levels of awareness among all companies in the packaging supply chain".*

Packaging/waste management, emissions to water and emissions to air are the top three issues identified by the respondents of the survey. Environmental policies are in place in 70% of the responding companies, 53% have a formal environmental

management system, 10% have ISO 14001[6] and 49% are currently obtaining ISO 14001 accreditation for their environmental management system. Table 2.5 presents the responses regarding the areas of packaging related achievements that have occurred from 1993-2001 in AFGC member companies.

Table 2.5 Percentage of responding AFGC member companies that indicate packaging-related achievements between 1993-2001 for a number of specific areas.

Areas in which packaging-related achievements have occurred	1993(1)	1999(2)	2001(3)
Use of recycled and recyclable packaging	17%	78%	77%
Light-weighting of packaging			67%
Changes to optimise transport effectiveness	13%	53%	60%
General reduction of packaging	52%	43%	53%
Move to larger trade units	13%	20%	35%
Introduction/use of refill packs/sachets	17%	23%	19%
No achievements	30%		2%

Source: (AFGC 2001, 12).

Note:

(1) 46 companies participated out of 60 member companies (76.6% participation rate).

(2) 40 companies participated out of 99 member companies (40.4 participation rate).

(3) 43 companies participated out of 106 member companies (40.5% participation rate).

Since 1993 there has been a significant increase in the number of companies using recycled and recyclable packaging and optimising the transport effectiveness of packaging systems.

[6] ISO 14001 = International Organisation of Standardisation 14001 - Environmental management systems. See Section 3.5 for a discussion on environmental management systems.

Table 2.6 presents the percentage of responding AFGC member companies that have identified environmental impacts to be managed at an operational level.

Table 2.6 Percentage of responding AFGC member companies and the environmental impacts identified to be managed (1993-2001).

Impacts that companies consider	1993[1]	1999[2]	2001[3]
Solid waste from production	98%	83%	91%
Liquid wastes	98%	95%	88%
Odour and other aesthetic considerations	60%	68%	88%
Energy consumption	96%	85%	81%
Noise	96%	83%	81%
Atmospheric emissions (not greenhouse)	89%	70%	79%
Packaging design (recyclability)			74%
Water consumption		83%	74%
Hazardous waste from production			72%
Packaging design (light-weighting)			70%
Greenhouse gases		30%	47%
Other minimisation of post-consumer waste		38%	37%
Reduced product size - concentrates			19%

Source: (AFGC 2001, 30).

Note:

(1) 46 companies participated out of 60 member companies (76.6% participation rate).

(2) 40 companies participated out of 99 member companies (40.4 participation rate).

(3) 43 companies participated out of 106 member companies (40.5% participation rate).

2.9 Summary

Packaging plays an integral role in the protection, containment, preservation and convenient provision of products from their point of origin through the supply chain to final consumption (use). The global packaging supply chain is faced with an array of environmental, economical and social issues, which include an ageing population,

increase in the number of single households, introduction of electronic shopping, waste management techniques, recycling targets, taxes and deposit systems, returnable packaging, and the introduction of regulatory and voluntary environmental frameworks. The specific environmental issue that the Australian packaging supply chain is faced with in the coming decade is the National Packaging Covenant (Williams 2001; PCA 2002a). This chapter has provided a background review of the packaging supply chain and some of the key environmental issues. These issues will be revisited in the findings Chapters 5 - 8 and the summary (Chapter 9).

3 ENVIRONMENTAL ACCOUNTING, COSTING APPROACHES AND LIFE CYCLE ASSESSMENT

3.1 Introduction

The purpose of this chapter is to review the literature on the traditional accounting system and the emerging field of environmental accounting with respect to environmental costs. This is followed by a review of research into environmental reporting and management systems. An analysis of three cost accounting approaches - life cycle costing (LCC), value chain analysis (VCA) and activity based costing (ABC) is undertaken. Finally the life cycle assessment (LCA) approach is reviewed and the chapter concludes with the presentation of the research aim and research questions.

3.2 Traditional accounting systems and environmental costs

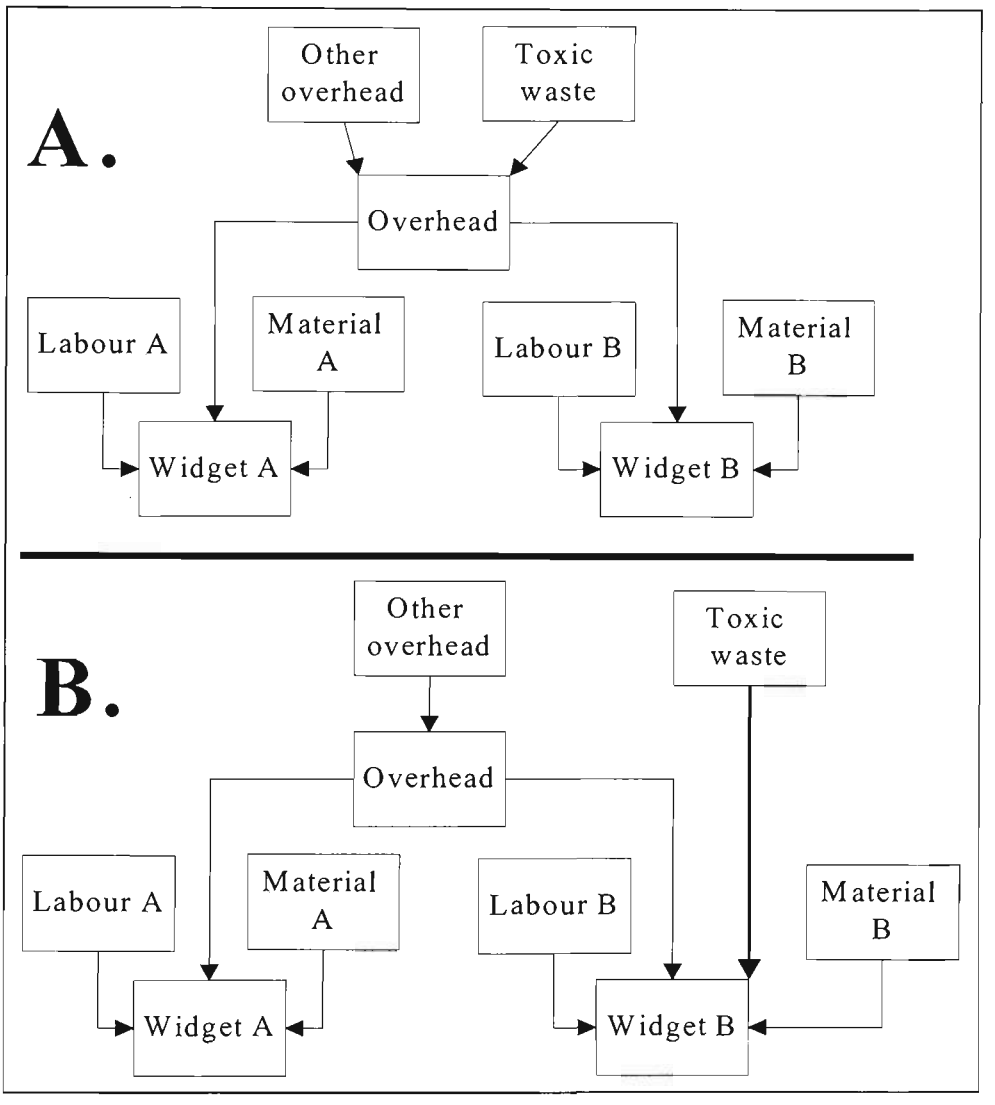
Conventional costing systems were designed for manufacturing facilities in the early 1900s when low volumes of products were produced and the facilities and products consumed similar services (Innes and Mitchell 1993). In recent decades, the diversity of products produced by companies has increased as have the resources and wastes involved. Typically, traditional accounting systems have classified costs under the following categories (Horngren *et al.* 1997; US EPA 1998b):

- Direct materials and labour;
- Manufacturing or factory overhead;
- Sales;
- General and administrative overhead; and
- Research and development.

Traditionally, there have been two ways of treating an overhead cost item within the accounting system. Firstly it could be allocated on a particular basis to specific

products or secondly it may be placed within a pool of costs that are not attributed to any specific product (US EPA 1998b). Overheads may be allocated incorrectly (higher for one product than another) or not reflected at all in the product cost. This results in poor product costing leading to poor pricing and incorrect management and information regarding true costs, which provides inadequate incentives to reduce impacts (US EPA 1998b). Figure 3.1 illustrates an example of traditional accounting (A) of overheads compared to a revised system (B) in which the cost is incurred by the responsible product.

Figure 3.1 Example of traditional and revised cost accounting system



Source: (Todd 1992, original not sighted) quoted in (US EPA 1998b, 75).

In many cases, internal environmental costs are treated as overhead costs and are therefore allocated equally among all cost drivers and equally among all products.

This approach does not reflect the true costs of clean-up facilities associated with the generation of emissions for example from 'dirty' products to that of 'clean' products (Schaltegger and Muller 1998, 88):

> *"The 'clean' products...are penalised...and bear costs that they did not cause".*

Table 3.1 illustrates an example of two types of cost allocation.

Table 3.1 Example of a traditional and revised cost allocation of environmental costs

	'Clean' Process A	'Dirty' Process B
Revised allocation		
Revenues	$200	$200
Production costs	$100	$100
Environmental costs	$0	$50
True profit	$100	$50
Traditional cost allocation		
If environmental costs are overhead	$25	$25
Then the book profit is	$75	$75
Which is incorrect by	- 25%	+ 33%

Source: (Hamner and Stinson 1993, 3 original not sighted) quoted in (Schaltegger and Muller 1998, 88).

Research findings (Porter and van der Linde 1995; Epstein and Roy 1997; Quarles and Stratton 1998; Schaltegger and Muller 1998; Stuart *et al.* 1999; Schaltegger and Burritt 2000; Wilmshurst and Frost 2001) are indicating that traditional accounting practices are limiting because many environmental costs are grouped together in overhead costs. As Bebbington *et al* (2001) explain it is well recognised that conventional accounting numbers and conventional economic measurements do not capture all of the consequences of economic action. This results in environmental costs being mis-represented, difficult to identify and therefore opportunities for collection and analysis of such data is restricted.

There is no consistency in the terminology and definition of environmental costs though they usually fall under the following categories (Weitz *et al.* 1994; Sharma and Weitz 1995; White *et al.* 1996; Kreuze and Newell 1997):

- Capital costs;
- Conventional operating costs such as labour and material;
- Hidden costs, for example regulatory compliance;
- Contingent liability costs which can comprise penalties and fines; and
- Externalities like the cost of pollution and resource depletion.

Companies are already recording costs with regard to monitoring, audits, pollution control, waste management and site decommissioning though these costs may not be shown specifically as environmental costs (Wilmshurst and Frost 2001). An externality is a cost that is borne by society.

Examples of environmental costs are presented in Table 3.2.

Table 3.2 Examples of environmental costs.

Direct conventional costs			
Capital	Utility connect	Operation and Maintenance	Waste disposal
Buildings	Equipment installation	Raw materials	Utilities
Equipment	Project engineering	Labour	Revenue recovered
Indirect or hidden costs			
Compliance costs	Reporting	Training	Permitting
Monitoring	Waste Handling	Testing	Insurance
Emergency preparedness	Waste disposal	Waste treatment	Value of lost inputs
Medical surveillance	Waste reuse	Pollution control equipment	Energy costs
Waste storage	Waste recycling	Raw materials linked to (NPO – non product output)	Pollution control purchase
Products reused	Products recycled	Emission costs	Pollution control maintenance
Contingent liabilities and externalities[7]			
Penalties and fines	Personal injury and property damage	Global warming	Ozone depletion

Source: (Weitz *et al.* 1994; White *et al.* 1996; US EPA 1998b)

Parker (1998) undertook an exploratory study of environmental issues and costing approaches in eleven Australian companies[8] operating in the manufacturing, mining, petrochemical, power and horticultural industries. He found that most of the

[7] Externalities are also known as external costs.

[8] Nine companies were publicly listed on the Australian stock-exchange, one was a private company and the other was government owned. The interviews were conducted with environmental managers and were tape recorded and transcribed and a semi-structured question design was employed.

environmental managers were unfamiliar with the costing approaches used within their companies. Companies appeared to be in the early stages of environmental cost recognition and accounting and, for the majority of companies, environmental costs were not separately costed but rather were integrated with the general cost accounting system. Seven of the eleven companies separately identified environmental capital costs for projects or other activities, though many were unconvinced that environmental costs were substantial in relation to the total annual operating costs of the business. The focus of companies still remained on an 'on-site' perspective.

3.3 The emergence of environmental accounting

Coupled with environmental issues (as outlined in Chapter 2), pressures from stakeholders, rising costs of environmental impacts, reduction of trade barriers and increasing globalisation are reasons for the development of improved means of data identification, collection, management, analysis and reporting of financial costs and benefits of business' environmental impacts (Bennett and James 1998a; Schaltegger and Burritt 2000). A recent area of development in the accounting field that attempts to integrate the above issues is environmental accounting.

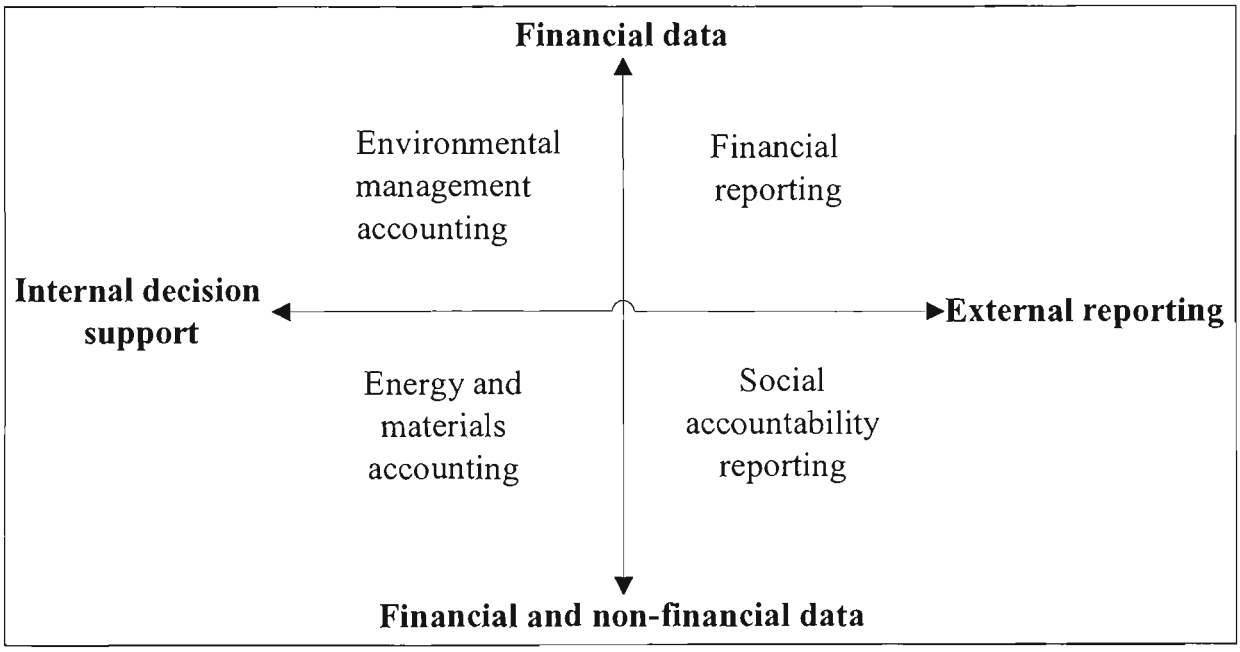
There are a number of definitions of environmental accounting. Schaltegger and Burritt (2000, 63) define environmental accounting as:

> *"a subset of accounting that deals with activities, methods and systems; recording, analysis and reporting environmentally induced financial impacts and ecological impacts of a defined economic system (e.g., a firm, plant, region, nation)".*

Gray (2001) suggests that environmental accounting comprises of two principal components: environmental reporting for accountability and environmental accounting for management control. The first entails the collection of information into 'public statement accounts', detailing how the organisation uses, interacts with and impacts upon the natural environment. The second relates to the information compiled into the public statement accounts being integrated within the information system of the organisation and being used in decision-making.

There are two broad types of costs within environmental accounting – internal and external[9] costs. The first is concerned with accounting for internal environment related expenditure (expenditure already incurred and captured within a company's accounting system but perhaps lost in general overheads). The second deals with 'external cost accounting' – the internalisation of environmental externalities (Bebbington *et al.* 2001). Four approaches to environmental accounting at the level of the organisation are presented in Figure 3.2.

Figure 3.2 Four approaches to environmental accounting at the level of the organisation



Source: (Bartolomeo *et al.* 2000, 33).

As Figure 3.2 illustrates there are four main approaches to environmental accounting - environmental management accounting, energy and materials accounting, financial reporting and social accountability reporting. Each approach uses different data (i.e., financial and/or non-financial) and can be used primarily for internal decision support or external reporting.

A number of researchers (Cooper and Kaplan 1997; Epstein and Roy 1997; Kreuze and Newell 1997; Bennett and James 1998b; Quarles and Stratton 1998; Cokins

[9] External costs also known as externalities.

1999; Healy and Stephens 1999; Stuart *et al.* 1999; Bebbington *et al.* 2001) have developed methods and costing systems to assist companies in the identification of costs, in particular internal and external environmental costs for input into decision-making.

In both physical and financial terms, the implications of the impact upon the environment by companies can no longer be ignored by management (Wilmshurst and Frost 2001). Reasons why companies should consider environmental related management accounting and environmental costs to manage the business (Bennett and James 1998a; Ditz *et al.* 1998; US EPA 1998b; Schaltegger and Burritt 2000; Gray 2001) include:

- To demonstrate the impact of environment-related activities on the balance sheet and the profit and loss statement;
- To more accurately determine costing and pricing of products through understanding environmental costs and process and product performance;
- To identify the profitable products, sites and companies by tracking and tracing environmental costs;
- To identify risks and opportunities resulting from, for example, environmental impacts or legislation;
- To identify and act upon opportunities for cost reduction, eco-efficiency opportunities and other improvements;
- To strategically explore and prepare for future changes in the business environment; and
- To enhance customer values and improve competitive advantage from the demonstration of environmentally preferable products, processes and services.

Ditz *et al* (1998, 165) explain that:

> *"the real value of environmental accounting lies behind the aggregate figures. By digging more deeply into the composition of the total, the*

behaviour of these costs and other underlying factors, firms can link cost reduction to significant improvements in environmental performance".

Mathews (1997) concluded that in the period 1970-1981 the focus of research in environmental accounting was upon social accounting, whereas in the period 1981-1995 the attention shifted to environmental accounting, which increased dramatically from the early 1990s. He also concluded that from 1995-2001 the major interest in environmental accounting by researchers was environmental disclosures (Mathews 2002).

Social accounting has been an active area of research since the mid 1960s (Gray 2002). It is concerned with community, employee, consumer and environmental issues along with issues of fair trade, involvement with other countries and transfer of wealth between countries (Gray and Bebbington 2001). As Gray (2002) suggests, the term social accounting can take on numerous forms and labels. Although it is a very important area of research which interlinks with environmental accounting, social issues are not the focus of this research.

With the increase in the level of research being undertaken within the field of environmental accounting, areas of research now include descriptive studies of environmental and social reporting, motivations for environmental and social reporting, developing 'best practice' for environmental and social reporting, full cost accounting, accounting for externalities, environmental management accounting, taxation instruments, environmental collaborations and correspondence between corporate disclosure and corporate performance (Deegan 2002).

A sub-set of environmental management accounting is environmental cost accounting, which according to Bartolomeo *et al* (2000, 49):

> *"can be seen in part as a specific application of activity-based costing (ABC) which focuses on the environment as a key cost driver; and environmental management accounting's emphasis on end-of-life costs, and on other costs which are either downstream or upstream from the organisation itself".*

A number of companies have demonstrated the value of identifying their environment-related costs and the opportunities achieved through the control and minimisation of these costs. Examples include Baxter International that achieved US $11.1 million in environmental savings (income, savings and cost avoidance) in 1996 (Bennett and James 1998c); Du Pont - which discovered that increases of over 19% of its manufacturing costs for one agricultural pesticide were identified as environmental, and at Amoco Oil nearly 22% of the operating costs (excluding feedstock) were considered environmental at the Yorktown refinery (Ditz *et al.* 1998). Xerox Ltd saved $2.1 million per year by replacing polystyrene packaging with returnable containers (Bennett and James 1998b). How companies define the word environment, where they draw the company's system boundaries, what they term as an environmental cost varies between companies and this can make it difficult to compare company environmental information (Burritt 1997; Ditz *et al.* 1998; Bouma and Kamp-Roelands 2000).

The EcoMac project conducted in 1996 by Bartolomeo *et al* (2000) found that environmental management accounting activities are not systematically and comprehensively implemented in companies, instead it appears in isolated environmental projects. The project involved interviews with an environmental specialist and a financial specialist from each of 84 companies in Germany, Italy, the Netherlands and the United Kingdom. The focus was upon the chemical, pharmaceutical, energy and printing industries. Of the companies participating in the interviews, 53% had formal environmental policy goals, 56% of the companies had an EMS and 24% were in the process of implementing an EMS. Most respondents

expected that the activities in environmental management accounting would increase in the future. ABC was only implemented in 18% of the companies and was being considered by another 6% (Bartolomeo *et al.* 2000).

Environmental management accounting opportunities for the businesses that were identified were (Bartolomeo *et al.* 2000, 48):

- *"understanding and managing environmental costs;*
- *introducing waste minimisation schemes;*
- *integrating environment into decisions with long-term implications on capital expenditure and product development;*
- *understanding and managing life cycle costs;*
- *involving accountants in a strategic approach to environmental management accounting and performance evaluation;*
- *encouraging cross-fertilisation of knowledge and ideas; and*
- *linking data held by different business functions".*

A survey[10] by Wilmshurst and Frost (2001) of the top 500 companies listed on the Australian Stock Exchange in 1994/95, found that the three most common environmental information inclusions within the existing management accounting information and control systems (by the responding 121 companies) were risk assessment (60%), capital budgeting (59%) and internal reporting (53%). The identified areas in which specific environmental accounting practices had been developed were energy use (45%), rehabilitation (43%), addressing the cost of legal regulations (42%) and part of product costing (41%).

[10] The Chief Financial Officer (CFO) and the Chief Executive Officer (CEO) were surveyed. A survey was mailed and delivered to 398 companies with 121 usable CFO responses (30% response rate) and 95 usable CEO responses (24% response rate).

Wilmshurst and Frost (2001, 137) concluded that:

> *"there is a need for mechanisms that are able to incorporate financial information as well as qualitative data relating to the environment. Such mechanisms may include tools such as life cycle analysis, activity based costing and cost-benefit analysis. These tools could be utilised to incorporate environmental impact into business decision making and the evaluation of performance".*

As a lead into the discussion of environmental reporting and environmental management systems the following quote from Elkington (1997b, 8) illustrates the time sequence of companies producing environmental reports and implementing environmental management systems:

> *"As more and more companies join the ranks of the report-makers, however, reporting remains haunted with a paradox. Logically, before companies began to report externally on environmental performance, initial efforts should have been focused upon developing appropriate environmental accounting methodologies for measuring performance and then installing full management structures and systems for auditing against them. Only then would a company environmental report be produced. So much for the ideal approach. In practice, companies have tended to kick-off with auditing, followed by reporting. Only now are many of them...starting to think about whether their EMS, if it even exists, is up to the task".*

3.4 Environmental reporting

The majority of research on environmental reporting to date has focused upon the type and amount of environmental disclosures in annual reports (Guthrie and Parker 1990; Deegan and Gordon 1996; Hackston and Milne 1996; Wilmshurst and Frost 2000; Tilt 2001), using content analysis (i.e., counting the number of words or sentences of environmental disclosures), though studies have not assessed the 'quality' of the disclosures. Other studies (Deegan and Rankin 1996; Deegan and Rankin

1997; Deegan *et al.* 2000; O'Donovan 2000; Wilmshurst and Frost 2000; O'Donovan 2002) have tested legitimacy theory to explain the degree of environmental and/or social disclosures as a result of external issues/influences.

There are several theories that have been developed, tested and refined which attempt to explain the increasing incidence of social and environmental reporting. These theories attempt to explain the function of information and disclosure within the interaction between organisations, governments, groups and individuals (Gray *et al.* 1996). Definitions for three of these theories are given below: legitimacy theory, stakeholder theory and political economy theory. As Gray *et al* (1995, 52) explain stakeholder theory and legitimacy theory should be viewed as two perspectives that overlap each other "*within a framework of assumptions about political economy*". According to Gray *et al* (1996, 45) stakeholder theory takes:

> "*an explicitly systems-based view of the organisation and its environment which recognises the dynamic and complex nature of the interplay between them*".

In order for a company to continue to operate, stakeholder support and approval must be sought and the activities performed by the organisation need to be adjusted to gain the stakeholder approval (Gray *et al.* 1995). Legitimacy theory extends upon stakeholder theory and it is argued that (Gray *et al.* 1996, 46):

> *"organisations can only continue to exist if the society in which they are based perceives the organisation to be operating to a value system which commensurate with the society's own value system".*

The type of legitimacy tactics chosen by a company depends on whether the company is trying to gain or extend its legitimacy, maintain it or repair it after it was lost or threatened (O'Donovan 2002). Political economy is defined by Gray *et al* (1996, 47) as:

> *"the social, political and economic framework within which human life takes place".*

By adopting a political economy theory perspective an attempt is made to introduce and widen analysis and reasoning from the narrower stakeholder and legitimacy perspective, to help explain the factors that are contributing to the phenomenon being studied (e.g., why companies disclosure environmental information). In summary these theories are viewed as similar whereby pressure is exerted upon organisations to disclosure social and environmental information and, on the other hand, organisations use this information to legitimate, to deflect disapproval and/or control the debate (Gray *et al.* 1996).

Findings from these studies (Deegan and Rankin 1996; Deegan and Rankin 1997; Deegan *et al.* 2000; O'Donovan 2000; Wilmshurst and Frost 2000; O'Donovan 2002) suggest that companies will generally only report information that is favourable to their corporate image, that there is an increase in the level of reporting following major incidents and/or companies will report information to either gain, maintain or repair their legitimacy.

Researchers have also investigated the link between requirements to supply information to, for example, the National Pollutant Inventory (Section 2.7.1.1) and what is reported in the annual report (Cunningham and Gadenne 2002) and others have investigated the reporting practices of companies on the internet (Lodhia 2002). Studies on environmental reporting have focused upon companies operating in the mining, oil exploration, chemical and forestry sectors (Neu *et al.* 1998; Parker 1998; Deegan *et al.* 2000) and the pharmaceutical sector (Schaper 2001; Schaper 2002) has also been investigated. Other studies (Guthrie and Parker 1990; Hackston and Milne 1996; Frost and Wilmshurst 2000; Wilmshurst and Frost 2000; Wilmshurst and Frost 2001) have concentrated upon the top 50, 100 or 500 companies on specific national stock exchanges for their sample population and have generally used mailed-survey questionnaires to collect the data. Cormier and Gordon (2001) took a different approach and used a case-study approach investigating electric utilities, two publicly owned and one privately owned. They found that more social and environmental information was disclosed by the publicly owned companies and suggested "*that legitimacy theory, proprietary costs and information costs*" be used to investigate and

explain "*why firms with different ownership structures have diverse reporting strategies*" (Cormier and Gordon 2001, 607-8).

Deegan and Rankin (1997, 580) found that annual report users, in particular, "*shareholders and members of organisations with a review oversight function*" consider environmental information to be material to their decisions, though this information is not of primary importance to their decisions. There is also evidence that environmental reports are used by environmental groups to assess the environmental performance of those companies (Tilt 1994). Wilmshurst and Frost (2000) investigated the factors that are involved in the decisions of companies to disclose environmental information. They found that the most important factors were "*shareholders' or investors' right to information, legal obligations and 'due-diligence' requirements, and community concerns*" (Wilmshurst and Frost 2000, 22). When these factors were correlated with what was actually disclosed, positive associations were found, except for the 'legal' factors that were rated a high factor but did not appear to be translated into actual disclosure quantity.

Tilt (2001) found that companies were more inclined to disclose information in their annual report on activities such as waste and recycling, rehabilitation, and pollution control measures. She found that there was a low number of companies in Australia producing public environmental reports, suggesting that this is evidence that companies are not sufficiently providing stakeholders with information on their environmental impacts. Therefore it is difficult to gauge the level of environmental responsibility of companies.

The Sustainability Reporting Guidelines (GRI 2002) and the Framework for Public Environmental Reporting (Environment Australia 2000) are two examples of voluntary guidelines that companies can follow in preparing an environmental report. In 1997, the Global Reporting Initiative (GRI) was launched as a joint initiative of the U.S. non-governmental organization Coalition for Environmentally Responsible Economies (CERES) and United Nations Environment Program with the aim "*of enhancing the quality, rigor, and utility of sustainability reporting*" (GRI 2002, i). An exposure draft was released in 1999 and following the release of the 2000 guidelines a review was undertaken which culminated in the production and release

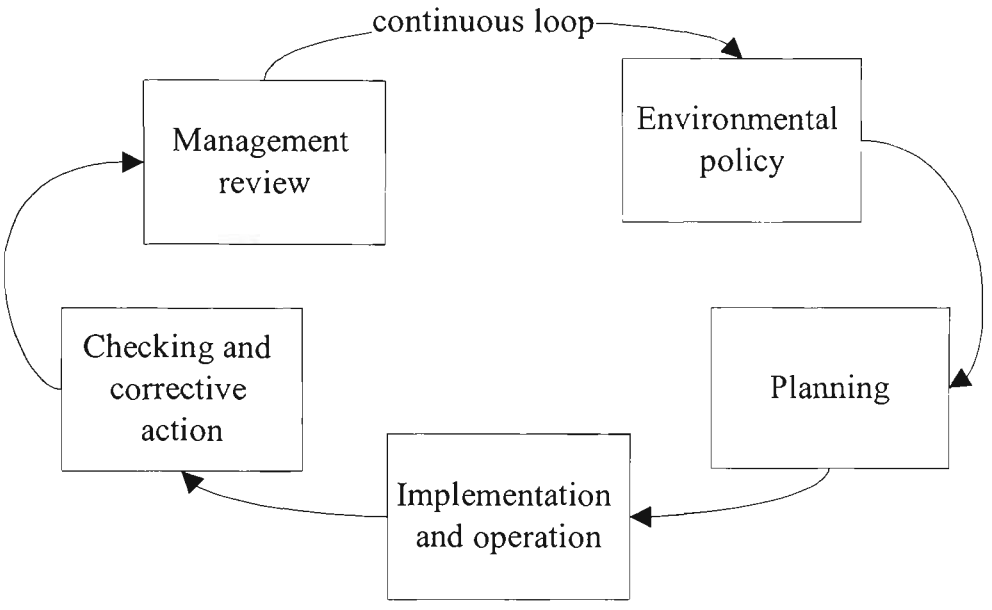
of the 2002 guidelines. The guidelines are voluntary and their aim is to assist companies and stakeholders in better understanding the reporting towards the sustainable development framework. The Framework for Public Environmental Reporting is an adaptation of the GRI guidelines to suit Australian companies and local requirements (Environment Australia 2000).

There is evidence that Australian packaging companies disclose environmental information (Gibson and O'Donovan 2000). There currently exists a knowledge gap of the reasons why companies in the Australian packaging industry undertake environmental reporting. There are several different theories that have been developed and tested to determine the drivers in other industries, and while acknowledging that these theories exists, they will not be tested in this thesis. An investigation of the drivers for companies operating in the Australian food packaging supply chain in regard to environmental reporting will be performed (Section 5.5).

3.5 Environmental management systems

An environmental management system (EMS) provides an organisation with a framework to identify and evaluate "*how its activities, products and services interact with the environment*" (Hortensius and Barthel 1997, 23). A strategy is developed that will ensure that the company achieves legal compliance, while also putting in measures to use energy and materials more efficiently (Fresner 2000). When implementing an EMS, companies are required to develop an environmental policy, identify environmental aspects, develop environmental objectives and targets, implement the measures and systems and provide continual monitoring, measurement, auditing and review (Standards Australia and Standards New Zealand 1996; Hortensius and Barthel 1997). Figure 3.3 illustrates the continuous improvement process within the EMS.

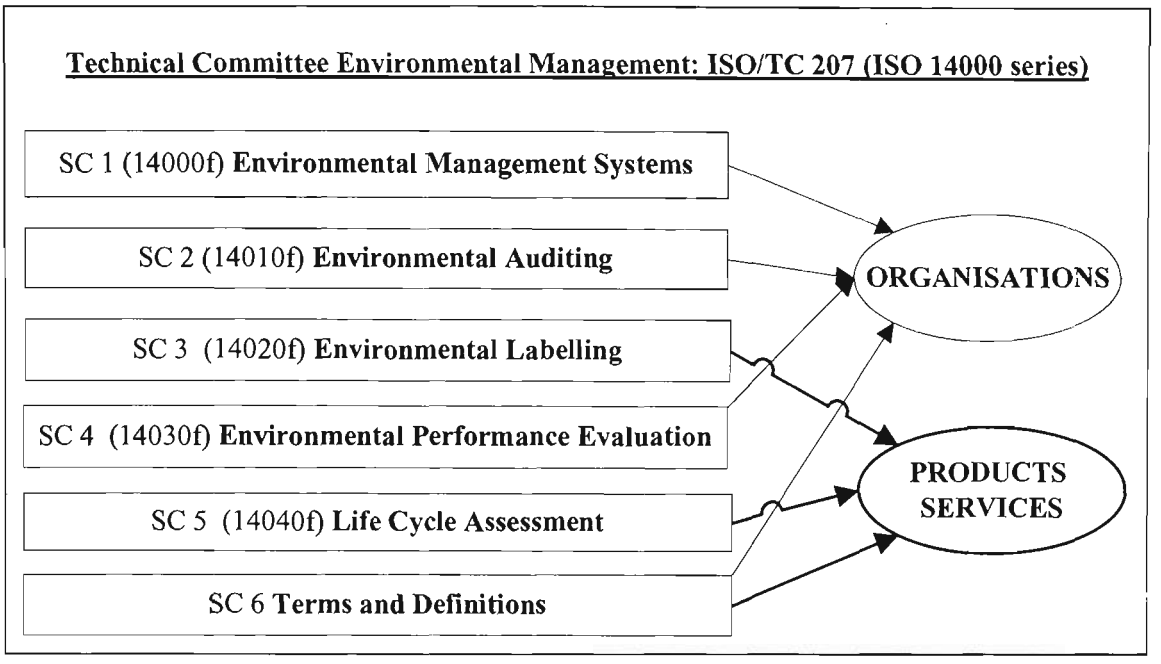
Figure 3.3 Environmental management system model



Source: (Standards Australia and Standards New Zealand 1996, 8)

The EMS framework is governed by an international standard - ISO 14001 (Standards Australia and Standards New Zealand 1996) and Figure 3.4 illustrates where this standard fits in with other environment related standards as embedded in the ISO 14000 series of standards. The ISO 14001 - Environmental management standard (Standards Australia and Standards New Zealand 1996) is a specifications standard (Gleckman and Krut 1997) that was launched on the 1st September 1996 (Sheldon 1997). As of the 31st of December 2001 there were 36,765 certifications to ISO 14001 across 112 countries with 1,370 in Australia, which is 3.9% of all certifications (ISO 2002). A limitation identified by some authors (Gleckman and Krut 1997; Hortensius and Barthel 1997; Wells and Galbraith 2000) is that the ISO 14001 EMS framework is management-based (emphasis on measuring environmental conformance to a set of standards) instead of performance-based and therefore many companies may not see results in improvement of environmental performance.

Figure 3.4 Overview of ISO 14000 series



Source: (Finkbeiner *et al.* 1998, 170).

Cramer (1998, 164) argues that:

> *"companies have concentrated mainly on adapting the business process to environmental requirements imposed by government and other external parties. Companies basically limit their endeavours to that what is necessary. They will also occasionally take further environmental measures if these yield financial benefits in the short term. Companies then look for the right 'fit' between their business operations and the environmental standards formulated by society".*

Cramer (1998) identified three variables that influence the level of ambition of a company to increase the efficiency in the use of materials and energy through environmental management. They are i) the link between increased eco-efficiency and market opportunities; ii) the company culture and internal structure; and iii) external pressures from immediate and wider society stakeholders to implement environmental measures.

Marinova and Altham (2000) investigated the adoption of new technologies within EMS and non-EMS companies in Western Australia. They found that companies that

had adopted an EMS were more likely to adopt new environmental technologies (4.3 new technologies per company) compared with the adoption rates of non-EMS companies (2.9 new technologies per company). EMS companies were also more aware of the environmental impacts of the company's activities compared with non-EMS companies where it was found that some of these latter companies were reluctant to acknowledge that they could reduce their impacts and were content to comply with regulations. The main factors for both EMS and non-EMS companies to adopt new environmental technology included cost reductions, energy efficiency, increased productivity, regulatory compliance and product differentiation. Cost reduction was an incentive for Austrian companies to implement an EMS (Fresner 2000), and in Belgium companies with an EMS in place observed advantages in terms of competition, public relationships and risk management (Tack 2000).

In a study of 13 internal and 13 external stakeholders of a multinational chemical company, Bouma and Kamp-Roelands (2000, 137) found that stakeholders generally expected:

> *"an EMS to enable the control of processes which are critical to both an organisation's environmental management and the protection of the environmental itself. The areas which were deemed to be of great or critical importance focused on: i) improving environmental performance; ii) preventing environmental accidents; iii) ensuring compliance with legislation; iv) the provision of reliable information; and v) the control of waste handling".*

Bouma and Kamp-Roelands (2000) also found that internal stakeholders are interested in using the environmental information from an EMS to assist them in the better management of their production processes and external stakeholders are interested in the accountability of companies.

In a study of eleven Australian companies, Parker (1998) found that ten had a formal environmental policy. The environmental policy was seen in some companies as driving the shape and orientation of the environmental management system (EMS). Six companies had an EMS in place with another two companies planning to put the

system in place, though most of the systems were not compliant with the ISO 14001 standard.

In 1996 Arthur D Little conducted a survey with 115 blue-chip companies in the United States of America and 84 in the United Kingdom and found that 62% of US and 60% of UK responding companies viewed the certification of their EMS important to their business (Sunderland 1997). The main driver for certification was to demonstrate due-diligence to stakeholders.

A required part of implementing an EMS is the development of an environmental policy (Standards Australia and Standards New Zealand 1996). Table 3.3 lists a number of characteristics of corporate environmental policies as complied by (Tilt 2001).

Table 3.3 Characteristics of corporate environmental policies

- Inclusion of an objective to report
- Charter subscription
- Setting of environmental standards or targets
- Board member given responsibility for the policy, including funding for the policy, research and development
- Involvement of staff with the policy
- Integration of the corporate environmental policy with other policies
- Evidence of an environmental management system
- Environmental manager or committee appointed
- Existence of an environmental audit
- Mention of environmental laws or compliance issues
- Other environmental disclosures

Source: (Tilt 2001, 195)

Tilt (2001) investigated, via content analysis, the corporate environmental policies of forty companies. She found that 93% of the policies had reference to staff support that is needed to successfully implement the policy and 80% mentioned compliance with environmental law. According to a comparison of the findings in Tilt's (2001) study with those of a United Nations (1994, original not sighted) study, Australian companies do not disclose their policies as frequently as companies from other countries. She also concluded that there appears to be a missing link between *"policy*

development, standard setting and performance evaluation via reporting" (Tilt 2001, 206) with their development and implementation occurring independently of each other within the company. The policies also "*contain little reference to reporting standards or the necessity of disclosure*" (Tilt 2001, 190).

An example of a company's environmental policy statement is presented in Table 3.4.

Table 3.4 Example of a company's environmental policy

[.....] [(1)] *environmental policy is expressed as a series of commitments that set the standards and practices, which we will use in addressing environmental issues.*

These commitments are to:

1. *Conduct our business in compliance with environmental laws and regulations. Even where we are in full compliance we will strive to minimise the environmental impact of our operations.*
2. *Provide employees with a healthy and safe work environment as well as encouraging their contribution towards environmental responsibility.*
3. *Ensure efficient use of energy, raw materials and natural resources by following the concept of 'Reduce, Reuse and Recycle'.*
4. *Work with relevant organisations, government bodies and public groups in the development of public environmental policy.*
5. *Promote awareness of environmental issues with our suppliers, our employees and the communities in which we operate.*
6. *Assign management responsibility for the environment and maintain procedures to ensure that this policy is implemented.*
7. *Implement procedures to check and review our environmental performance. We will set targets for improvement and aim to demonstrate continually improving performance.*

Note: (1) Reference to company has been removed to maintain confidentiality.

Three management cost accounting approaches - life cycle costing (LCC), value chain analysis (VCA), and activity-based costing (ABC) are each discussed in the following sections as being relevant in the identification, allocation and analysis of environmental costs and provide platforms for the integration of environmental information into business decisions. A description of the life cycle assessment methodology as one of many environmental evaluation techniques supporting environmental management is then presented.

3.6 Life cycle costing

In the 1960s the United States (US) Department of Defence began developing life cycle costing (LCC) for the purposes of government procurement (Shields and Young 1991; Epstein 1996). LCC was further developed by others (Artto 1994; Booth 1994; Bennett and James 1998b) to provide additional understanding of the costs associated with the design, production, manufacture and use of a product and to assess costs associated with an investment.

Currently there is no consistency in the terminology or definitions of LCC. To date over ten definitions have been found in the literature describing LCC. Terminology used includes product's life cycle, strategic positioning, total cost assessment, total costs accounting, life cycle costing, and full cost accounting (Ferrara 1990; White *et al.* 1996). Some authors consider the life cycle of the product to be from design to disposal – what will be termed in this thesis as the 'producer' life cycle, and others consider the life cycle of the product is from raw materials extraction through to and including disposal – to be considered the 'supply chain' life cycle. Others define the life of the product in the marketplace as the life span and there are also definitions related to the life cycle cost borne by the consumer once they purchase a product (Shank and Govindarajan 1993; Artto 1994).

Examples of definitions to describe LCC are illustrated in Table 3.5 under the categories of 'producer', 'supply chain' and 'customer' life cycle boundaries.

Table 3.5 Examples of life cycle costing definitions

Definitions of Life Cycle Costing	**Source**
'PRODUCER life cycle	
"Life cycle costs refer to all the costs that the producer will incur over the product's life cycle, including design, manufacture, marketing, logistics and service. Whole life cost of a product includes life cycle costs as well as costs that consumers incur, such as the costs of installation, operation, maintenance, revitalization and disposal".	(Shields and Young 1991, 39)
The producer's product life cycle costs *"refers to all the costs a producer incurs over the life of a single product including costs for product conception, design, product and process development, production, logistics, marketing, service and guarantees".*	(Artto 1994, 29)
"A life cycle cost estimate encompasses all costs, including design, development, operation, maintenance and final disposition over the anticipate life span of a process, product, facility or system".	(US EPA 1998c, 122)
"The process of assessing the cost of a product over its life cycle or portion thereof. The life cycle cost is the sum of acquisition cost and ownership cost of a product over its life cycle".	(Standards Australia and Standards New Zealand 1999, 7)

'SUPPLY CHAIN life cycle	
"Life cycle cost is defined as all internal and external costs associated with a product, process, project or activity throughout its entire life cycle - from raw materials acquisition to recycling/final disposal of waste materials. Internal costs are those directly incurred by an organisation (e.g., capital, labor, energy and regulatory compliance costs). External costs are those not directly incurred by the organisation (e.g., resource depletion, water contamination, and human health effects)".	(Weitz *et al.* 1994, 28)
"Life-cycle costs include all internal costs plus external costs incurred throughout the entire life cycle of a product, process, or activity".	(White *et al.* 1996, 7.11)
"Considers the full costs over the product's (system's, operation's) life cycle - from research through disposal, from cradle to grave"	(Kreuze and Newell 1997, 62)
"A method in which all costs are identified with a product (process or activity) throughout its lifetime, from raw material acquisition to disposal. Life cycle costing may focus on internal costs, or it may attempt to consider internal and external costs".	(Schaltegger and Burritt 2000, 112)
'CONSUMER life cycle	
"The relationship between what a consumer pays for a product and the total cost the consumer incurs over the life cycle of using the product".	(Shank and Govindarajan 1993, 15)
"Means extending horizons beyond the purchase costs of products to consider all the costs that will be incurred over their operating lifetime – including, in principle, the environmental costs involved in buying, using and disposing of the product".	(Bennett and James 1998a, 48)

An example of a company using concepts of LCC is Ontario Hydro, which is developing a strategy for full cost accounting that considers concepts of LCC. The aims are to consider the full life cycle cost (including consideration of damages to human health and the environment) though at a minimum to consider costs it has direct control over and responsibility for – design, construction, operations and maintenance and decommissioning/disposal (US EPA 1998a).

In the publication *Public Policy Applications of Life Cycle Assessment*, by the Society for Environmental Toxicology and Chemistry (SETAC) life cycle costing is identified as (Allen *et al.* 1997, 69):

> *"..... one approach for incorporating environmental considerations directly into cost calculations. By considering material and energy flows (from a life cycle inventory) over an extended time period, cost and potential savings that may be neglected in conventional accounting can be addressed".*

3.7 Value chain analysis

A method that takes a broad focus to managing costs that extend out and external of a company is what Porter termed as the value chain (Shank and Govindarajan 1993). The value chain concept originated through the work of Porter regarding competitiveness of companies and competitive strategies (Porter 1980; Porter 1985; Porter 1990; Porter and van der Linde 1995). The concept is that each business is a part of an extended value chain and to gain competitive advantage over its competitors it must (Porter 1990, 40):

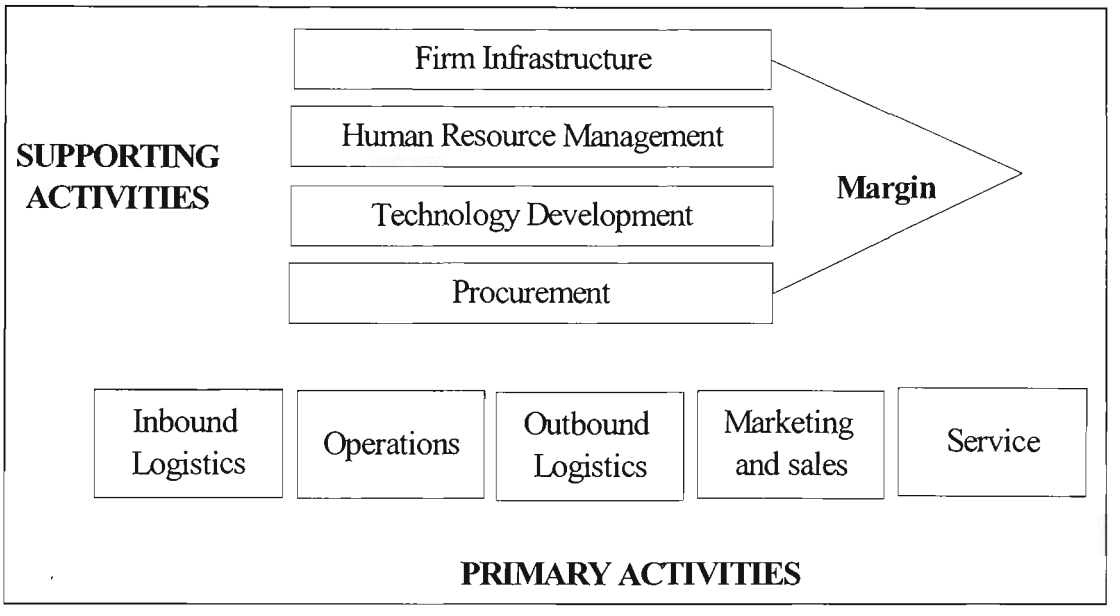
> *"perform activities more efficiently than its competitors (lower cost), or perform activities in a unique way that creates greater buyer value and commands a premium price (differentiation)".*

Value chain analysis (VCA) is defined by Shank and Govindarajan (1993, 13) as:

> *"for any firm in any business is the linked set of value-creating activities all the way from basic raw material sources for component suppliers through to the ultimate end-use product delivered into the final consumers' hand. This focus is external to the firm, seeing each firm in the context of the overall chain of value-creating activities of which it is only a part, from basic raw material components to end-use consumers".*

The definition of the value chain by Shank and Govindarajan (1993) omits a very important stage of the life cycle that being post-consumer waste management as is considered in life cycle assessment (Section 3.9). A generic value chain is illustrated in Figure 3.5.

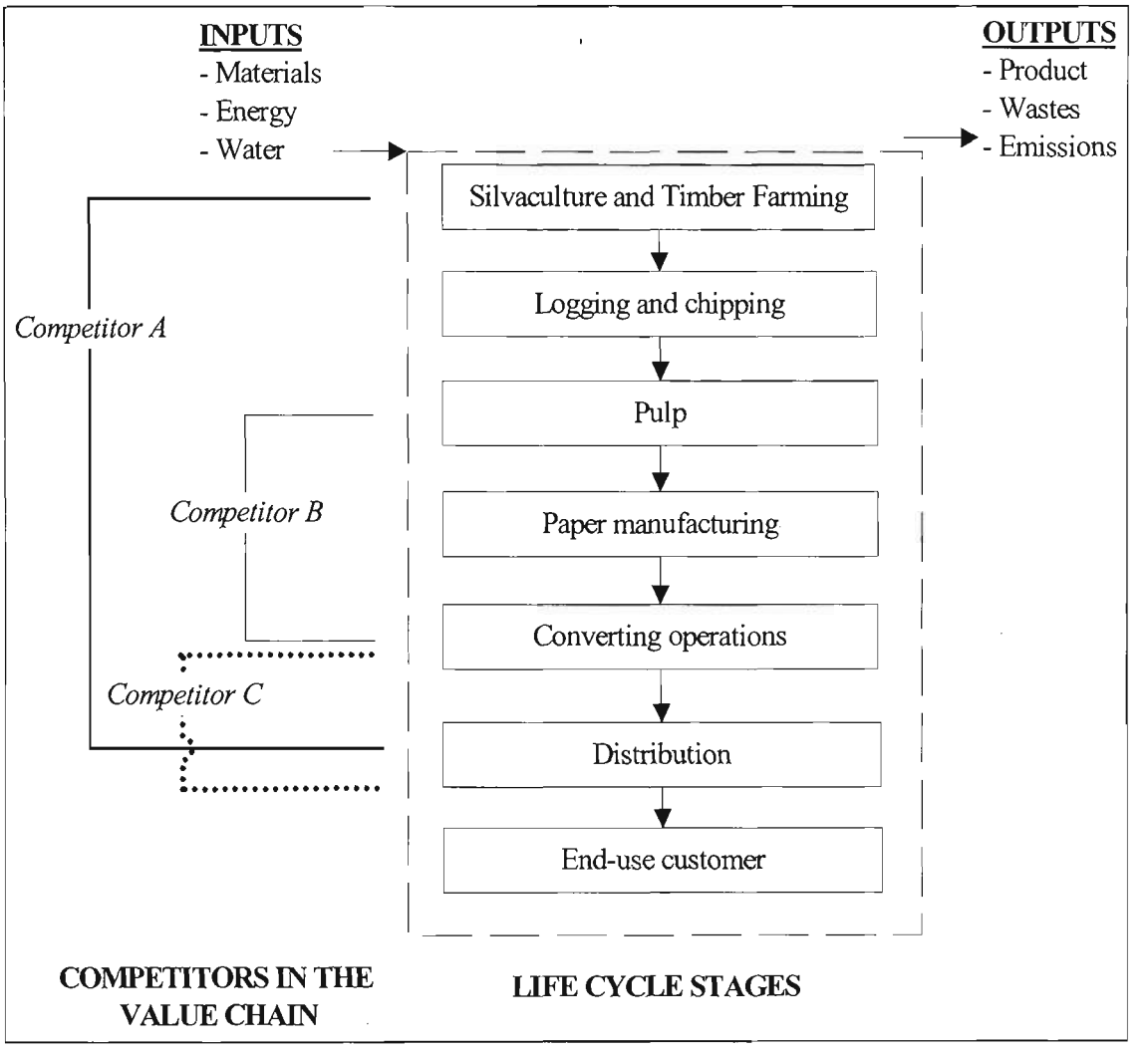
Figure 3.5 Generic value chain



Source: (Porter 1985, 37).

In Figure 3.6, an example of a value chain illustrating a paper products industry is presented.

Figure 3.6 Value chain and life cycle inventory in the paper products industry



Source: Adapted in part from Shank and Govindarajan (1993, 52).

Note: The post-consumer stage is not considered within the Shank and Govindarajan value chain.

This example has been adapted in part from Shank and Govindarajan (1993) and provides an illustration of the different processes and stages of the life cycle that are performed to deliver a final product, in this case paper, to the end-user. Figure 3.6 also combines the principles of life cycle assessment (Section 3.9). On the left side of Figure 3.6 an illustration of possible competitors and the range of activities they perform in the value chain are identified. The dashed box on the right side of the figure represents the system boundary. For each of the identified activities (stages of

the life cycle), material and energy are consumed as inputs, and products, emissions and wastes are generated as outputs. This represents the life cycle assessment component.

Drury and McWatters (1998) support the argument for value chain analysis and life cycle costing. They describe the value chain as a framework that (Drury and McWatters 1998, 38):

> *"separates activities that add value to the firm's products from those that do not, and provides the basis for ABC costing and thus attention to cost and revenue drivers.....It also emphasises the importance of..... life cycle costing thus linking suppliers to customers through the value chain"*

The holistic approach of the value chain concept (though it excludes post consumer waste management) is consistent with the life cycle assessment approach in management accounting.

3.8 Activity based costing

In the mid 1980s, US companies were faced with major issues, which centred around a new manufacturing environment and the introduction of advanced manufacturing technology, in conjunction with the global penetration of local markets (Jones and Dugdale 2002). At that time, there were also two strands of managerial thinking - identifying company core businesses through product profitability and corporate decentralisation directed at niche markets (Armstrong 2002).

In the 1980s Kaplan, Cooper and Johnson conducted field studies where they developed the beginnings of the activity based costing (ABC) approach. Johnson's emphasis was upon the management of activities, while Cooper and Kaplan were concerned with the more accurate measurement of product costs (Jones and Dugdale 2002). Between 1985 and 1987 the method of ABC emerged. In the early 1990s, Kaplan and Cooper redefined the ABC method. A research and development organisation - the Computer-Aided Manufacturing, International (CAM-I) - which was sponsored by a US coalition of industry, professional accountancy firms and

government agencies also conducted work towards the development of ABC (Jones and Dugdale 2002).

ABC is a management system that provides improved product costing (Coates and Frey 1999; Woodlock 2000) through the more accurate allocation of internal costs (Schaltegger and Muller 1998). In an ABC system, costs can be disaggregated to a product, service, customer or organizational level and provides managers with a better understanding of the profitability areas (Cooper and Kaplan 1998) within the organisation. It also provides managers with a better understanding of the linkages between their operations, products and processes across the organisational functional boundaries (Kaplan 1992).

Terms that are used to describe the process of allocating environmental costs to responsible activities, cost centres and cost drivers include environmental-enlightened cost accounting, full cost accounting, process costing, activity based accounting and activity based costing (ABC). Unlike the other terms, full cost accounting includes the consideration of external environmental costs (Schaltegger and Muller 1998; Bebbington *et al.* 2001). ABC enhances managerial understanding of the processes in the business that is associated with each product and identifies where value is added and destroyed (Schaltegger and Muller 1998).

The definition of ABC by Quarles and Stratton (1998, 24) is that ABC:

> *"identifies activities, the resources used by the activities, the cause and effect relationships of resource consumption (resource drivers), products that consume the activities, and the cause and effect relationships for activity consumption (activity drivers)".*

Costs can be calculated on four different levels – unit, batch, product and facility (Cooper 1990). The ABC model provides an inventory of all of the activities and services that are consumed by the processes and products and describes their cost build-up and the costs of resources actually used (Kaplan 1992; Cooper and Kaplan 1998).

ABC provides information for long-term decision analysis (Landry *et al.* 1997; Corbett 2000) and on customer relationships by identifying low price and low cost suppliers (Kaplan 1992). In addition it has been suggested that ABC can provide managers with an understanding of products and customer profitability, identify high impact areas to be targeted for process improvement and supply strategic cost information about the business (Cooper and Kaplan 1998).

3.8.1 Implementing and using ABC data

Information from an ABC system can be used in strategic decision making with respect to product pricing, investigating changes in product range and mix on existing production lines, and developing and designing new products (Innes and Mitchell 1993). ABC data should not be used in isolation for decision-making. As it is a 'snap-shot' of historical data (Innes and Mitchell 1993) it should be used in combination with other management information systems to aid the decision-making process. In addition to past financial information, budgeted, forecasted or even targeted data can be used (Kaplan 1992).

It has been argued that there are generally two reasons why an organization implements ABC. First, Landry *et al* (1997) explain that managers would like to obtain an understanding of the particular cost structure within the organisation from a process perspective and, second, to ascertain the real cost of its products.

Cooper *et al* (1992) conducted a case study of eight companies in respect of their experiences in implementing an ABC system. Benefits that were observed included mapping and re-structuring the organisational (Cooper *et al.* 1992, 55):

> *"expenses from functional categories and departments to show how they related to the activities and business processes"*,

and realizing that ABC is not just for products but also for processes and activities. The major findings from the case study were that ABC was seen as a management process that could co-exist with traditional financial systems. It provided managers with information to make strategic and operational decisions in respect of product lines, market segments, customer relationships and process improvements.

Eunsup and Stagliano (1997) surveyed 141 United States of America manufacturing companies about ABC implementation and the perceived usefulness of generating information for use by managers in the decision making process. The industry types represented in the survey were classified under chemical, machining, electronics, transportation, medical/photographic instruments and others. The findings indicated that 91 companies (64%) either planned to implement or had already implemented an ABC system during the early-mid 1990s. The three main reasons that were given regarding the importance of the ABC systems to various types of management decisions were product costing, product line profitability and product pricing (Eunsup and Stagliano 1997). Companies with sales within the US $11-500 million (AUD $ 22 million - 1 billion) range were more likely to have implemented an ABC system or were planning to, than companies with sales over US $500 million (AUD $1 billion).

3.8.2 Models developed

In recent decades money spent upon environmental driven activities has dramatically increased, though many companies cannot identify their total environmental costs due to the inappropriate design of the accounting system and cost allocation system. Therefore they do not have the information enabling them to recognize the impact of these costs upon their financial performance. Environmental cost information needs to be related to the activities (e.g., production), places (e.g., cost centres) and objects (e.g., products) in which they occur within the company (Schaltegger and Burritt 2000).

In response to the increases in the amount of money spent upon environmental driven activities, Quarles and Stratton (1998) developed a model whereby Environmental Activity Costs Analysis (EACA) is used to identify, quantify, and classify environmental costs at the organisational, process, and specific product levels. A ten-step process is used to model the organization's activities, products and environmental costs. Five activity-based environmental task classifications were proposed. In a case study example the results indicated that the production process had the lowest percentage of environmental costs, whereas production support, maintenance and

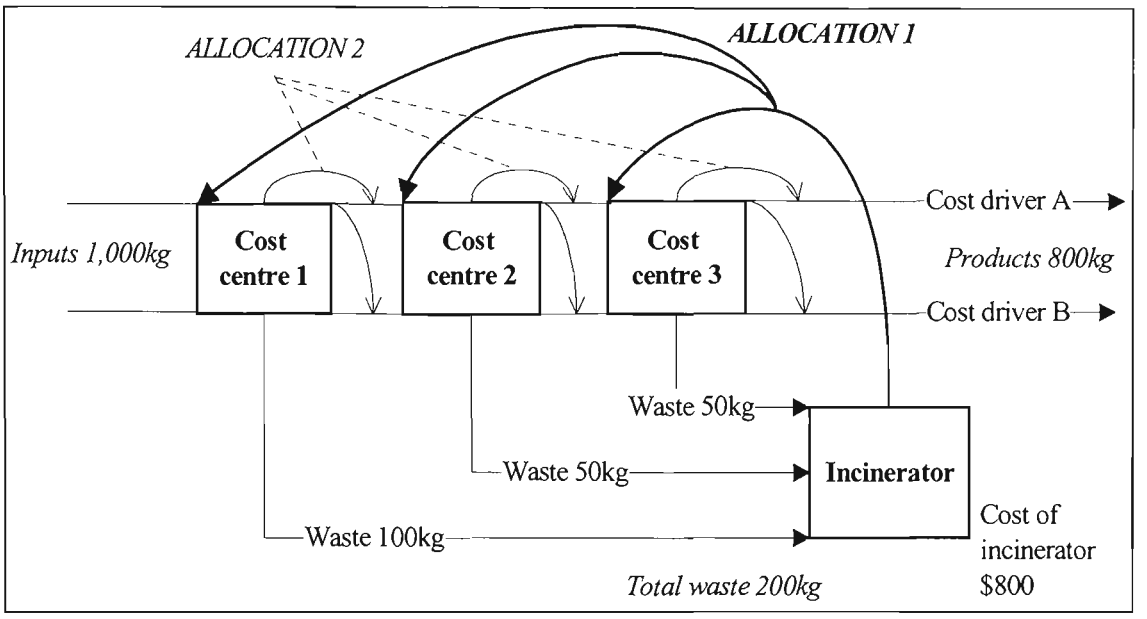
other support functions showed higher percentages. Quarles and Stratton (1998, 30) concluded that the EACA model demonstrated the way in which ABC could:

> *"be used as a framework to identify and quantify the environmental costs in an organisation or in a particular step in the life cycle of a product...successfully addressed environmental costs at the total plant or facility level, at the specific function level and at the individual product level. In addition, the analysis quantified the composition of the total environmental expenditures for each of these levels based on the environmental objectives of prevention, detection, disposal, correction and reporting".*

Stuart *et al* (1999) developed a generic method that incorporated ABC and life cycle inventory for an electronics product assembly line. It aimed to assist designers in measuring the environmental inputs and outputs of the manufacturing process where the allocation procedure is based upon 'cost levels' and 'quantitative input/output levels' (Stuart *et al.* 1999). The model was developed in response to observed deficiencies in the traditional accounting approach that saw emissions, effluents and solid waste that are generated within companies being tracked on a plant-wide basis. As a result these costs were being hidden within the overhead costs, which lead to a reduction in the personnel motivation to reduce or eliminate the production of the wastes. Stuart *et al's* (1999) model claims that environmental inputs and outputs are more accurately determined using an ABC approach.

Schaltegger and Muller (1998) developed a three-step material flow-oriented activity based cost allocation which they applied in investment appraisal of pollution prevention (Figure 3.7).

Figure 3.7 Material flow-oriented activity based cost allocation



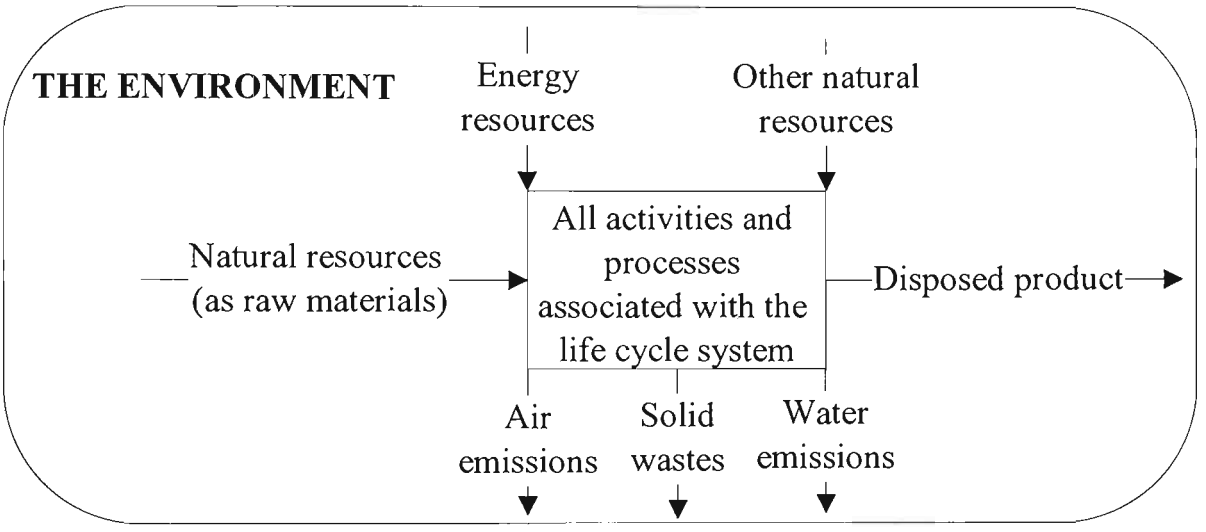
Source: (Schaltegger and Muller 1998, 90)

It involved a three-stage allocation process whereby joint environmental cost centres (e.g., incinerator) are allocated to the responsible cost centres (e.g., production stages) and from there to the final cost objects (products) (Schaltegger and Burritt 2000). The third step involves the allocation of other environmental driven costs to the production cost centres and cost drivers. This allocation process is said to provide managers with information to encourage them to improve the eco-efficiency of the organisation and to support environmentally benign production methods.

3.9 Life cycle assessment

Life cycle assessment (LCA) is an environmental management tool that assesses the potential environmental impacts of a product, process or activity throughout its life cycle. Figure 3.8 illustrates the system concept of LCA.

Figure 3.8 Life cycle system concept



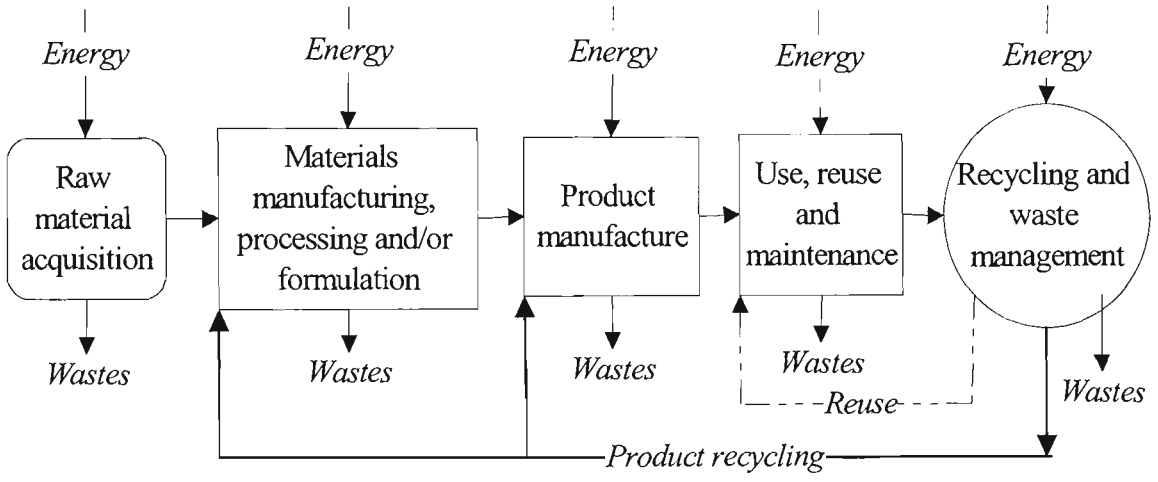
Source: (Boguski *et al.* 1996, 2.4)

In LCA the life cycle encompasses extraction and processing of raw materials, manufacturing, transportation and distribution, use/reuse/maintenance, recycling and final disposal (Fava *et al.* 1991). In the ISO 14040 standard LCA is defined as (AS/NZS 1998, iii):

> *"a technique for assessing the environmental aspects and potential impacts associated with a product,*
>
> *i) by compiling an inventory of relevant inputs and outputs of a product system;*
>
> *ii) evaluating the potential environmental impacts associated with those inputs and outputs; and*
>
> *iii) interpreting the results of the inventory analysis and impact assessment phases in relation to the objectives of the study".*

Other environmental assessment tools include risk assessment, environmental impact assessment, environmental audits, substance flow analysis, energy analysis and material flow analysis. However, unlike LCA, these tools are unable to assess the environmental impacts across the entire life cycle. Figure 3.9 presents a general materials flow diagram for a product life cycle identifying the different life cycle stages.

Figure 3.9 General materials flow diagram for a product life cycle



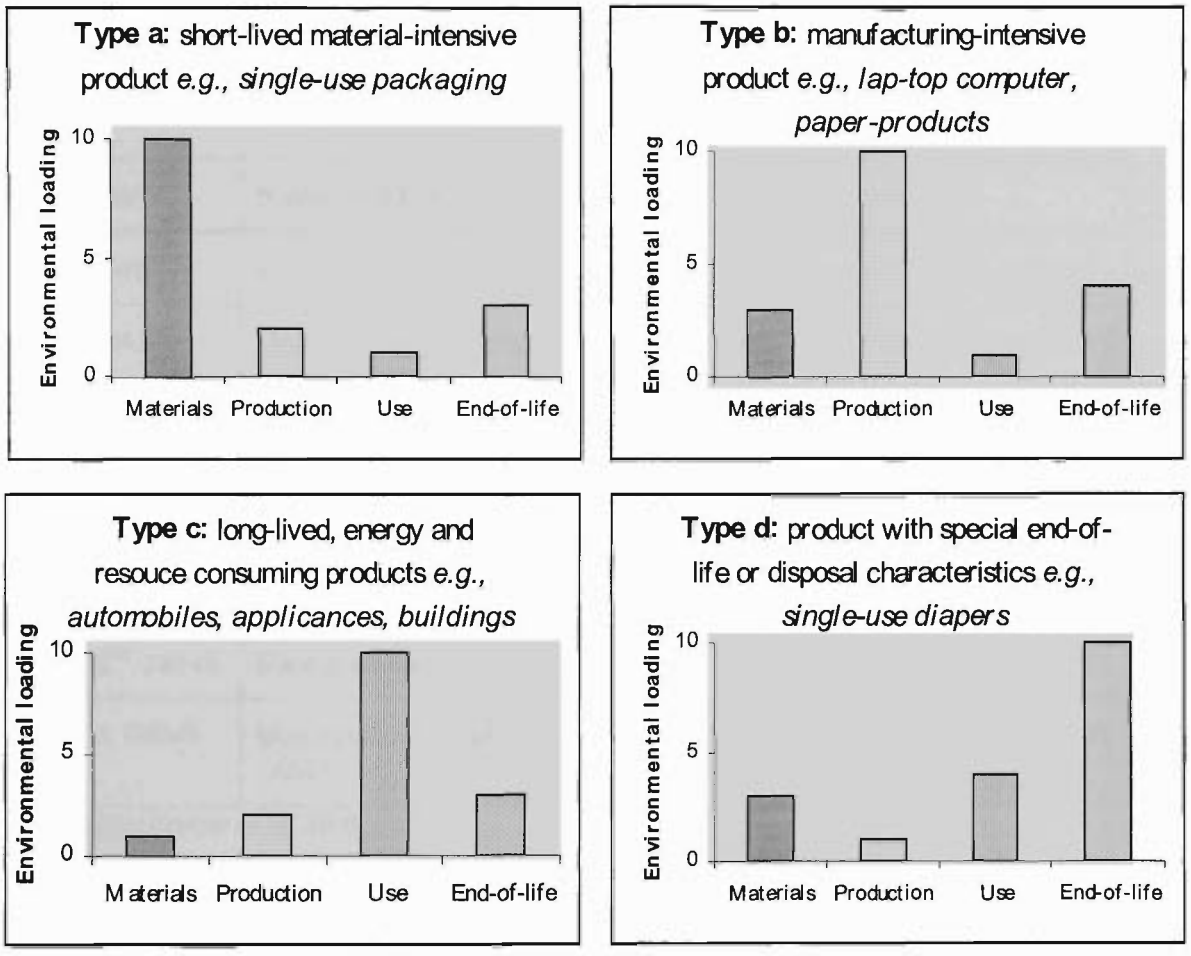
Source: Adapted from (Boguski *et al.* 1996; Allen *et al.* 1997).

LCA adopts a holistic approach to increase our understanding of the potential environmental impacts of a system (product, process, activity or service) and can provide information for decision support (Allenby 1998; Klopffer 1998; Notarnicola *et al.* 1998; Wenzel 1998; Guinee *et al.* 2001). LCA can also play a valuable role in illustrating the complexities that are involved in making environmental choices (Gray *et al.* 1993) and it can provide information that can assist in identifying priority areas and issues (Elkington 1997a). Heiskanen (2000, 241) notes that LCA:

> *"directs attention and potentially action, to new issues beyond the traditional scope of business environmental management".*

As Figure 3.10 illustrates each product has different degrees of impact across the life cycle and LCA provides a means by which to better understand where they occur.

Figure 3.10 Variations in environmental loading for different product types



Source: (Saur 2002, 2).

LCA has evolved since the late 1960s[11] from a solid waste identification method used by only a small number of people, into an environmental management tool governed by an international series of standards (ISO 14040 series - see Table 3.6). The methodology is gaining continual wide adoption by industry, government, academics and consultants. The term life cycle assessment (LCA) was officially adopted in 1990 after a purpose meeting held by the Society of Environmental Toxicology and Chemistry (SETAC) (Fava *et al.* 1991). SETAC has played an important role in the

[11] See (Hunt and Franklin 1996; Norris 1998; Curran 1999; Grant et al 2001a) for specific historical examples.

advancement of LCA methodology development and application e.g., (Fava *et al.* 1991; Consoli *et al.* 1993; Fava *et al.* 1993; Fava *et al.* 1994; Udo de Haes 1996; Allen *et al.* 1997; Udo de Haes *et al.* 1999; van Hoof *et al.* 2001). In the mid 1990s the International Organisation of Standardisation (ISO) began work on the development of the LCA international standards - ISO 14040 series (Table 3.6).

Table 3.6 ISO 14040 Environmental Management - LCA series

Number	Name of LCA standard	Status
ISO 14040	Principles and framework	1st edition (1997)
ISO 14041	Goal and scope definition and Inventory analysis	1st edition (1998)
ISO 14042	Life cycle impact assessment	1st edition (2000)
ISO 14043	Life cycle interpretation	1st edition (2000)
ISO/TR(1) 14047	Examples of application of ISO 14042	1st edition (2002)
ISO/TS(2) 14048	Data documentation format.	1st edition (2001)
ISO/TR 14049	Illustrative examples of how to apply ISO 14041	1st edition (1999)

Source: (Guinee *et al.* 2001, 9).
Notes:
(1) TR = Technical Report
(2) TS = Technical Specification

In 2000, SETAC joined with the United Nations Environment Program (UNEP) to develop the UNEP/SETAC Life Cycle Initiative, which has the intention of establishing LCA best practice throughout the world. The overall aim of the LC Initiative is (UNEP and SETAC 2001, 1):

> *"to develop and disseminate practical tools for evaluating the opportunities, risks, and trade-offs associated with products over their entire life cycle to achieve sustainable development".*

As a result of the work by SETAC, four stages for LCA were proposed, developed and refined over the years (Consoli *et al.* 1993; Fava *et al.* 1993; Allen *et al.* 1997; Standards Australia and Standards New Zealand 1998). They are:

- *Goal and scope definition*: Define, for example, the reasons for conducting the study, the intended audience, and the identification of the product, process or activity under study, the system boundary and functional unit. It is the 'function' of the 'system' under study that is the core of an LCA (e.g., in a comparison of materials for beverage packaging the function of delivering a quantity of beverage to the consumer is considered).

- *Inventory analysis*: The identification, collection and validation of data occurs in the inventory analysis. Data is collected on all inputs (e.g., energy, raw materials) consumed at every stage identified within the system boundaries and all outputs of the system (e.g., product, by-product, wastes and emissions). This results in a list of potentially hundreds of individual data related to the functional unit and is presented in an inventory table.

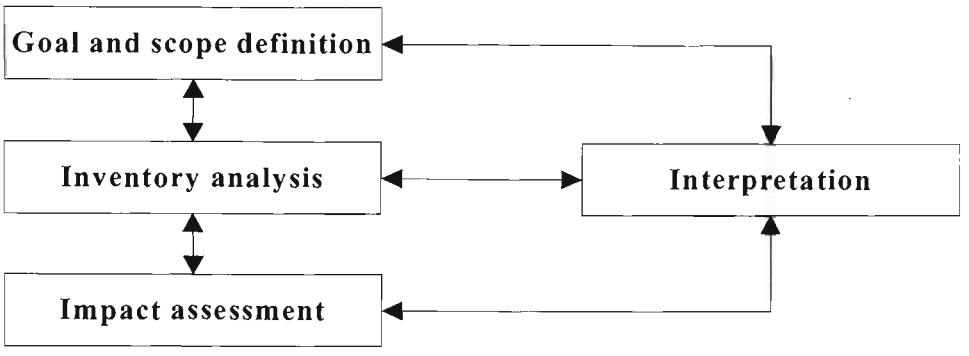
- *Impact assessment*: The third phase of an LCA is impact assessment. The allocation of the inventory data to impact (effect) categories is undertaken in this component. Impact assessment involves four stages (characterisation, classification, valuation and weighting). In recent years research has focused upon the development of impact models and what is known as midpoints and endpoints, see for example (Udo de Haes and Jolliet 1999; Udo de Haes *et al.* 1999; Bare *et al.* 2000).

- *Interpretation*[12]: The final phase of an LCA is interpretation, which involves the identification of areas and processes for improvement using data from the inventory analysis and impact assessment stages.

[12] The fourth stage was initially known as improvement analysis though was changed to interpretation in the late 1990s as a result of ISO work and the move towards enhancing the application/adoption side of LCA.

The LCA framework comprising the four stages is illustrated in Figure 3.11.

Figure 3.11 Life cycle assessment framework



Source: (Standards Australia and Standards New Zealand 1996, 4).

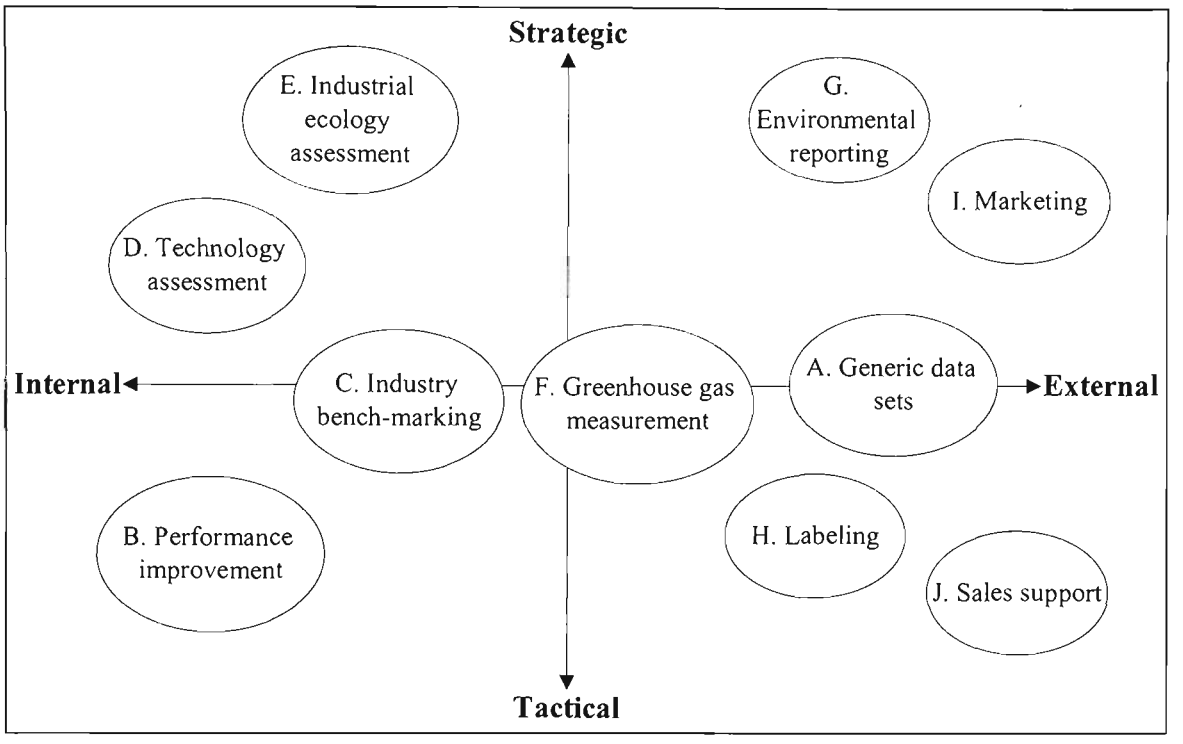
3.9.1 Applications of LCA

LCA has been applied to many different types of products and processes. Examples include packaging (James *et al.* 2001; Rousseaux *et al.* 2001), food (Anderson and Ohlsson 1999; Talve 2001; Jungbluth 2002; Ziegler *et al.* 2002), detergents (Saouter *et al.* 2002; Saouter and van Hoof 2002), buildings (Jönsson *et al.* 1998; Hes 2002), waste management scenarios (Weitz *et al.* 1999; Grant *et al.* 2001b), transport (Spirinckx and Ceuterick 1996; Nigge 2001) and fuels (Grant 2002). Companies like SmithKline Beecham and Bristol-Myers Squibb (BATE 1998c), the 3M Company (BATE 1998a), Electrolux (BATE 1998d) and Unilever (King 2002) have understood the value of LCA and have used it to better understand the environmental impacts of their products and processes.

LCA can be used in an array of applications such as product and process improvement, strategic decision-making, eco-design, product comparisons, eco-labelling and marketing, and public policy development (Consoli *et al.* 1993; Allen *et al.* 1997; Frankl *et al.* 2000; Guinee *et al.* 2001). In recent years LCA has increasingly become a planning and projective tool (Saur 2002).

Figure 3.12 illustrates the different application areas of LCA.

Figure 3.12 Applications of LCA



Source: (Saur 2002, 3).

LCA is now also applied to (Guinee *et al.* 2001, 5):

> *"complex business strategies or government policies relating to consumption and lifestyle choices in various sectors of society".*

Examples include companies in the EU investigating reusable versus one-way packaging under the EU's Packaging Directive, comparison of different waste management options by government and strategic comparison of different modes of freight transport.

Over the years, LCA has been used in a positive way to assist in the generation of information regarding the environmental profile of products and processes though it has also been used and abused to back up policy making, with varying degrees of success (Sonneveld and James 2002). Examples include packaging studies conducted in Germany, Denmark, and the Netherlands (Schmitz 2002).

In a study of two Swedish companies, Baumann (2000) found that the use of LCA was justified as a way to improve the poor environmental reputation of an industry. In the second company, LCA was justified to prove the environmental benefits of the industry. In both cases, the projects initiated the role of making LCA a routine activity within the companies. The LCA's were a learning device rather than a decision tool by identifying the impacts generated by particular activities.

According to Frankl and Rubik's (2000) study[13] of LCA adoption patterns in four European countries[14] in 1997, the drivers for companies to use LCA were related to cost saving opportunities and product related problems. They also discovered that in Switzerland, one third of companies that undertake LCA were small and medium size enterprises (SME's) with less than 250 employees. In the other three countries, large companies with more than 5000 employees undertook LCA. The applications of LCA differed between the four countries with the identification of bottlenecks and information/education to external stakeholders as the major applications. Environmental departments and research and development were the company sections primarily involved in conducting the studies and this is confirmed by work undertaken by Heiskanen (2000). The difficulties that were encountered by the companies in undertaking the LCA studies were the collection and quality of data, definition of system boundaries and the assessment and interpretation of results. The economic, technical and internal company political arrangements were identified as contributing factors to the level of adoption of LCA activities within companies (Frankl *et al.* 2000). It was found that the benefits of using LCA were perceived to be long term.

Heiskanen (2000) discussed the application of LCA for decision making arguing that LCA has been used to support decisions related to process or product development and strategic decision making, though the frequency of this actually occurring is low. Disconnections exist between the introduction of LCA into environmental

[13] A mailed questionnaire sent to environmental departments in 1,625 companies across four countries, with a response rate of 23.5%.

[14] Countries were Germany, Italy, Sweden and Switzerland.

management and the reality of supply chain relations in the marketplace. Heiskanen (2000, 242) argues that:

> *"the aim of LCA is to identify environmentally optimal solutions from the viewpoint of the whole system, irrespective of what is environmentally optimal for individual processes".*

LCA is still being used to deflect environmental concerns and to legitimate the status quo (Baumann 2000; Frankl *et al.* 2000; Heiskanen 2000) and there is little evidence of LCA being integrated throughout organisations (Heiskanen 2000). Most research on LCA to date has focused upon the development and improvement of the methodology and integrating LCA with diverging interest areas (Frankl *et al.* 2000) and not upon the application of LCA, and testing it in case studies (Wrisberg *et al.* 1997; Heiskanen 2000). According to researchers Frankl *et al* (2000) and Baumann (2000), the focus of LCA should be on using LCA to learn rather than be used to support a specific decision.

Research in Australia to understand how LCA is used within companies has been limited to investigating how LCA is used by practitioners (van Hoof *et al.* 2001; James and Grant 2002). The use of LCA in many different industry sectors in Australia has grown since the early 1990s (Grant *et al.* 2001a). Though it is not widely used in the packaging supply chain. In light of the National Packaging Covenant, it is important to understand if, and how, Australian food and packaging companies are taking a greater 'life cycle' perspective of their activities and products.

3.9.2 Limitations of LCA

The recent *Life Cycle Assessment, An operational guide to the ISO Standards* lists the following limitations of the LCA methodology (Guinee *et al.* 2001):

- Unable to address localised impacts;
- Is generally a 'steady-state' approach, rather than dynamic;
- The focus is upon the physical characteristics of industrial activities and other processes;

- Processes in the economy and environment are regarded as linear;
- The focus is upon the environmental aspects of products and their economic, social and other characteristics are not investigated;
- The impacts are 'potential';
- Includes technical assumptions and value choices; and
- Availability of data and its quality.

A further limitation, is the fact that monetary data is not collected. There is a growing awareness that there is a need to incorporate costs with LCA to assist in the decision making context that affects process or product modifications, alternative products or product designs (Norris 2001a; Norris 2001b; Shapiro 2001). Several different approaches have been developed and proposed such as total cost assessment (TCA), life cycle costing (LCC) and environmental accounting (EA). As Norris (2001b) discusses, to assist in decision making the economic consequences of alternative products or product designs must be taken into account within LCA[15]. He defines LCC as discounted cash flow analysis of investments incorporating pay back and internal rate of return. The consequences of leaving LCC out of LCA are (Norris 2001, 118):

- *"limited influence and relevance of LCA for decision making;*
- *Inability to capture relationships among environmental and cost consequences, which also inhibits the search for the most cost-effective means to environmental improvements; and*
- *Potential to miss economically important or in some cases even economically pivotal environment-related consequences to the company of alternative decisions".*

[15] LCA results should be considered with economic aspects in the decision making process.

3.9.2.1 *Approaches to integrating LCA and LCC*

There are attempts emerging to integrate environmental management systems and life cycle assessment with life cycle costing (Epstein and Roy 1997; Stuart *et al.* 1999; Norris 2001b; Norris 2001a) and activity based costing (Stuart *et al.* 1999). The development of LCC is not restricted to the environmental accounting field. Several practitioners in other disciplines such as science and engineering (Weitz *et al.* 1994; White *et al.* 1996; Hunkeler and Rebitzer 2001; Norris 2001b; Shapiro 2001; Gloria and Norris 2002) are looking at ways to integrate LCC analysis with their discipline. Though as Norris (2001b) indicates there are major methodological differences between LCC and LCA in particular the purposes, scope and approach (Table 3.7).

Acknowledging and addressing the spatial and temporal issues of the LCA methodology (Schaltegger and Burritt 2000) will be important in the integration of LCA and LCC (Bennett and James 1998a: 49; Norris 2001b; Norris 2001a). Two approaches that integrate full LCA with full LCC are PTLaser and TCAce (Norris 2001b; Norris 2001a). The PTLaser program:

> *"calculates life cycle inventories for the modelled system alternatives (LCA results) and provides financial evaluations of all alternatives (LCC results), present valuing costs and benefits" (Norris 2001b, 119).*

PTLaser also includes uncertainty and risk calculations of the environmental investments using Monte Carlo simulations and scenario building. The methodology behind the TCAce program is the differentiation of five cost types (direct, indirect, contingent, intangible and external). It has assisted companies in re-evaluating capital investment and product related decisions (Norris 2001b).

Table 3.7 Differences in LCA and LCC purpose and approach

Tool/Method	Life Cycle Assessment (LCA)	Life Cycle Costing (LCC)
Purpose	Compare relative environmental performance of alternative product systems for meeting the same end-use function, from a broad, societal perspective	Determine cost-effectiveness of alternative investments and business decisions, from the perspective of an economic decision maker such as a manufacturing firm or a consumer
Activities which are considered part of the "Life Cycle"	All processes causally connected to the physical life cycle of the product; including the entire pre-usage supply chain; use and the processes supplying use; end-of-life and the processes supplying end-of-life steps	Activities causing direct costs or benefits to the decision maker during the economic life of the investment, as a result of the investment
Flows considered	Pollutants, resources, and inter-process flows of materials and energy	Cost and benefit monetary flows directly impacting decision maker
Units for tracking	Primarily mass and energy; occasionally volume, other physical units	Monetary units (e.g., dollars, euro, etc)
Time treatment and scope	The timing of processes and their release or consumption flow is traditionally ignored; impact assessment may address a fixed time window of impacts (e.g., 100-year time horizon for assessing global warming potentials) but future impacts are generally not discounted	Timing is critical. Present valuing (discounting) of costs and benefits. Specific time horizon scope is adopted, and any costs or benefits occurring outside that scope are ignored.

Source: (Norris 2001, 118).

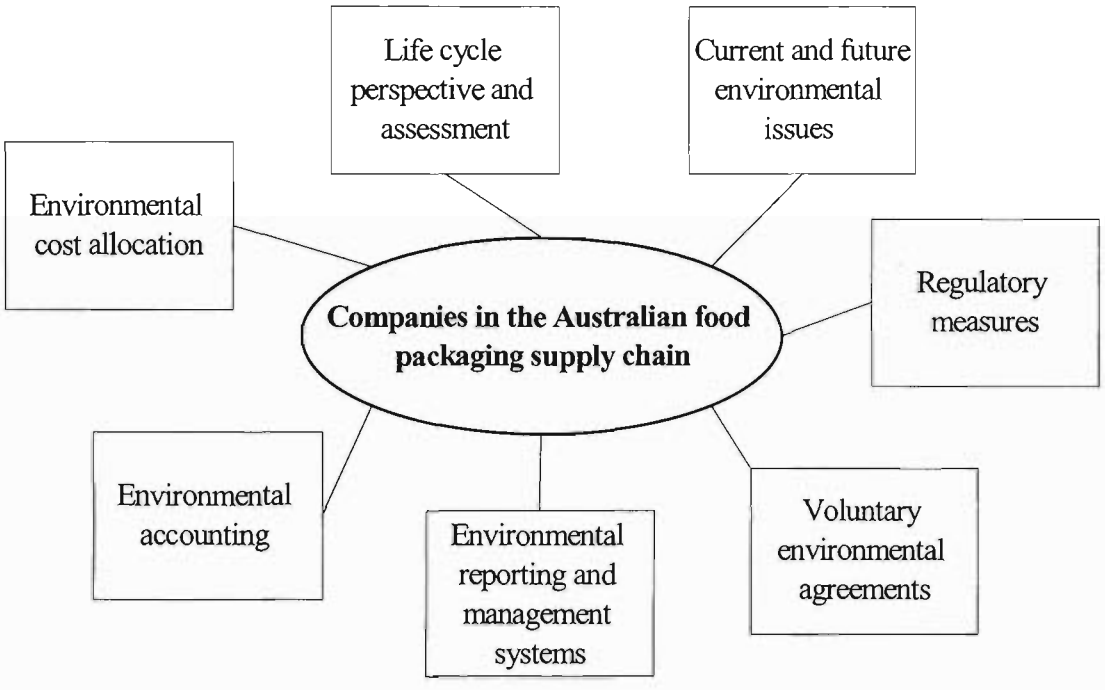
Since 1995, the Erasmus Centre for Environmental Studies (ECES) in the Netherlands has worked with the Rijksgebouwendienst (Rgd) a Dutch government agency who is responsible (Bouma 1998, 148):

> *"for the design, construction and maintenance of government buildings"*
> to develop an approach to attach *"a monetary value to the environmental impact of their buildings"*.

Following the undertaking of an LCA, monetary values are attached to the impact categories and the results used to determine the most appropriate buildings (Bouma 1998).

This literature review has focused upon environmental accounting, allocations of environmental costs, cost accounting approaches and life cycle assessment and in Chapter 2 environmental issues in and characteristics of the packaging industry were presented. Figure 3.13 illustrates the key issues, identified from the literature, within the Australian food packaging supply chain.

Figure 3.13 Key issues presented in the literature review



3.10 Research questions

The broad aim of this thesis is to identify and explore how companies in the Australian food packaging supply chain treat environmental impacts and how they account for and manage environmental costs. In order to satisfy this aim a number of research questions have been developed. A summary of the key issues identified in the literature reviewed are described below prior to the presentation of each research question.

Environmental challenges in the food and packaging supply chain include regulations, voluntary environmental initiatives/agreements, greenhouse gas issues, renewable and non-renewable resources, returnable packaging, the National Packaging Covenant, and demographic and life style changes of consumers (Section 2.7).

Research question 1a): What do companies in the Australian food packaging supply chain believe are current and future environmental issues which may affect their operations?

1b) What types of voluntary initiatives are companies involved in?

1c) Do companies have some type of environmental statement?

There is evidence of growing pressure and importance for companies to acknowledge and address environmental issues. Internally this can include producing environmental reports and implementing an environmental management system (Section 3.4 and 3.5) with different drivers and motivations for each company. Research has demonstrated that companies will disclose particular environmental information to legitimise their continuing operations following major environmental incidents and/or 'bad' publicity. Other studies have used content analysis to determine the level and type of environmental disclosures in annual reports. There is no general consensus as to why companies produce an environmental report or an environmental section included in the annual report in the first instance other than for example, reacting to a specific incident.

Research question 2: Why do companies in the Australian food packaging supply chain produce environmental reports and implement environmental management systems?

In recent years the growth in the number of voluntary environmental initiatives/agreements throughout the world has dramatically increased (Section 2.7.2) in place of or as a supplement to regulations (Section 2.7.1). The National Packaging Covenant (Section 2.7.2.1) is one such voluntary agreement that was

agreed upon by all levels of the Australian government and the packaging supply chain industry. It is based upon the principles of product stewardship and shared responsibility and relates to post-consumer packaging waste management. The Greenhouse Challenge Program (Section 2.7.2.2) is a voluntary agreement between the federal government and Australian industry with respect to greenhouse gas emissions. The regulatory National Pollutant Inventory (Section 2.7.1.1) requires companies that exceed certain thresholds of chemical substances listed on the NPI to publicly provide quantitative values on the particular chemicals emitted from the company processes.

Research question 3a): What are the drivers for companies in the Australian food packaging supply chain to sign onto the voluntary National Packaging Covenant and the voluntary Greenhouse Challenge Program?

3b) What is the effect of these programs within the participating organisations?

3c) What effect do the voluntary NPC and GHCP have when compared to the regulatory National Pollutant Inventory (NPI)?

Life cycle assessment (Section 3.9) is an environmental management tool that assesses the environmental impacts of products and processes across the life cycle. It is based upon material and energy flows and the interactions with the natural environment. Research has recently begun to incorporate monetary values to enhance the value of LCA information in decision-making contexts. Applications of LCA include product and process improvement; strategic decision-making; eco-design; product comparisons; eco-labelling and marketing; and public policy development. The purpose of many LCAs to date has been to deflect environmental concerns and to legitimate the status quo. It has been suggested that LCA should be used as a learning device to better understand environmental impacts. The use of LCA in Australia has continually grown since the early 1990s though it is not widely used. In view of the National Packaging Covenant one wonders whether Australian food and

packaging companies are increasingly taking a 'life cycle' perspective of their activities and products.

Research question 4a) : How has Life Cycle Assessment been used within the Australian food packaging supply chain?

4b) What is the level of adoption of LCA?

4c) If companies have undertaken an LCA, what are the drivers for and features of those LCA studies?

4d) What are the reasons for companies not using LCA?

Many different methodologies and models have been developed to assist companies in the identification of costs, in particular internal and external environmental costs for input into decision-making. Reasons to consider environmental related management accounting and environmental costs to manage the business include better understanding of environmental costs and performance of products and processes, identifying environmental risks and opportunities, and strategically preparing for future changes in the business environment.

Life cycle costing (LCC), value chain analysis (VCA) and activity based costing (ABC) are three distinct cost accounting approaches each with its own characteristics and applicability. Definitions and terminology used to describe life cycle costing vary though the underlying principle relates to the identification and calculation of costs that occur across the life cycle of the system under study (Section 3.6). Value chain analysis methodology allows for the identification of 'value-adding or non-value adding' activities throughout an organisation and the interactions with the supply chain (Section 3.7). Activity based costing methodology allows for the more accurate allocation of costs to responsible products and processes (Section 3.8). Research into why companies use these approaches and what benefits they can achieve, has not considered the reasons why companies decide not to use them.

Research question 5a): What is the level of adoption of life cycle costing, value chain analysis and activity based costing within the Australian food packaging supply chain?

5b) What are the benefits of using VCA and ABC?

5c) Which cost accounting system or systems do companies not use?

5d) Which accounting costing systems are the most appropriate for use in conjunction with LCA to identify environmental costs?

Environmental accounting has emerged in recent decades to start to address the issues regarding environmental issues and costs within accounting. Research has varied from environmental management accounting, through to taxation and internalising externalities through to environmental disclosures and reporting. There are many drivers contributing to the increase in interest and research in the field such as pressures from stakeholders, rising costs of environmental impacts, reduction of trade barriers and increasing globalisation.

Research indicates that traditional accounting practices, originally designed for manufacturing facilities in the early 1900s, are limiting because many environmental costs are grouped together in overhead costs. This approach does not reflect the true costs of clean-up facilities associated with the generation of emissions for example from 'dirty' products to that of 'clean' products. It can result in environmental costs being mis-represented, difficult to identify and therefore collection and analysis of such data is restricted. Environmental costs can be classified as capital, conventional, hidden, contingent liability and externalities. It is not understood how food and packaging companies in Australia identify and allocate environmental costs.

<u>Research question 6a):</u> What environmental costs are companies in the Australian food packaging supply chain identifying?

6b) If environmental costs are identified, how are these costs allocated throughout the organisation?

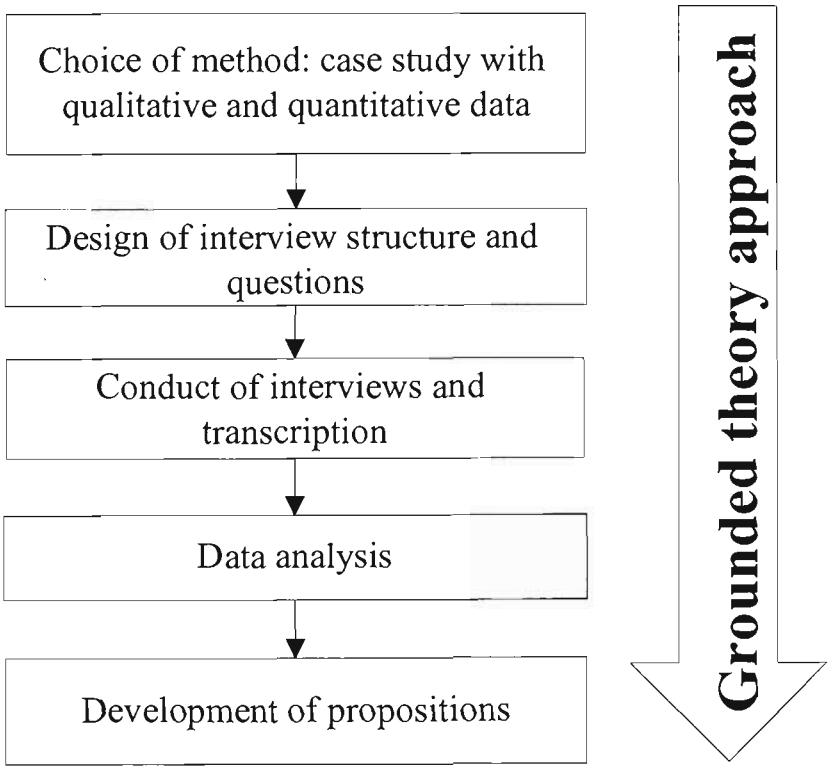
Following a review of the literature on environmental issues related to accounting and costing, this chapter has developed a series of research questions and a research framework.

4 METHODOLOGICAL APPROACH

4.1 Introduction

The purpose of this chapter is to describe the methodology employed for this thesis. The chapter contains a discussion on the issues centred upon the research design. First, a discussion of theory building is given followed by a discussion of the issues focused upon in the conduct of the research (e.g., validity and reliability) and ethical issues of the research. This is followed by a discussion of the justification for the selection of a qualitative case study research approach. The next section details the methods on data collection and the chapter concludes with a discussion of the data analysis techniques used. An overview of the research method is presented in Figure 4.1.

Figure 4.1 Overview of research method



4.2 Grounded theory

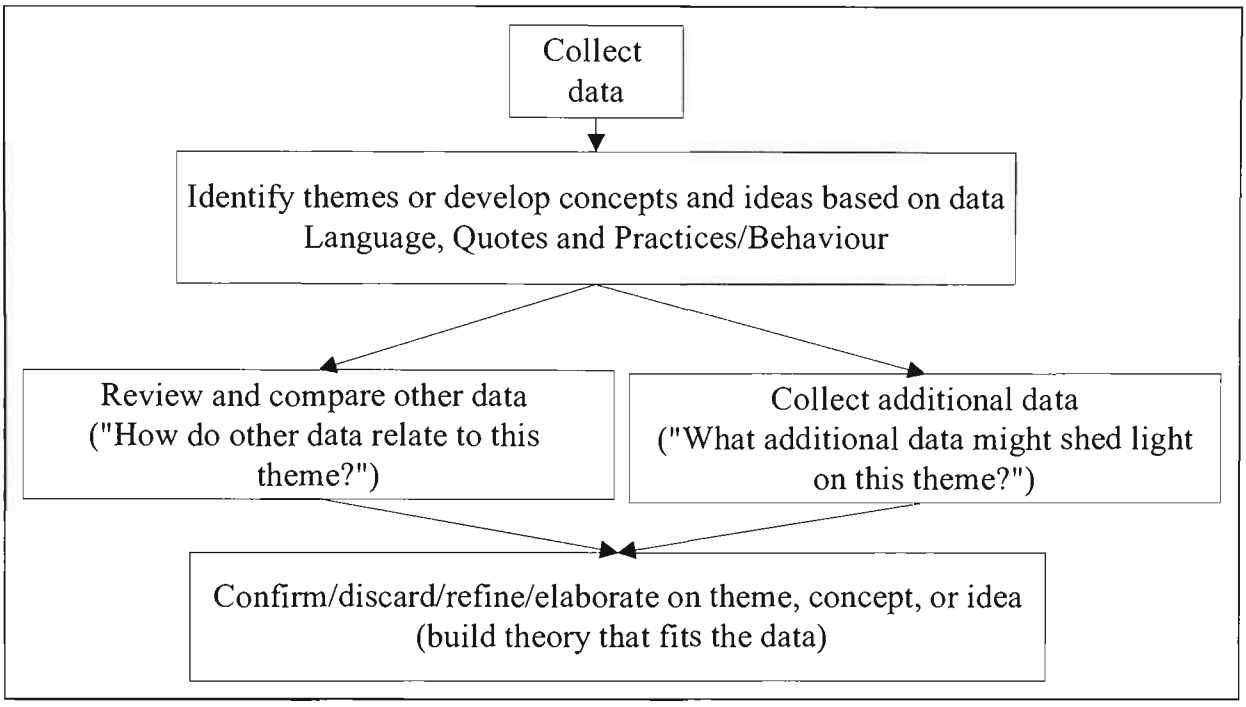
The idea behind theory is to (Punch 1998, 16):

> *"explain whatever is being studied, with the explanation being couched in more abstract terms than the terms used to describe it".*

Grounded theory is a qualitative research analysis technique whereby theory is generated from the collected data (Punch 1998; Taylor and Bogdan 1998; Charmaz 2000; Ryan and Bernard 2000; Locke 2001). Inductive processes are used to collect and analyse the data (Punch 1998; Charmaz 2000), and theories, concepts, hypotheses and propositions are developed from the collected data rather than from prior theories, assumptions or other research (Glaser and Strauss 1978; Taylor and Bogdan 1998; Locke 2001). In contrast, according to Glaser and Strauss (1978, 5) "*the source of certain ideas, or even 'models', can come from sources other than the data*". The developed theoretical frameworks, hypotheses and propositions (Raffish 1997; Taylor and Bogdan 1998) explain the collected data (Charmaz 2000). The theory is developed inductively, though in the refinement of the theory deduction techniques may be used (Punch 1998).

Figure 4.2 depicts an overview of the grounded theory approach.

Figure 4.2 Elements of the grounded theory approach



Source: (Taylor and Bogdan 1998, 138).

As Charmaz (2000) describes, there are no rigid prescriptions with grounded theory. There is a set of flexible strategies that this style of qualitative analysis allows the researcher to experiment with. Charmaz (2000, 514) writes that "*grounded theory methods specify analytic strategies, not data collection methods*". It is the interpretation of the data by the researcher that shapes the emerging codes in grounded theory (Charmaz 2000).

Glaser and Strauss (1967), both sociologists, initially articulated the grounded theory approach in 1967 with the publication of *The Discovery of Grounded Theory* using their study of hospital staff and how they dealt with dying patients. The aim of this book was to demonstrate how theory could be generated from data systematically obtained from social research (Glaser and Strauss 1967).

As Parker (1998) describes, there is confusion between the different descriptions, methods and assumptions that have been proposed by the originators of grounded

theory, as Glaser and Strauss have since developed their concepts separately. The definition of grounded theory given by Strauss and Corbin (1990, 24) is:

> *"a qualitative research method that uses a systematic set of procedures to develop and inductively derive grounded theory about a phenomenon".*

Strauss and Corbin's analysis involves posing analytic questions.

The definition given by Glaser (1992, 16) is:

> *"a general methodology of analysis linked with data collection that uses a systematically applied set of methods to generate an inductive theory about a substantive area".*

Taken from Parker and Roffey (1997), Table 4.1 presents the different approaches that Strauss and Corbin (1990) have taken compared with Glaser (1992) regarding the grounded theory methodology. Glaser proposes the path whereby the researcher allows the core code or central concepts to emerge from the coding process following data collection. The Strauss and Corbin approach indicates that the researcher can elect in advance to focus observations and interview data gathering on a particular issue. A central concept (code) is then sought to represent the interplay of subjects and researcher's perceptions of the nature and dimensions of the concept (Parker and Roffey 1997).

Selecting the appropriate orientations from Table 4.1 as applicable to this thesis, a combination of the Glaser (1992) (G) and Strauss and Corbin (1990) (S&C) approaches to grounded theory were employed:

- The research questions were statements that identified the phenomenon to be studied (S&C);
- Specific questions were posed to interviewees, though themes emerged from the coding process following data collection (G);

- Concepts and their relationship were generated to explain and/or interpret variations in behaviour in the substantive area under study (G);
- Theoretical formulation or set of conceptual hypothesis (i.e., the propositions) were produced (G) that were applicable to this thesis.

Table 4.1 A comparison of grounded theory methodology orientations: Strauss and Corbin (1990) versus Glaser (1992)

Strauss and Corbin (1990)	Glaser (1992)
1. The research question is a statement that identifies the phenomenon to be studied.	1. Two core questions: • What is the chief concern/problem of people in the area under study? • What category does the concern indicate?
2. Researchers need help with the interpretation process: procedures and techniques need to be spelled out. Subcategories are linked to categories that denote a set of relationships (i.e., causal conditions, action/interaction strategies, and consequences).	2. The problem emerges and should not be 'forced' by the methodology. Categories and their properties 'emerge' through constant comparison of incident to incident.
3. Easier to operationalise.	3. Can be difficult to operationalise.
4. Generates an inductively derived theory about a phenomenon comprised of interrelated concepts.	4. Generates concepts and their relationships to explain and/or interpret variations in behaviour in the substantive area under study.
5. Undertakes continual verification and testing to determine likely validity of concepts and relationships between them.	5. Produces a theoretical formulation or set of conceptual hypothesis. Testing is left to other researchers interested in such work.

Source: (Parker and Roffey 1997, 221).

As Charmaz (2000) explains there is flexibility with the grounded theory approach whereby the researcher shapes the codes (themes) from the interpretation of the

collected data and the employed approach illustrates this. Theories such as legitimacy, stakeholder and political economy have been developed to describe why companies adopt certain practices (Section 3.5). In this thesis, the objective was not to test a particular theory but to collect data and allow the data to "tell the story". This approach, as discussed, is known as the grounded theory approach.

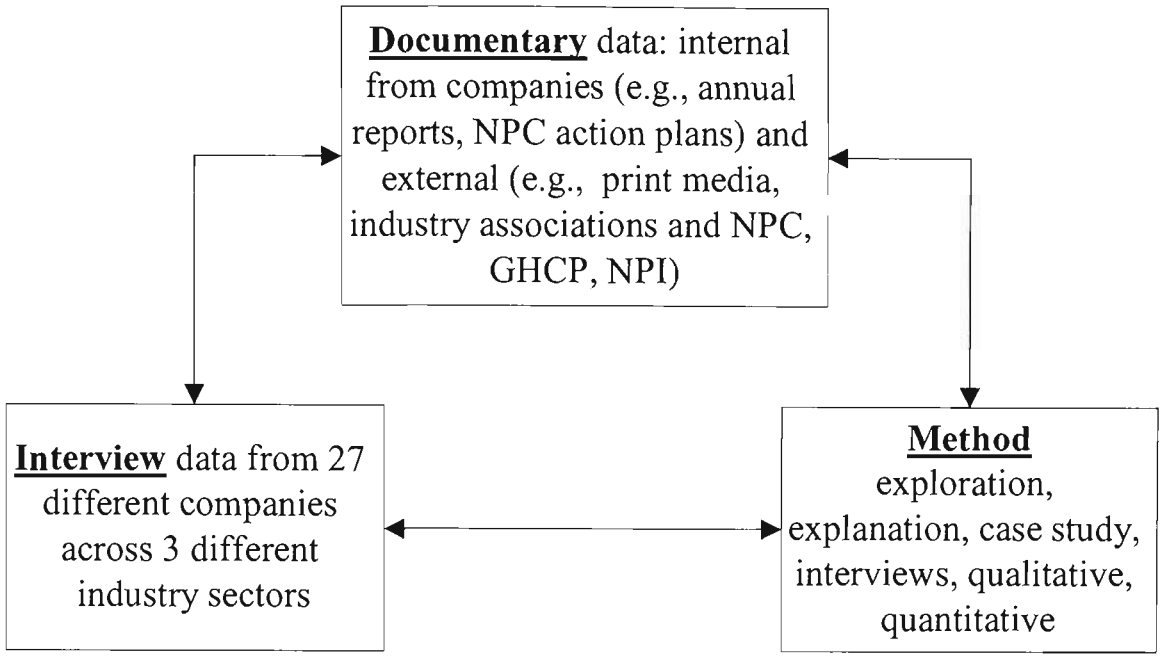
4.3 Research validity and reliability

Tests that can be used to establish the quality of empirical research are construct validity, internal validity, external validity and reliability (Yin 1994; Kvale 1996). These tests verify the appropriate conduct of the research and the analysis of the data. The features of each test and how this research incorporated validity and reliability are explained in the following sections. Justification for the methodology and a more detailed description of the data collection and analysis techniques adopted in this thesis are included in Sections 4.5, 4.6 and 4.7 respectively.

4.3.1 Construct validity

Construct validity is concerned with establishing the correct operational measures for the concepts under study (Yin 1994). This can be achieved by using multiple sources of evidence, establishing a chain of evidence and having the draft case study reviewed by the participants (Yin 1994) (in the case of this study the interviewees). In line with Yin's (1994) multiple sources of evidence, there are different ways that data can be "triangulated" according to Denzin (1989). They are: data triangulation (i.e., time, space and person), investigator triangulation (i.e., more than one investigator), theory triangulation (i.e., more than one perspective), and methodological triangulation (i.e., within-method and between method). In this thesis, triangulation is pursued by employing multiple data sources i.e., interview, documentary and method (Figure 4.3).

Figure 4.3 Multiple sources of evidence



Construct validity was enhanced in the following ways (Yin 1994; Brownell 1995):

i. Employing multiple sources of evidence:

- interviews within three different industry sectors (i.e., packaging, food, 'other') comprising twenty-seven different companies in the Australian food packaging supply chain;
- environmental information from internal company reports (e.g., annual reports, stand-alone environmental reporting, NPC action plans); and
- documentary data from external sources such as the print media, government, industry associations (e.g., PCA and AFGC), documentation on the NPC, GHCP and NPI and review of academic journals which were used to develop the interview questions.

ii. Collecting data, using multiple methods:

- the use of different types of interview questions (structured with open-ended and closed questions).

iii. Establish a chain of evidence:

- compiling verbatim interview transcripts from audio tapes for twenty-two of the twenty-seven interviews;
- having transcripts reviewed by twenty-two interviewees[16];
- note taking throughout the various stages of the data analysis.

4.3.2 Internal validity

Internal validity is concerned with establishing a causal relationship to determine whether event X led to event Y and could be used to make inferences. It is applicable for causal (or explanatory) case studies and not for exploratory or descriptive studies (Yin 1994). Specific tactics that can be used to achieve internal validity are "*pattern matching, explanation-building and time series analysis*" (Yin 1994, 35). As this thesis is primarily concerned with an exploratory approach, a test for internal validity was not pursued.

4.3.3 External validity

External validity is concerned with establishing the degree of generalisation of the study's findings beyond the case(s) studied. In case study research the (Brownell 1995, 64):

> *"notion of generalisability does not apply because the unit of analysis is the case itself, as opposed to the multiple individuals, situations, places and contexts which may be implicated in a single case".*

The researcher is aiming to "*generalise a particular set of results to some broader theory*" (Yin 1994, 36) i.e., analytical generalisation. Yin suggests that external validity is not always needed for case studies and qualitative data. The intention of this thesis is not to generalise externally.

[16] Each interviewee was given the opportunity to review their transcript and 22 did so.

4.3.4 Reliability

The objective of a study and its reliability is to ensure that procedures are documented to allow reproduction of the results should the 'same' case study be undertaken by another researcher (Yin 1994; Brownell 1995; Kvale 1996). The procedures will also demonstrate how consistent the results are (Kvale 1996). The goal is to minimise the biases and errors in the study.

To obtain and maintain reliability it has been suggested that *a case study protocol and database* be prepared (Yin 1994; Brownell 1995), though there is no agreed prescription. The case study protocol is a guide which provides details on the planned phases of the study (Brownell 1995) for the researcher to follow, but also provides a record on what was done and how it was done. The protocol consists of at least four topics (Yin 1994; Brownell 1995): project overview, a list of field procedures to be undertaken or considered, a set of case study research questions and a plan of the proposed structure of the final report.

In this case study, an overview of the project was developed prior to and through the data collection phase illustrating the emerging findings. Notes detailing the names of the interviewees, their job position, their company and the date, time and location of the interview were kept in the researcher's journal[17]. Once each interview transcript had been prepared and reviewed it was noted, as such, in the researcher's journal. When the interview questions were being prepared a form of checklist was used to assist in the refinement of the questions. A report framework was compiled illustrating the preliminary plan of how the findings would be presented.

The case study database allows for the collection and collation of all of the data obtained for the case study. It consists of at least four levels (Yin 1994; Brownell 1995): case notes, documentations and artefacts, tabular material and narratives. In this study, the case notes were hand-written into the researcher's journal and include thoughts on the un-transcribed and transcribed interviews, the different documentary

data, journal articles and the development of the theory as the data was refined. The documents that were collected include those from the companies represented in the interviews such as annual reports, stand-alone environmental reports and NPC action plans. The external documents include the wording of the NPC, information on the GHCP and NPI from government web sites and documents and media releases from industry associations such as the PCA and AFGC. The narratives in this study were the transcribed interviews of twenty-two of the twenty-seven interviews. The information from the transcribed and un-transcribed interviews was tabulated in a spreadsheet, which allowed easy access and analysis to the summary data. This is discussed in more detail in Section 4.7.2.

The research files maintained included:

- original audio tapes of all twenty-two interviews;
- printed and electronic copies of the verbatim interviews and the un-transcribed case notes;
- originals or photocopies of documentary data;
- notes and comments (in researcher's journal);
- originals of interview questions (printed and electronic copies);
- electronic and handwritten copies of data summary tables, matrices and figures from the analysis of the interview data; and
- minutes of meetings held with supervisors, along with meeting agendas.

Prior to the interviews with the representatives of the 27 companies, a pilot interview was performed with two associates from the packaging industry (Section 4.6.2.2) who were outside the sample population. This ensured that none of the interviewees had seen the questions beforehand and it allowed the timing of the interview to be

[17] A journal was maintained by the researcher which documents for instance when interviews were planned and who was to be interviewed. It also contained thoughts and ideas that arose during the research and minutes of meetings held with supervisors.

reviewed along with the refinement of questions to improve readability and comprehension (Yin 1994).

4.4 Ethical considerations

There are three types of ethical guidelines regarding interviewing that researchers should be aware of. They are informed consent, confidentiality (the right to privacy and protecting identify) and consequences (protection from for example physical and emotional harm) (Kvale 1996; Fontana and Frey 2000). Each is described below with a description of how they were addressed for this thesis.

4.4.1 Informed consent

Each interviewee was provided with details of the research topic, overall purpose and outline of the key themes to be posed during the interview (background brief - refer Section 4.6.2.3). Before each interview, the interviewee was asked to read, and when satisfied, sign a prescribed consent form (Appendix A) advising participation was voluntary with the right to withdraw at any time from the study. In addition the consent form outlined the objectives of the research, the methods to be used, how response data would be used, and assurances of their anonymity and confidentiality. The interviewer also asked for permission to use an audio tape recorder and laptop computer. All interviewees agreed to the use of the audiotape recorder and laptop computer except one interviewee who declined to have the interview recorded on audiotape.

4.4.2 Confidentiality

All interviewees were informed that their name and their company's name would remain anonymous. In the presentation of results, analysis of data and discussion of the outcomes no references to an individual person or company name are made to maintain confidentiality of participant companies and their representatives. All tapes and transcripts are kept in a locked filing cabinet.

4.4.3 Consequences

During the design of the interview and questions, the potential harm to the interviewees and expected benefits of participation in the study (Kvale 1996) were taken into consideration. The questions were designed to obtain specific information about how the company was addressing particular issues and not on the specific personal views of the interviewee. This ensured that interviewees did not become uncomfortable with answering 'personal' questions and would enable practical responses to be recorded. By obtaining information on how companies are considering and addressing particular issues, it was envisaged that the data would provide insight into how specific industry sectors and subsequently how the industry as a whole, are and should be managing environmental issues and related accounting systems. Benefits for the interviewee by participating were the opportunity to contribute information, and receiving a transcribed copy of his/her statements. They will also be notified of how to obtain a copy of the thesis upon its completion.

4.5 Justification for the methodology

The characteristics and differences between qualitative and quantitative data are described in Section 4.5.1 along with a description of the appropriate research strategies and techniques. In Section 4.5.2 the research strategy of the 'case study' is described and this is followed by a description of the data collection and data analysis techniques (Section 4.5.3) through to interviewing (Section 4.5.4).

4.5.1 Qualitative versus quantitative

There are two types of data - quantitative and qualitative. Quantitative research is concerned with the collection and analysis of numerical data, whereas qualitative research is concerned with non-numerical and unstructured data (Punch 1998) consisting of ..."*language in the form of extended text*" (Miles and Huberman 1994: 9). Punch (1998) describes, at the start of qualitative research, the research questions and methods are general and as the study progresses they become more focused, i.e.,

conceptualisation and structuring of the data are delayed until later in the research (Miles and Huberman 1994; Punch 1998).

Prior to a particular research strategy being employed for data collection, the objectives of the research need to be clearly identified (Easterby-Smith *et al.* 1991) to ensure that the correct strategy is utilised. Miles and Huberman (1994) detail six different types of qualitative research strategies. They are ethnography, field study, participant and non-participant observation strategies, interview strategies and archival strategies. Yin (1994) takes a slightly different approach to that of Miles and Huberman by identifying case studies, experiments, survey, history, and computer based analysis of archival records as research strategies.

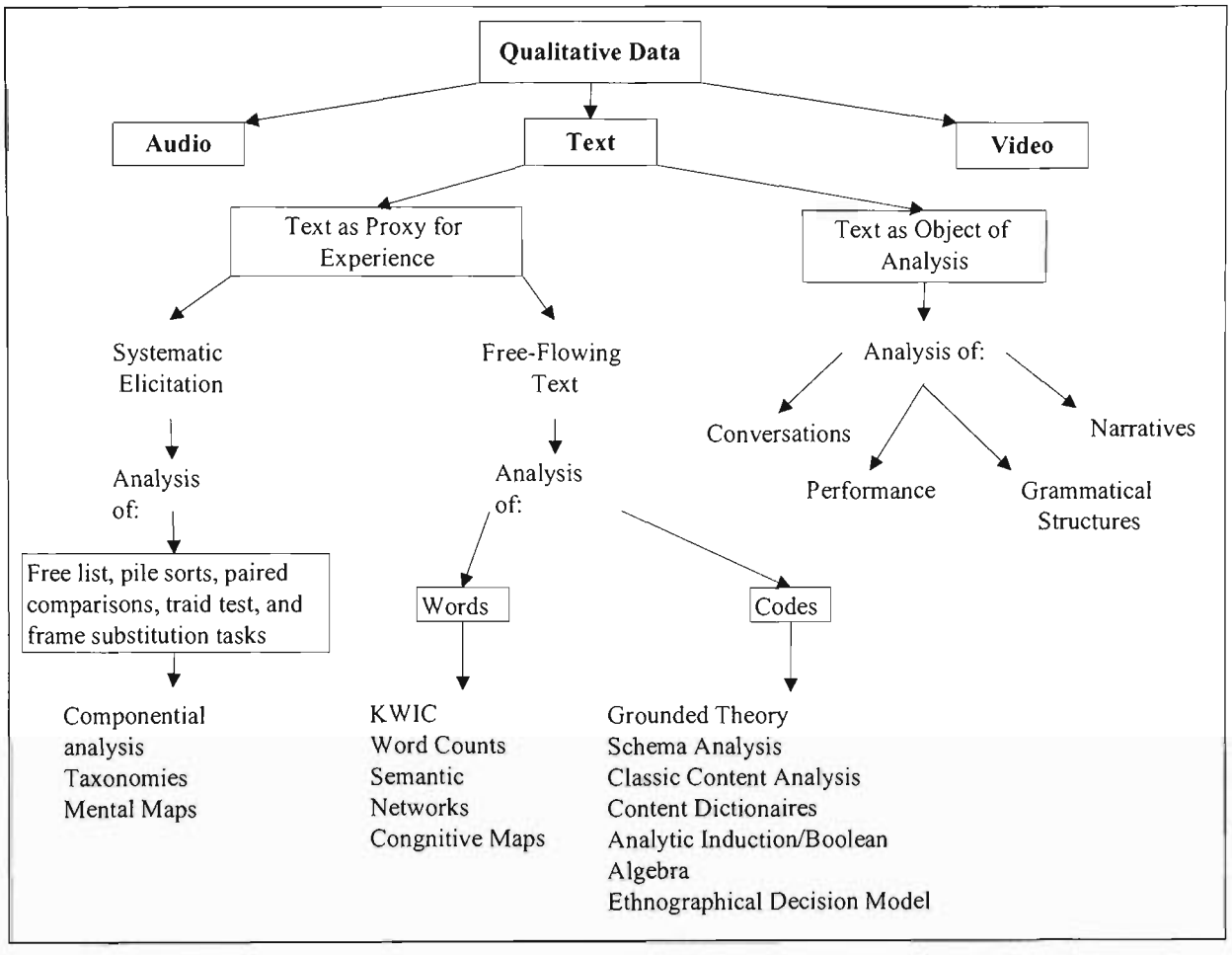
According to Marshall and Rossman (1989) the two fundamental techniques used to gather information in qualitative research are observation and in-depth interviewing. Observation techniques are utilised when the events, behaviours and artefacts in the chosen social setting are systematically described. An in-depth interview has been described by Marshall and Rossman (1989) as an interaction between an interviewer and interviewee with the purpose of obtaining valid and reliable information.

The collection and analysis of empirical data for each of the above qualitative research strategies are different, though all strategies can be used for three different purposes - explanatory, exploratory and descriptive (Yin 1994). The distinguishing conditions of the research strategies are (Yin 1994, 4):

> *"(a) the type of research question posed,*
>
> *(b) the extent of control an investigator has over actual behavioural events and*
>
> *(c) the degree of focus on contemporary as opposed to historical events*".

Ryan and Bernard (2000) have produced a typology of qualitative analysis techniques as presented in Figure 4.4.

Figure 4.4 Typology of qualitative analysis techniques



Source: (Ryan and Bernard 2000, 771)

As Figure 4.4 demonstrates there are three types of qualitative data - audio, text and video, with the various techniques employed for qualitative 'text' data being given. Text can be analysed via codes, words, free lists, conversation and performances.

Qualitative data can be collected using a range of methods and from an array of sources. The spoken and/or written representations and records of human experience are studied, based upon observation, interviews and/or documents. The data will require some form of processing once collected, but prior to analysis e.g., transcribing a tape recording (Miles and Huberman 1994).

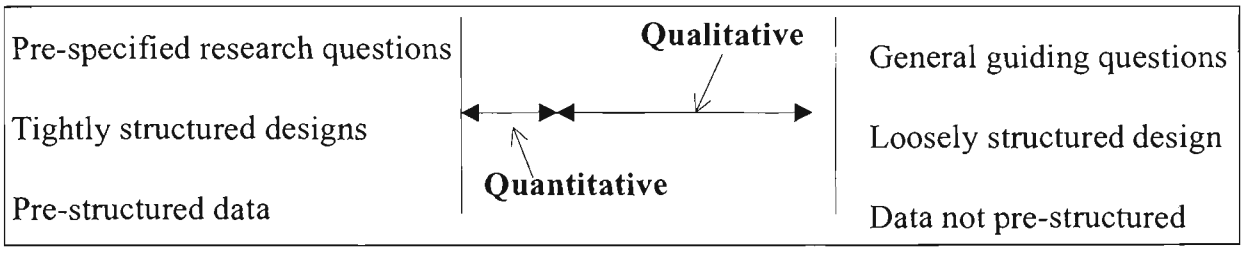
The sources of qualitative data according to Punch (1998, 60) are:

> *"interview transcripts, recordings and notes, observation records and notes, documents and the products and records of material*

culture, audio visual materials, and personal experience materials (such as artefacts, journal and diary information and narratives)".

There is more flexibility in the timing of the structure of the research for qualitative research compared with quantitative (Figure 4.5).

Figure 4.5 Pre-specified versus unfolding: the timing of structure



Source: (Punch 1998, 23).

In quantitative research the research questions are pre-specified, the research design is tightly structured and the data is pre-structured (see left hand side of Figure 4.5). On the right hand side of Figure 4.5, at the start of data collection, there is little structure to the data. There are no pre-established codes or categories. During the analysis of the data, the structure of the data, codes and categories emerge from the data - "*they are developed a posteriori*" (Punch 1998, 25). Qualitative research can take on a range of structures from pre-specified research questions through to general guiding questions, and from structured to loosely structured design and data.

Defining the type of research questions to be investigated - who, what, where, how and why - will assist in refining which research strategy to employ. If "what", "who" and "where" questions are the focus then they are exploratory and depending on the form of the question, all five strategies identified by Yin (1994) could be used, though generally the strategies of 'survey' or 'analysis of archival records' are used. "How" or "why" questions are explanatory and preferred research strategies are 'experiments', 'histories' and 'case studies' according to Yin (1994). Marshall and Rossman (1989) have prepared a matrix that explains the type of research question, the research strategy and data collection techniques for the different purposes of a study (Table 4.2).

Table 4.2 Matching research questions with strategy

Purpose of the study	Research questions	Research Strategy	Examples of Data Collection Techniques
EXPLORATORY To investigate little understood phenomenon. To identify/discover important variables. To generate hypotheses for further research.	What is happening in this social program? What are the salient themes, patterns, and categories in participants' meaning structures? How are these patterns linked with one another?	Case study Field study	Participant observation In-depth interviewing Elite interviewing
EXPLANATORY To explain the forces causing the phenomenon in question. To identify plausible causal networks shaping the phenomenon	What events, beliefs, attitudes, policies are shaping this phenomenon? How do these forces interact to result in the phenomenon?	Multi-site case study History Field study Ethnography	Participant observation In-depth interviewing Survey questionnaire Document analysis
DESCRIPTIVE To document the phenomenon of interest	What are the salient behaviours, events, beliefs, attitudes, structures, and processes occurring in this phenomenon?	Field study Case study Ethnography	Participant observation In-depth interviewing Document analysis Unobtrusive measures Survey questionnaire
PREDICTIVE To predict the outcomes of the phenomenon. To forecast the events and behaviours resulting from the phenomenon	What will occur as a result of this phenomenon? Who will be affected? In what ways?	Experiment Quasi-experiment	Survey questionnaire (large sample) Kinesics/proxemics Content analysis

Source: (Marshall and Rossman 1989, 78).

Qualitative and quantitative analysis can be used to verify and/or generate theory (Punch 1998). Verification studies begin with a theory, from which hypotheses are

deduced and the study is designed to test the hypotheses (typically using quantitative data). In generation studies the theory is developed systematically from the data collected (typically using qualitative data).

A fundamental assumption of qualitative research is that it is the (Marshall and Rossman 1989, 82):

> *"participant's perspective on the social phenomenon of interest that should unfold as the participant views it and not as the researcher views it".*

This assumption is important and as outlined in the following sections, procedures were undertaken to ensure that the data collected, recorded and subsequently analysed represented the views of the participants (interviewees).

4.5.2 Case study

A case study has an array of dimensions. Yin (1994) writes that the case study should be considered as a method that can use qualitative and/or quantitative data. A case study is a unit of analysis such as an individual, a role, a small group, an organisation, a community or settlement, or a nation (Miles and Huberman 1994). A case can also be defined temporally - an episode or encounter, an event, a period of time, or a process. There could also be cases embedded in cases, e.g., a case study of a school of specific classrooms (Miles and Huberman 1994). Yin (1994, 10) describes case studies as being:

> *"like experiments, are generalizable to theoretical propositions and not to populations or universes. The investigator's goal is to explain and generalise theories (analytic generalization) and not to enumerate frequencies (statistical generalization)".*

In addition there can be single cases or multiple cases (Yin 1994) and a case can be simple or complex (Stake 2000). A case study is a 'system', and, according to Stake (2000, 436), "*are both a process of inquiry about the case and the product of that*

inquiry". Miles and Huberman (1994, 10) further define a case as a "*focused and bounded phenomenon, embedded in its context*".

Punch (1998, 150) quotes Goode and Hatt (1952, 331):

> *"the case study then is not a specific technique; it is a way of organising social data so as to preserve the unitary character of the social object being studied".*

Stake (2000, 437) identifies three types of case study:

- intrinsic: to understand a particular case because of an intrinsic interest.
- instrumental: mainly to obtain "*insight into an issue or to redraw a generalisation;*
- collective: *when a researcher studies a number of cases in order to investigate a phenomenon, population or general condition. ...believed that understanding them will lead to a better understanding perhaps better theorizing about a still larger collection of cases*".

In Section 4.5.3 the description of the case study for this thesis is presented.

4.5.3 Data collection and analysis techniques

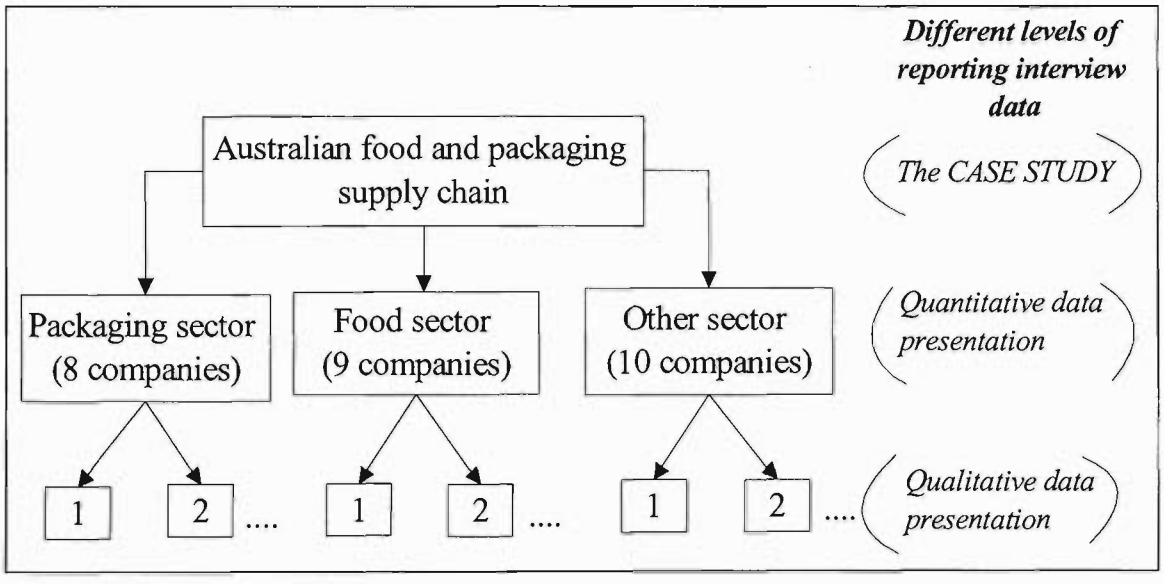
Exploratory and explanatory qualitative case study research and data analysis techniques, with some quantitative analysis, were used in this thesis. Two sets of data collection were performed: (i) documentary data and (ii) interview data. Documentary data (Section 4.3.1) was collected to establish an understanding of the issues within the Australian food and packaging industry and along with the literature review (Chapter 3) formed the basis of the questions in the interviews (Section 4.6.2.2). The second set of data was derived from in-depth individual face-to-face interviews (Section 4.5.4 and 4.6.3) with 27 companies from three industry sectors within the Australian food and packaging supply chain.

The primary activities of the companies were:

- packaging converters and manufacturers (classified as **packaging**)
- food and beverage processors and fillers (classified as **food**), and
- other companies in the packaging supply chain, from the extraction, processing, transport and distribution sectors (classified as '**others**').

Figure 4.6 illustrates the different levels of reporting the interview data: for the industry (the Australian food packaging supply chain) as a whole (i.e., the case), the industry sectors (i.e., quantitative data presentation) and the individual companies (i.e., qualitative data presentation).

Figure 4.6 Different levels of reporting interview data



Data were collected using individual face-to-face interviews (Miles and Huberman 1994) that were conducted employing a structured sequence of questions (Marshall and Rossman 1989; Yin 1994; Kvale 1996; Taylor and Bogdan 1998: 88; Fontana and Frey 2000). The majority of questions were exploratory (Yin 1994) aiming at investigating why companies, for example, adopt particular programs and accounting approaches, for instance LCC and ABC. Some questions were explanatory and investigated what actions companies were taking in response to identified environmental issues.

All interviewees received the same series of questions in the same order. The interview questions were semi-structured in that a limited number of questions required a yes/no response, while the remainder were open-ended and provided interviewees with an opportunity to elaborate on the issues while expressing facts and opinions. The questions were designed in this way in order to allow flexibility in the responses and not to prompt answers (Foddy 1994). The face-to-face interview method was preferred to a mailed questionnaire for the purposes of this research, as a mailed questionnaire was less likely to enable the collection of the exploratory type of information able to be gathered using interviews (Parker 1998). The data collected in the interviews can be classified as data with 'local groundness' because it was collected in close proximity to the specific situation and not through the mail (Miles and Huberman 1994).

4.5.4 Interviews

Different forms of interviews have been identified by Kvale (1996). They vary according to content, such as seeking factual information, attitudes, opinions, narratives and/or life histories. Kvale (1996) describes two 'purposes' that an interview can have. Firstly, *empirical*, where information is gathered on a particular topic; and secondly, *theoretical*, where a theory is tested or developed (i.e., grounded theory). Interviews can be conducted in a variety of formats including individual or group face-to-face verbal interchange, mailed or self-administered questionnaires, telephone surveys, and electronic interviewing via fax, email and internet (Punch 1998; Fontana and Frey 2000).

Interviews can differ in their degree of structure from a well-structured sequence of questions, through focused interviews following a particular set of questions to an open-structure with no predetermined sequence or formulation of questions, where respondents are asked for facts as well as their opinions (Denzin 1978; Marshall and Rossman 1989; Yin 1994; Kvale 1996; Taylor and Bogdan 1998: 88; Fontana and Frey 2000). In a structured interview, each interviewee receives the same series of questions in the same order (Punch 1998; Fontana and Frey 2000). Interviews are a useful way of obtaining large amounts of data quickly and provide the means for

immediate follow up questions, if required, for clarification or to obtain additional information (Marshall and Rossman 1989).

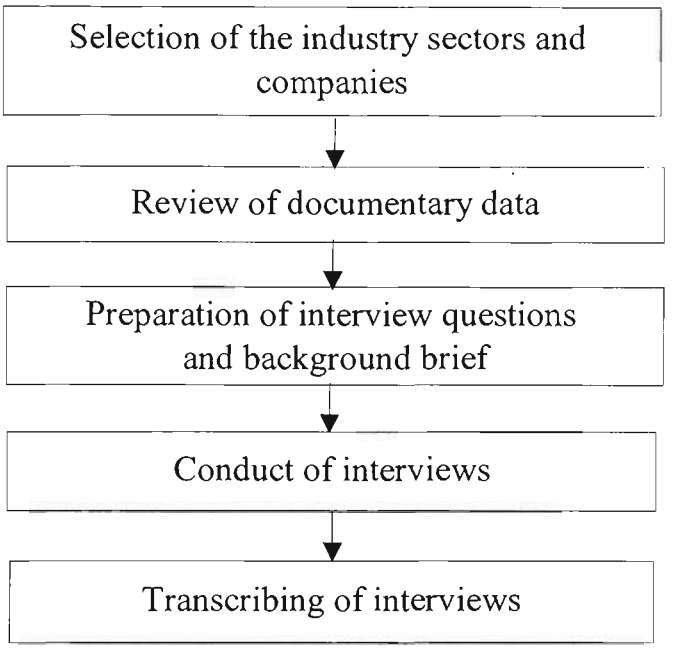
There are two broad types of questions that can be asked in an interview - open and closed. In open-ended questions the interviewee has total freedom and flexibility to respond, whereas in closed questions they are limited to the alternatives provided (Davis and Cosenza 1993). It is claimed that open questions allow interviewees to respond in "*their own words*" (Foddy 1994, 128) with this type of question structure not 'prompting' responses. In the case of closed questions they are more structured in that interviewees are required to 'tick' a category/box (variability in answers is reduced), they are easier to answer and the responses are easier to computerise and analyse (Foddy 1994). Even though open and closed questions have different characteristics, the quality of the collected data will be dependent upon, for example, the level of knowledge that the interviewee has, how interviewees interpret the questions, the responses given by individual interviewees to the question, how the interviewer interprets the responses and the type of coding performed (Foddy 1994).

In employing a structured question strategy there is an assumption that questions will be worded and ordered in a way understood by all interviewees (Denzin 1978). Though interviewees may have different perspectives and some words, terms and/or concepts may not be the same. In this thesis every attempt was made to ensure that each interviewee understood the terminology being used (e.g., through use of a background brief - Section 4.6.2.3) and on the occasions when an interviewee asked for clarification of a term, clarification was provided.

4.6 Data collection

Figure 4.7 provides an overview of the stages undertaken with respect to the planning, organization, conduction, collection and recording of the interviews. A description of each stage is given in the following sections.

Figure 4.7 Overview of design, conduct and analysis of interviews



4.6.1 Selection of the industry sectors and companies

The Australian food and packaging industry was profiled in Chapter 2. The intention of this thesis was to survey companies that operate, market and/or sell in the Australian food and packaging supply chain, including multinational companies. Sectors of the Australian food and packaging supply chain that were targeted for representation in the interviews were extraction, processing, manufacturing, end user (i.e., fillers), and transport/distribution companies. This was done to ensure that a life cycle perspective was taken.

Retailers and waste management companies were not approached because the focus was upon the food and packaging companies that actually manufacture or use packaging systems. Although retailers potentially have an influence upon the use of packaging systems they were not included in this study. With regard to waste

management companies, their primary focus is upon recycling, reprocessing or disposal of packaging materials and they are not involved as manufacturers or fillers of packaging systems.

All food packaging material sectors were approached - glass, paper, metal, and plastic. Sources used to obtain company contacts details were the 'current' list (as per February 2000) of the NPC signatories, the Australian Packaging Directory and personal contacts of the researcher.

4.6.1.1 Sending of invitations

In February 2000, sixty-seven companies were invited by letter to participate in the interviews. This was followed by a telephone call to confirm interviewees. The one-page invitation letter was addressed to the Environmental Manager (if the name of the person was known), or to the Managing Director or Chief Executive Officer who would be able to direct the letter to the appropriate person in the organization.

The invitation letter (Appendix B) contained an introduction to the research thesis, the department and university and aim of the research. Key environmental issues and external influences upon organizations were given (to set the scene) followed by a description of how the proposed research was expected to contribute to the field of knowledge. A general description of the proposed interviews, how they would be conducted, including the expected time required, number of people involved and topics to be posed was included. It was also explained that the names of interviewees and companies represented would be held in confidence and a summary of findings for each specific interview would be made available to the respective interviewee for internal use. The letter concluded with the announcement of a follow-up call to discuss the interview process in more detail and to arrange an interview time.

4.6.1.2 Confirmation of interviewees and interview

During mid-February through to March 2000 each person who was sent an invitation to participate in the interviews was contacted via telephone. Those who agreed to participate were then asked for a date and time at which the interview could be conducted (at their workplace). The interview participation was subsequently

confirmed in writing including date, time, and location of the interview. A copy of the background brief (Section 4.6.2.3) accompanied the confirmation letter. Table 4.3 provides an overview of the participation rates in the interview series per industry sector.

Table 4.3 Overview of participation rates in interview series per industry sector

Number of companies	Industry sector			
	Packaging	Food	'Other'	Total
Invited to participate	24	25	17	67
Participating in interviews	8	9	12[a]	29[b]
Response rate	33%	36%	70%	43%
Included in final analysis	8	9	10	27[b]

Note:

a) Two 'other' companies were interviewed though not used in the subsequent analysis because they were not directly involved in the food packaging supply chain.

b) Responses from twenty-seven interviewees were included in the final analysis

The remainder of this thesis refers only to the data of the twenty-seven interviews that were included in the final analysis.

4.6.2 Documentary data, preparation of interview questions and background brief

This section describes the procedures undertaken in the collection of documentary data (Section 4.6.2.1), the selection and preparation of the interview questions (Section 4.6.2.2) and the background brief (Section 4.6.2.3).

4.6.2.1 Documentary data

The collection of documentary data included environmental information from internal company sources and from external sources such as the print media, government and industry associations (Section 4.3.1). These documentary data were used to obtain information on current environmental issues in the industry and formed part of the literature review. They were also used to assist in the compilation of the interview questions (Section 4.6.2.2). For instance the review of the NPC documentation provided information for the literature review and as this is an important voluntary

agreement in the industry, questions were written based upon the NPC and becoming a signatory into the interview questions. Information collected through the PCA newsletters (Packaging Expose) and other PCA documentation provided insight into the important issues from the perspective of the packaging industry association.

4.6.2.2 The interview questions

The interview questions (Appendix C) were composed after a review of the documentary data (Section 4.3.1 and 4.6.2.1) and the literature in the following areas:

- environmental science including life cycle assessment, e.g., Elkington (1997a);
- accounting approaches, e.g., Bennett and James (1998a) and Parker (1998);
- life cycle costing, e.g., White *et al* (1996);
- value chain analysis, e.g., Porter (1985) and Shank and Govindarjan (1997);
- activity based costing, e.g., Cooper and Kaplan (1997) and Stuart *et al* (1999); and
- environmental accounting, e.g., Gray *et al* (1993) and Schaltgger and Burritt (2000).

A number of questions in the interviews conducted by Parker (1998) on environmental costing were identified as suitable for this investigation and subsequently included in addition to new questions focused upon issues identified from the literature review. The interview questions were structured around eight key themes (Figure 4.8).

Figure 4.8 Interview question themes

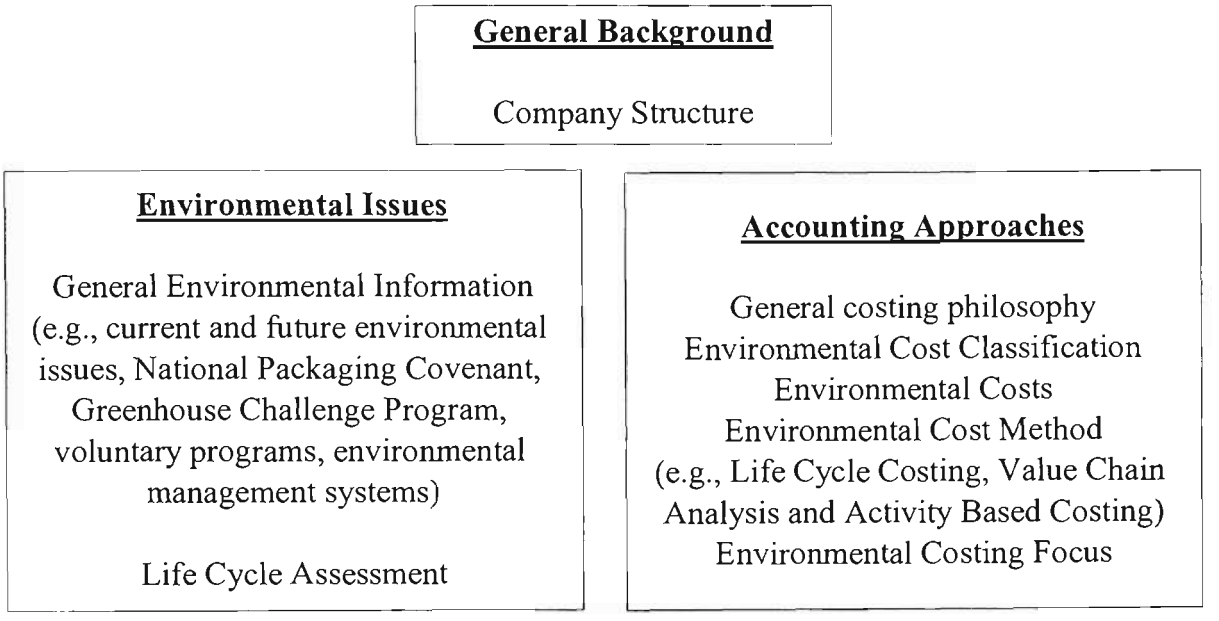


Figure 4.8 lists the key issues that were included in the interview questions that were divided into two main sections - one on environmental issues and the other on accounting approaches and environmental costs. Prior to conducting the interviews a pilot interview was performed with two associates in the packaging industry to allow for critical comment to be received on the types and number of questions proposed. As a result some questions were refined and those not adding value were eliminated after this process. With this review of the questions and final editing, the first interview was held on 27th of March 2000. The relationship of the research questions to the interview questions is illustrated in Table 4.4.

Table 4.4 Relationship between research questions, interview questions and the purpose of the questions

Research questions	Purpose of research question		Related interview questions
	Exploratory	Explanatory	
1. Background information		✓	1.1 to 1.6
2. Environmental issues	✓	✓	2.1, 2.3, 2.4, 2.5, 2.9
3. Reporting		✓	2.2
4. NPC and GHCP	✓	✓	2.6, 2.7
5. LCA	✓	✓	3.1 to 3.7
6. LCC, VCA and ABC	✓	✓	6.6, 6.7, 6.8
7. Environmental costs		✓	4.1, 5.1, 6.2, 6.4, 6.5, 7.1, 8.2

Note: More interview questions were posed than are presented in this table. This table includes reference to the responses from the interview questions that were subsequently analysed and coded.

4.6.2.3 Background brief

Prior to an interview it is important that background information, known as an interview guide or brief, is supplied to each interviewee. This background information provides the interviewee with information about the researcher, the research topic, procedures to be followed and any required follow-ups. Kvale (1996) identifies that the guide should include the topics and sequence (structure) of the interview and can be as detailed as necessary. Background information (the background brief) (Appendix D) for this study along with a list of terms to be used, was sent to the interviewees at least one week prior to the interview being conducted. This was done in order to assist interviewees with his/her understanding of the terminology to be used throughout the interview.

4.6.3 Conduct of interviews

The interviews were conducted over a six-week period between March and May 2000. Given the area of research, the intent was to conduct the interviews primarily

with Environmental Managers[18]. Environmental Managers were selected for several reasons: (i) it was envisaged that they would have a background in environmental issues; (ii) if a company has an environmental manager, or equivalent, then environmental issues are viewed as important in some way to the company; (iii) the position of the Environmental Manager is generally in a senior level of management; and (iv) they are one of many managers in an organisation (Mathews and Reynolds 2001) who receive financial data from the accounting department to assist them in managing their area of responsibility.

It was not possible on all occasions to interview an Environmental Manager. For those organisations where an environmental manager was not available or a position did not exist, a person in an equivalent position or a relevant senior manager within the company was interviewed (Appendix E). Twenty-three face-to-face interviews were conducted. The other four interviews were performed via telephone, due to the distant geographic location of the interviewees. Prior to conducting the interviews each interviewee signed a consent form (Section 4.4).

Kvale (1996) describes the process of supplying each interviewee with the context of the interview through a briefing and debriefing. He suggests that the context involves the interviewer informing the interviewee of the definition of the situation, the purpose of the interview, if a tape recorder is to be used and if the interviewee has any questions. Prior to each interview commencing, the interviewee was informed about the structure of the interview, permission was asked to use a tape recorder (one declined) and that the interviews would be transcribed. For the interviewee who declined to have the interview audio taped and the four interviews via phone, detailed notes were taken. Each interviewee was given the opportunity to ask any outstanding questions they may have had about the process. Following the completion of each interview the purpose of the research was restated, timelines and plan for completion of the thesis was given and each interviewee was informed that

[18] For example, Parker (1998); Bansal and Roth (2000); Bartolomeo *et al* (2000); O'Donovan (2000); and Burritt *et al* (2002) interviewed Environmental Managers.

they would receive a copy of the transcript of their interview for their review and information.

The methods for recording interviews for documentation and later analysis are videotape recording, note taking and the usual way of audiotape recording (Kvale 1996). For the telephone interviews, responses were typed directly into the computer whereas for the face-to-face interviews, two types of media were used to capture the responses. A laptop computer was used during the interviews to enter short responses and general themes being raised, and an audiotape recorder was used to capture the entire interview dialogue for later transcription (Section 4.6.4). The duration of the interviews ranged between one and three hours with an average of 1½ hours. During the interview the interviewees had a copy of the questions in front of them so that they could follow the questions as the interviewer asked them. For the telephone interviews a copy of the questions were sent to the interviewees via email or fax just prior to the interview being conducted.

4.6.4 Transcribing the interviews

There are a number of theoretical and methodological problems associated with transcription. The first is the translation of oral language into written language, with each having their own rules. Secondly, transcripts are interpretations of the original conversation and not copies according to Kvale (1996). Judgements and decisions need to be made as to what level of detail is included such as whether the statements should be transcribed (Kvale 1996, 170):

> *"word by word or into a more formal written style, and if pauses, emphases in intonation, and emotional expressions like laughter and sighing be included".*

There is no correct answer, though it does depend upon the research purpose, the intended use of the transcript and the intended audience of the text (Kvale 1996).

Each interview was transcribed by the researcher with the responses translated from the oral to written word by word. Emotional tones and hesitations were generally not

transcribed as the focus of the research was on the facts provided by the interviewees. Reliability and validity checks were performed on the written text versus the audio (oral) communication.

Following the completion of the transcriptions each interviewee was informed via e-mail and given the opportunity to receive a copy of the transcript for review of the contents for accuracy. Twenty-two interviewees responded positively and subsequently received their transcript. Three interviewees provided amendments relating to the re-naming of manufacturing locations that were incorrectly spelt or listed. By providing the interviewees the transcripts for review, the accuracy of the raw data (the interview data) was ensured.

In the e-mail correspondence each interviewee was also given the opportunity to indicate their interest in receiving copies of publications arising from the research and a copy of the thesis once completed. Positive responses were received and copies of those papers (Appendix F) that were written were forwarded.

4.7 Data analysis

This section is divided into two sub-sections. A description of data analysis strategies is given in Section 4.7.1 and a description of coding, memoing and defining propositions in Section 4.7.2.

4.7.1 Data analysis strategies

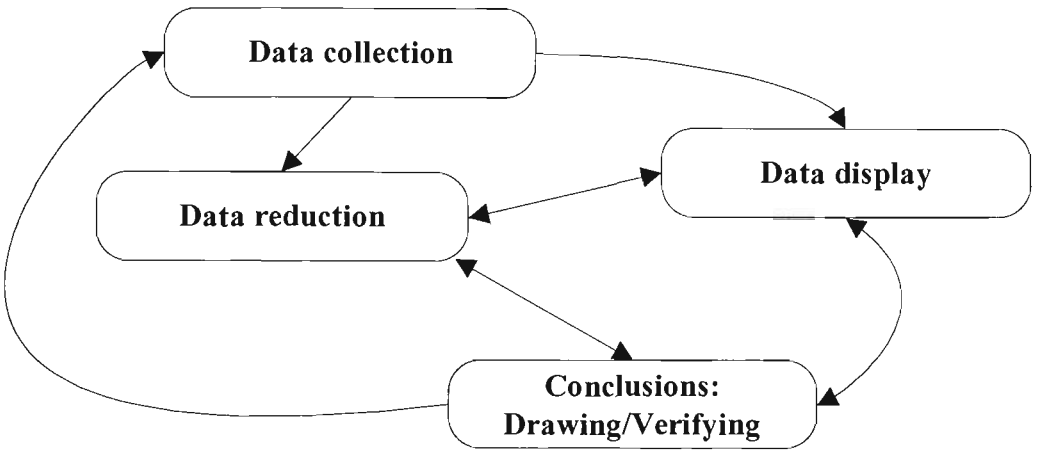
Marshall and Rossman (1989, 112) describe qualitative data analysis as:

> *"a search for general statements about relationships among categories of data: it builds grounded theory".*

Bringing order, structure and meaning to the collected data is the process of data analysis and the purpose of reporting this data is to present the phenomenon under study (Marshall and Rossman 1989).

According to Miles and Huberman (1994) qualitative data analysis consists of three activities: data reduction, data display and conclusion drawing and verification (see Figure 4.9).

Figure 4.9 Components of data analysis: interactive model

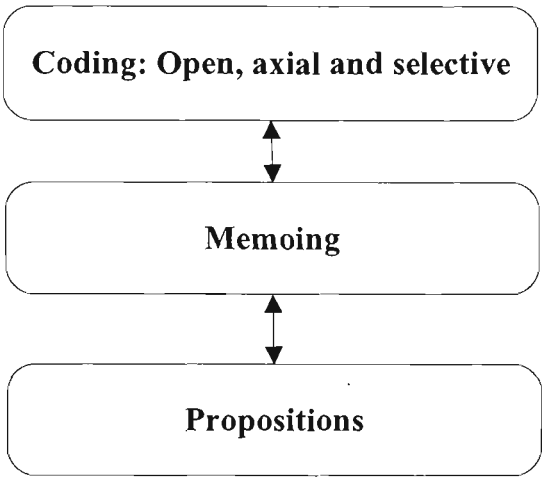


Source: (Miles and Huberman 1994, 12).

Figure 4.9 illustrates there is a continuous looping and forward and backward movement with respect to data collection, data reduction, data display and conclusion drawing. Data was collected via the individual (face-to-face) interviews and the subsequent transcriptions, recording the word-by-word conversation between the interviewer and interviewees were prepared. These data were then reduced by a process of selection, focusing, simplification, abstraction and transformation of the data (Miles and Huberman 1994) enabling categories, themes and patterns to be identified (Marshall and Rossman 1989). Once the data was reduced to the categories, themes and patterns, the data was displayed in matrices, graphs and network diagrams. Data organised and compressed in displays provide an opportunity for emergent hypotheses to be tested against the data and alternative explanations of the data to be found according to Marshall and Rossman (1989). Following the data display, propositions were developed. As the process of data analysis proceeds from data collection to conclusion drawing, data is reduced and the interpretation of the data increases.

The operations of data analysis consist of coding, memoing and developing propositions (Miles and Huberman 1994) and are described in the following sections and graphically in Figure 4.10.

Figure 4.10 Process from coding, memoing and propositions



4.7.2 Coding, memoing and defining propositions

Coding is the process of assigning units of meaning (tags or labels, in this thesis themes were developed) to the descriptive data collected during the study (Miles and Huberman 1994). Varying sized 'chunks' of data - whole paragraphs, sentences, phrases or words - can be coded (Miles and Huberman 1994). By coding, researchers sharpen their ability to ask questions about the data (Charmaz 2000) and it forces them to make decisions regarding the meanings of the continuous blocks of text (Ryan and Bernard 2000). The tasks associated with coding that Ryan (2000) proposes are sampling, identifying themes, building codebooks, marking texts, constructing models (relationships among codes) and testing these models against empirical data. The basic units of analysis could be composed of an entire interview, a book, words, sentences, paragraphs, or even pages.

There are different ways in which themes can be found in data dependent upon the type of analysis performed. It could include looking for metaphors (schema analysis), identifying different meanings (content analysis), or line by line looking for processes, actions, assumptions and consequences (grounded theory) (Ryan and

Bernard 2000). For this thesis, the third approach was used analysing the interview transcripts line by line. Figure 4.11 illustrates how themes were generated from the interview data for this thesis (using the question on reasons why companies implement an EMS as an example).

Figure 4.11 Generating themes from interview transcripts with example question

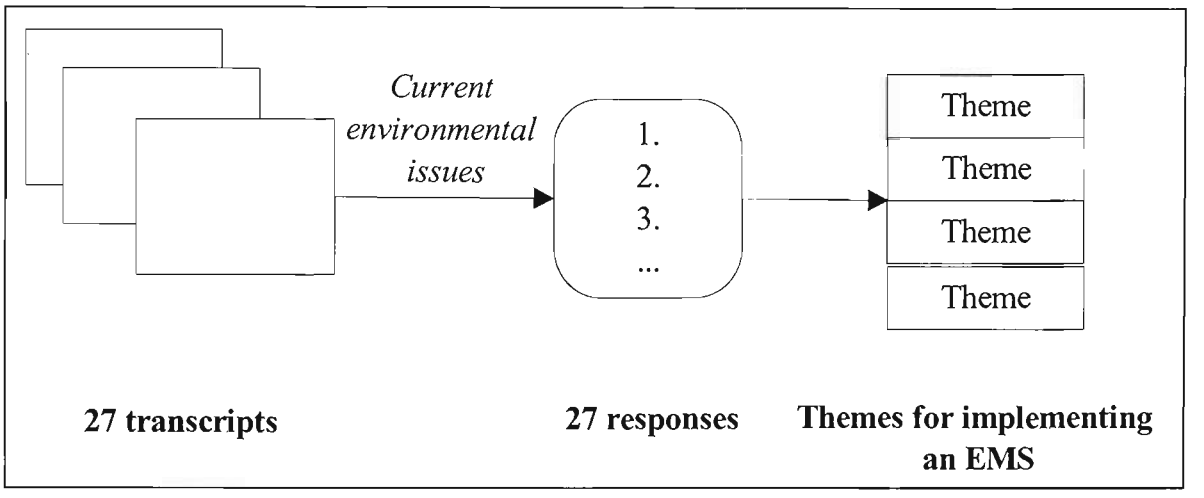


Figure 4.11 depicts the twenty-seven transcripts that had been compiled. For each individual question asked in the interview, the 27 responses were compiled. The transcribed text was then read line by line with key words, sentences, phrases and/or paragraphs being highlighted using colour pens (Table 4.5). This process is also known as inductive coding as described by Miles and Huberman (1994).

Table 4.5 Example of identifying themes from transcript for interview questions

Reasons for implementing an Environmental Management System (direct from transcripts)	Themes
"Improving environmental mgt. performance - ensure that you are in line (due diligence)"	Management of business. Due diligence.
"System in place which is basically (aligned to 14001) not certified. We have developed it so that if we decide to go for certification in a year or two years time it is pretty compatible in terms of the moving in that direction. So taking items of 14001 and modelled it around that. Good business. The environment is developed to a stage where you recognized you have a formal system in place. Prior to that we have had environmental mgt. but really from the parent company and had copy of their manual and half the stuff wasn't relevant and all that sort of stuff. so putting it in a bit more formal".	Certification to ISO 14001. Management of business.
"Ensure compliance with laws and demonstrate due diligence in relation to environmental management".	Compliance with regulation. Due diligence.

Note: Themes and patterns were highlighted (underlined in this example for clarity in presentation) which represent the reasons why companies implemented an environmental management system. A selection of interview responses have been presented and specific reference to companies have been deleted to maintain confidentiality.

Themes were identified for each response given for each question. Pre-definition of categories to the interview questions was not performed. Categories were not imposed because the interviewer wanted to give the interviewees as much flexibility and freedom as possible in their response to questions and wanted to obtain the key issues and concerns as perceived by the interviewee, and not to restrict them with prior categories (utilising a grounded theory approach - Section 4.2). Therefore, as Punch (1998, 60) describes, the interviewees were able "*to 'tell it in their own terms' to a much greater extent*" without categories imposed upon them. This provides a 'richer' source of raw data.

The key words and issues were then grouped into a number of themes and specific trends were identified. A second stage of analysis saw the themes arranged into question-by-question matrices for further analysis. The matrices allowed the investigator to more clearly isolate specific reasons for certain decisions. For example, using the matrices allowed a clearer identification of drivers for signing the NPC (Table 4.6).

Table 4.6 Example of question-by-question matrix

Drivers for signing the NPC	Industry sector (number of companies)			
	Packaging	Food	'Other'	Total
Number of companies per industry sector	8	9	10	27
Avoid alternative regulation	2	3	3	8
Better than NEPM	2	1	1	4
Support the process	1	2		3
Good business decision/commercial/marketing reasons	2			2
Have done our share in the past		2		2
Corporate citizenship		1		1
Involved in NPC development	1			1

Note: An interviewee may have responded with more than one reason.

Table 4.7 illustrates the spread-sheet (summary sheet data compilation matrix) where the final coded/themed data was stored (in quantitative form) to assist in analysis of trends across questions.

Table 4.7 Example of summary sheet data compilation matrix

Companies	QUESTION 1.2					Question 2.6			
	publicly listed	private	wholly owned govern	joint venture	other	Yes	No	Letter of Intent	Plans for the future
PACKAGING									
Company A	x						X		Intent to sign
Company B		x				X			
Sub-total packaging	4	4				5	3	0	
FOOD									
Company C	x					X			
Company D		x					X		Not at this stage
Sub-total food	4	2			2	3	4	2	
OTHER									
Company E	x						X		Still evaluating
Company F				x			X		Yes
Sub-total other	3	5		2		3	7	0	
TOTAL	11	11	0	2	2	11	14	2	

Note: Reference to the companies has been removed to maintain confidentiality. Question 1.2 refers to business structure and question 2.6 refers to whether a company is a signatory to the NPC (Appendix C).

Memo writing occurs between coding and the first draft of the completed analysis (Charmaz 2000). Memoranda do not just report data, they bring together pieces of data and illustrate how that data contributes to the concepts (Miles and Huberman 1994). Memoing helps in clarifying ideas about the data, refining categories, and defining relationships between the categories (Charmaz 2000). Memoranda were prepared and formed the basis of the write-up of the data. As the data analysis proceeded there was a need to formalise the thinking of what was apparent in the data into a set of coherent explanations (Miles and Huberman 1994). This initiated the development of the propositions. The propositions reflect the findings and the conclusions of the study.

4.8 Summary

Using a grounded theory approach, a qualitative case study research method was adopted. The case was the Australian food packaging supply chain and quantitative findings were reported on three industry sectors (i.e., packaging, food, 'other') and qualitative findings were reported on the level of the twenty-seven companies. Face-to-face interviews were conducted with Environmental Managers from each of twenty-seven companies. A structured interview questionnaire was developed, generally using open-ended questions in order to collect information to explore and explain environmental and accounting issues. The transcribed interview data was subsequently refined through coding (generating themes) and memoing and along with the documentary data the findings were analysed and propositions developed.

5 CURRENT AND FUTURE ENVIRONMENTAL CHALLENGES

5.1 Introduction

In this chapter the important current and future environmental issues that will affect the operations of companies operating in the Australian food packaging supply chain are presented. The number of companies that have some type of environmental statement along with the categories of voluntary initiatives in which companies participate are presented. In addition the drivers for companies to produce environmental reports and implement environmental management systems are presented. The chapter begins with the presentation of quantitative data (e.g., turnover, number of employees) to provide background information on the companies that were represented in the study.

5.2 Company characteristics

The sample population comprises fourteen public companies (of which two are not listed on the Australian Stock Exchange), eleven private companies and two joint venture companies (Table 5.1).

Table 5.1 Business structure of companies by industry sector

Business structure	Industry sector				Percentage of total
	Packaging	Food	'Other'	Total	
Public	4	7	3	**14**	*52%*
Private	4	2	5	**11**	*41%*
Joint-venture			2	**2**	*7%*
Total	**8**	**9**	**10**	**27**	*100%*

Two packaging companies, five food companies and six 'other' companies are subsidiaries of overseas companies.

Eight companies (33%) have an annual turnover greater than AUD $1 billion (Table 5.2).

Table 5.2 Approximate annual turnover of companies by industry sector

Approximate (AUD$) turnover of company	Industry sector				Percentage of total
	Packaging	Food[1]	'Other'[2]	Total	
< 50 million	3	1	1	**5**	*21%*
50 - 100 million		1	3	**4**	*17%*
100 - 500 million	2		2	**4**	*17%*
500 million - 1 billion		2	1	**3**	*12%*
> 1 billion	3	4	1	**8**	*33%*
Total	**8**	**8**	**8**	**24**	*100%*

Note:
(1) One interviewee did not provide a value.
(2) Two interviewees were unable to provide a value.

Seven companies (31%) have between 101 and 500 domestic employees, six companies (26%) have between 1001 and 5000 domestic employees and five (22%) have less than 100 employees (Table 5.3). These are the three dominant categories in terms of the number of domestic employees per company.

Table 5.3 Number of domestic employees in companies by industry sector

Number of employees	Industry sector				Percentage of total
	Packaging[1]	Food[2]	'Other'[3]	Total	
< 100	1	1	3	**5**	*22%*
101- 500	1	1	5	**7**	*31%*
501 - 1,000	1			**1**	*4%*
1,001 - 5,000	1	4	1	**6**	*26%*
5,001 - 10,000	2	1		**3**	*13%*
> 10,001		1		**1**	*4%*
Total	**6**	**8**	**9**	**23**	*100%*

Note:
(1) Two packaging interviewees did not know the number of employees.
(2) One food interviewee did not know the number of employees.
(3) One 'other' interviewee did not know the number of employees.

Table 5.4 shows the state in which manufacturing sites are located. Manufacturing site refers to all operations other than offices (i.e., administration), where processing, production, converting, filling and/or distribution activities are undertaken.

Table 5.4 Location of manufacturing operations of companies by industry sector

Location	Industry sector			
	Packaging	Food	'Other'	Total
Victoria	8	9	9	26
New South Wales	6	7	5	18
Queensland	7	5	3	15
South Australia	6	5	2	13
Western Australia	5	4	3	12
Tasmania	1	2	1	4

The majority of the companies operate from more than one site and from more than one site in a particular state. In the case of more than one site per state per company, the company is only accounted for once in the values represented in Table 5.4 (e.g., company A has two sites in Victoria, three sites in New South Wales and one site in South Australia, but is only counted once in the total for each state). The majority of operations are undertaken along the eastern seaboard of Australia (Victoria, New South Wales and Queensland), which is similar to trends reported in BIS Shrapnel (1999) (Section 2.5).

Table 5.5 provides a summary of the operations (activities) performed by the sample companies.

Table 5.5 Summary of operations performed by companies by industry sector

Operations/Activities[1]	Industry sector							
	Packaging		Food		'Other'		Total	
I. Packaging supply activities								
a) Natural resource extraction					1	*10%*	1	*4%*
b) Processing[2]	1	*12%*			7	*70%*	9	*33%*
c) Manufacturing[3]	8	*100%*	1	*11%*	2	*20%*	11	*41%*
d) Transport	2	*25%*	1	*11%*	2	*20%*	5	*19%*
e) Distribution	2	*25%*	1	*11%*	3	*30%*	6	*22%*
II. Food supply activities								
a) Growing	1	*12%*					1	*4%*
b) Harvesting	1	*12%*					1	*4%*
c) Processing	1	*12%*	9	*100%*			10	*37%*
III. Other activities								
a) Retailing								
b) Waste management[4]	1	*12%*	1	*11%*			2	*7%*
c) Other (specify)								

Note:

(1) Some companies are involved in more than one type of operation.

(2) Processing involves the transformation of natural resources (e.g., oil) into a processed material (e.g., plastic pellets).

(3) Manufacturing encompasses conversion of processed material (e.g., plastic pellets) into a packaging system (e.g., plastic bottle).

(4) Companies involved in reprocessing operations of materials.

Table 5.5 is divided into three supply chains - those related to packaging activities (e.g., extraction of natural resources for processing into a processed material for subsequent conversion into packaging systems), food activities (e.g., growing, harvesting and processing) and other activities (e.g., downstream operations of retailing and waste management including recycling and reprocessing).

5.3 Environmental mission, values and policy statements

Mission, values and policy statements are broad statements about a company's philosophy and how its activities affect the environment (Tilt 2001). Mission and values statements are generally a couple of sentences in length, whereas policy statements will include a general statement followed by aims or objectives.

Ten companies (37%) have developed an environmental mission statement, while ten companies[19] (37%) have developed an environmental value statement. Nineteen companies[20] (70%) have an environmental policy (Table 5.6).

Table 5.6 Number of companies with environmental mission, value or policy statements

Statement	Industry sector															
	Packaging				Food				'Other'				Total			
	Yes		No		Yes		No		Yes		No		Yes		No	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Mission	2	*25*	6	*75*	4	*44*	4	*44*	4	*40*	6	*60*	10	*37*	16	*60*
Value	1	*12*	6	*75*	4	*44*	4	*44*	5	*50*	5	*50*	10	*37*	15	*55*
Policy	5	*63*	3	*37*	8	*88*	0	*0*	6	*60*	4	*40*	19	*70*	7	*26*

Note: One interviewee (food sector) was unsure if company had an environmental policy - this has not been recorded in the table. The column percentages are calculated for each individual industry sector.

Association between industry sector and the existence of a particular statement was tested using a chi-square test (χ^2). There was no significant association between industry sector and the existence of a particular statement [Mission: ($\chi^2 = 1.64$, df = 2, P>0.25); Value: ($\chi^2 = 1.8$, df = 2, P>0.25); and Policy ($\chi^2 = 4.27$, df = 2, P = 0.10)]. In all industry sectors, there are more companies that have an environmental policy statement compared with those that have an environmental mission statement. There was no intention to collect information on the process of developing the

[19] These ten may not necessarily be the same ten which have an environmental mission.

[20] Some of the nineteen companies may be those included in the companies which have an environmental mission and/or value statement.

statements, who was involved in the development of the statements or the year in which the statements were implemented. Instead, a general 'Yes/No' response was requested from the interviewees in order to determine whether companies have such a statement. It was envisaged that this information would provide an initial indication of the degree to which environmental issues within the sample population are acknowledged. Table 5.7 presents the number of companies with environmental mission, value or policy statements with respect to company structure (i.e., public, private).

Table 5.7 Number of companies with environmental mission, value and policy statement in relation to company structure

	Company structure							
	Public		Private		Other		Total	
	#	%	#	%	#	%	#	%
Mission statement								
Yes	8	*57*	1	*10*	1	*50*	*10*	*38*
No	6	*43*	9	*90*	1	*50*	*16*	*59*
Total	*14*		*10*		*2*		*26*	
Value statement								
Yes	9	*64*	0		2	*100*	*11*	*42*
No	5	*36*	10	*100*	0		*15*	*58*
Total	*14*		*10*		*2*		*26*	
Policy statement								
Yes	13	*93*	4	*40*	2	*100*	*19*	*73*
No	1	*7*	6	*60*	0		*7*	*27*
Total	*14*		*10*		*2*		*26*	

Note: One interviewee was unable to answer this question and subsequently has not been included in above table.

Table 5.7 illustrates that there are differences between public and private companies and the existence of a particular statement. Eight public companies have an environmental mission statement compared with only one private company. There is no statistically significant association between the existence of an environmental mission statement and company structure ($\chi^2 = 5.599$, df = 2, P = 0.10).

In the case of the existence of an environmental value statement, nine public companies have one compared with none of the private companies. There is a statistically significant association between the existence of an environmental values statement and company structure ($\chi^2 = 12.83$, df = 2, P = 0.0025).

Thirteen public companies have an environmental policy statement compared with only four private companies. There is a statistically significant association between the existence of an environmental policy statement and company structure ($\chi^2 = 9.08$, df = 2, P = 0.02). In general, public companies are more likely to have some form of environmental statement than private companies.

5.4 Current environmental issues

Interviewees provided 62 specific responses regarding what current environmental issues they regard as important. The responses have been categorised into 8 broad environmental issues (Table 5.8).

The values presented in Table 5.8 refer to the number of companies that identified a particular environmental issue. A packaging company, for example, may have identified compliance with NPC, minimisation of solid waste and energy management as three current environmental issues. These three issues would have been included under the following three broad environmental issues - legislation, solid waste and energy.

Over the total of the three industry sectors, the issues of legislation, solid waste and emissions are the most mentioned as current issues. In the packaging sector 75% of companies identified legislation (especially the NPC/NEPM) related issues as a current issue and 50% identified energy related issues. In the food sector companies, 55% identified water and 44% legislation (especially the NPC/NEPM) as current issues which are consistent with findings from the AFGC Environment Report (2001) (refer Section 2.7). The issues of emissions and solid waste (both 50%) and miscellaneous issues (60%) are the current environmental issues of importance to the 'other' sector companies.

Table 5.8 Number of responses per broad environmental issue by industry sector

Current important broad environmental issues	Industry sector							
	Packaging		Food		'Other'		Total	
Number of companies	8		9		10		27	
Legislation	6	*75%*	4	*44%*	1	*10%*	11	*41%*
Solid waste	3	*38%*	3	*33%*	5	*50%*	11	*41%*
Energy	4	*50%*	1	*11%*	3	*30%*	8	*30%*
Emissions	2	*25%*	3	*33%*	5	*50%*	10	*37%*
Water	1	*13%*	5	*55%*	1	*10%*	7	*26%*
Land	1	*13%*	2	*22%*	1	*10%*	4	*15%*
Resource related	1	*13%*	1	*11%*	0	*0%*	2	*7%*
Miscellaneous	1	*13%*	2	*22%*	6	*60%*	9	*33%*
Total							*62*	

Note:

- Interviewees had the opportunity to provide up to a maximum of three issues.
- In order to determine how many companies in a specific industry sector named a particular environmental issue, if for example, an interviewee named two legislation issues it would only be recorded once.
- The first three columns of percentage values are calculated based upon the number of companies per the specific industry sector.

The level of association between industry sector and environmental issues, and the company structure and environmental issues, was tested. There is no statistically significant association between industry sector and the identification of environmental issues (χ^2 = 17.735, df = 14, P>0.25). There is no statistically significant association between company structure and the identification of environmental issues (χ^2 = 6.024, df = 14, P>0.25).

An open-ended question was asked of the interviews to identify three current environmental issues. This resulted in a large number of individual responses, 62, which has been previously documented in this section.

In Table 5.9 the key words that were used by the interviewees to describe the current environmental issues are presented (Appendix G provides the individual responses).

Table 5.9 Key words within the current broad environmental issues

Current broad environmental issues	Key words	Number of issues identified
Legislation	Compliance with NPC	6
Solid waste	Management, Minimisation, Disposal, Recycling, Litter	9
Energy	Global Warming, Carbon Trading, Challenge Program	5
Emissions	Reduction (A, O, G), Compliance (G), Discharge (A), Quality (A), Pollution (N), Management (O, N), Elimination (O)	11
Water	Quality, Reduction, Contamination, Management	5
Land	Conflicts, Impacts	6
Resource related	Efficiency, Use	2
Miscellaneous	Management, Education, Technology, Sustainability	13

Note:

- Code for emissions row: A (air), O (odour), N (noise), G (general).

Each of the eight broad environmental issues is discussed next for the purpose of expanding upon each issue and presenting examples of responses received.

Legislation

The National Packaging Covenant (Section 2.7.2.1) is the most significant legislative issue according to nine companies (33%):

> *"Major concern with this company is conforming with requirements of the Covenant, which is an all-encompassing thing - it doesn't divide into any areas. Meeting our obligations as set out in our action plan under the covenant will be the major issue"* Interviewee 6.

At the time of the interviews, six of the nine companies that indicated the NPC as the most significant legislative issue were already signatories to the Covenant and another one had signed a letter of intent. As per September 2002, all nine were NPC

signatories. The NPC was specifically highlighted by 33% of the sample population which supports other sources (Williams 2000; AFGC 2001; Williams 2001; PCA 2002a) indicating the NPC being an issue for the packaging supply chain (Section 2.7 and Section 2.8). The other legislative issues identified are the National Pollutant Inventory (Section 2.7.1.1), container deposit prospects, trade waste license and changes in regulation.

Solid waste

The management of solid waste is a current generic issue for the 'other' companies, whereas food and packaging companies were more specific about the issue and included words such as minimisation, disposal and recycling of solid waste. In total eleven companies (41%) mentioned various issues related to solid waste minimisation and management.

Energy

Eight companies (30%) identified energy related issues. Companies in the packaging and 'other' sectors indicated that energy related issues such as energy consumption, emissions trading, and global warming were important current issues.

Emissions

Companies in the 'other' sector dominated the emissions category, relating to the reduction, quality and compliance of emission levels. A reason for the dominance could relate to the types of activities (e.g., processors of raw materials) that these companies perform and the levels of emissions generated compared with the lower levels of emissions generated from companies further down the supply chain. Ten companies (37%) identified emission-related issues.

Water

Food companies consider wastewater issues important (consistent with those highlighted in Section 2.7):

> *"Still have significant waste-water management issues"* Interviewee 14,

and 'other' companies see groundwater contamination as a current water environmental issue they need to address:

> *"Well I guess this site in particular we have a well known ground water issue that we are working through with EPA and local community"* Interviewee 21.

Water-related environmental issues are an important current issue for seven companies (26%).

Land

Land issues that are identified focus upon the potential conflicts between residents and companies relating to, for instance, the locality of operations to residential areas:

> *"Noise and odour management with local residents"* Interviewee 11.

Site contamination from previous activities was another land issue:

> *"site contamination is a big one financially in terms of identifying, managing and remediating in terms of selling and buying properties"* Interviewee 7.

Salinity and the impact upon the natural landscape are two other land issues identified. In total, four companies (15%) identified land issues.

Resource related

Forest management and efficiencies in water and energy use were the two resource related issues identified by one food and one 'other' company.

Miscellaneous

Those issues that could not be placed within one of the above seven broad environmental issues were classified under miscellaneous and included issues such as internal management, education, technology and sustainability.

5.5 Environmental reporting

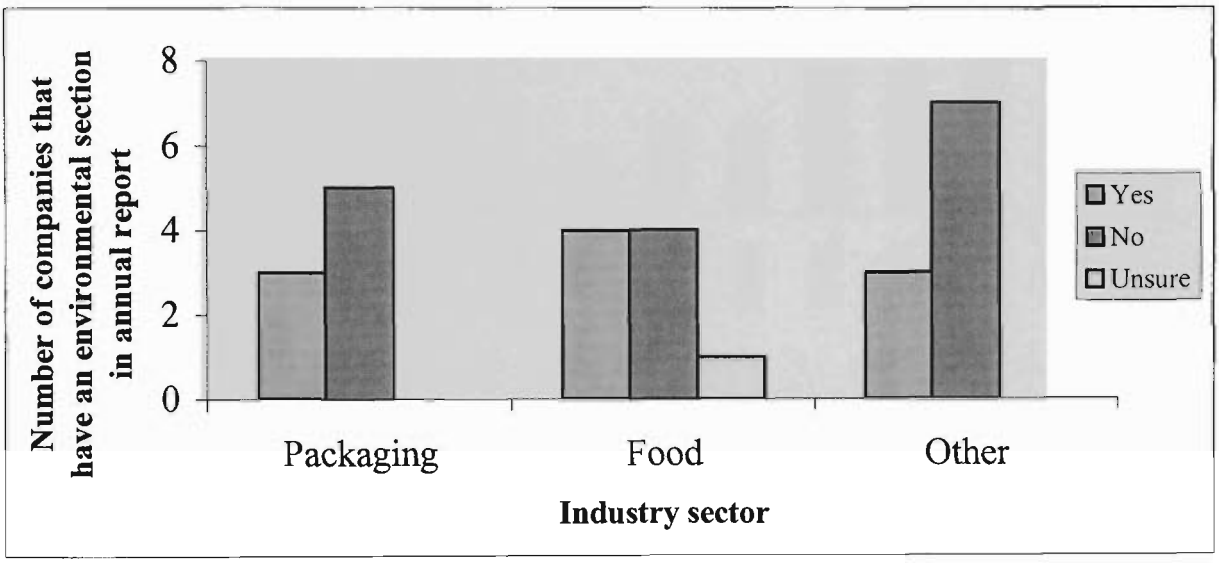
Material and energy flows, environmental impacts, environmental incidents, spills, breaches of regulations and description of participation in external voluntary programs are examples of environmental information (with respect to the operations and activities of a company) to be included in a company's environmental and/or annual report (Section 3.4). This information can take the form of a statement, several paragraphs, and a number of pages in an annual report or an entire report in its own right.

Two types of environmental reporting are investigated in this study. Firstly an environmental section in the company's annual report (Section 5.5.1) and secondly, a stand-alone environmental report (Section 5.5.2). It was not intended to collect information with regard to the quantity and quality of the information contained in the two types of reports. In view of the identified research questions it was only of interest to know of the existence or not of such reports and the reasons for their production.

5.5.1 Environmental section included in company annual report

Ten companies (37%) have an environmental section included in the company's annual report (Figure 5.1).

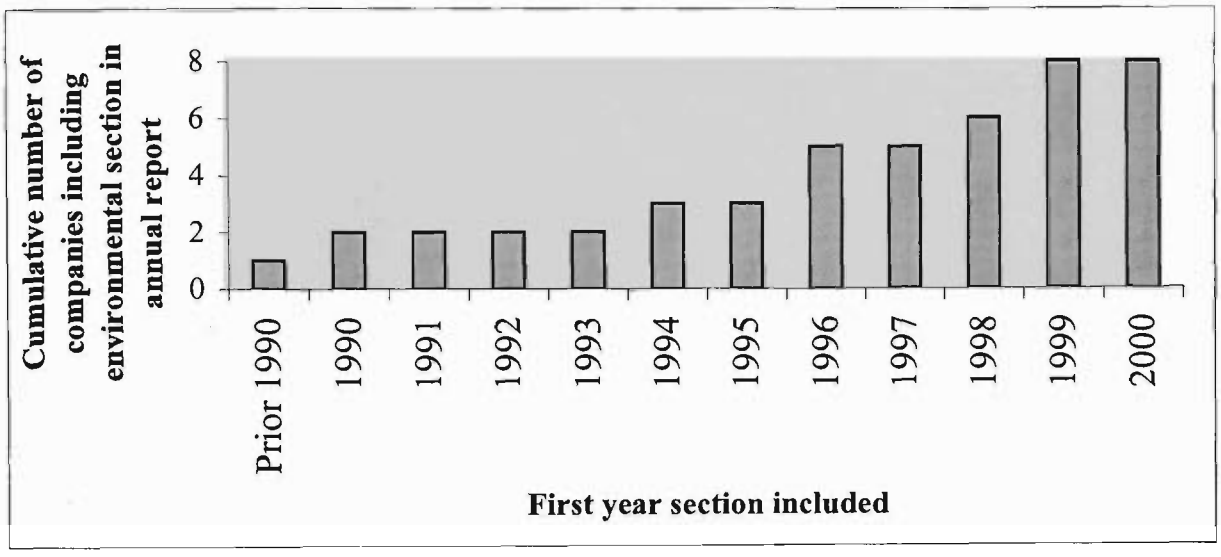
Figure 5.1 Number of companies with an environmental section in their annual report by industry sector



There is no statistically significant association between industry sector and the existence of an environmental section in the annual report (χ^2 = 0.755, df = 2, P>0.25). There is a statistically significant association between company structure and the existence of an environmental section in the annual report (χ^2 = 13.92, df = 2, P = 0.001). One explanation for this strong correlation is that private companies are not legally required to produce annual reports. Five of the companies (50%) have included an environmental section in their annual report at least since 1996.

Figure 5.2 illustrates the year in which the ten companies first included an environmental section in the company's annual report.

Figure 5.2 Cumulative number of companies including an environmental section in their annual report



Note: Two interviewees were unable to provide the first year in which an environmental section was included in the annual report.

Companies include an environmental section in the annual report with the objectives of disseminating information to internal and external stakeholders and increasing the awareness of environmental issues among these stakeholders:

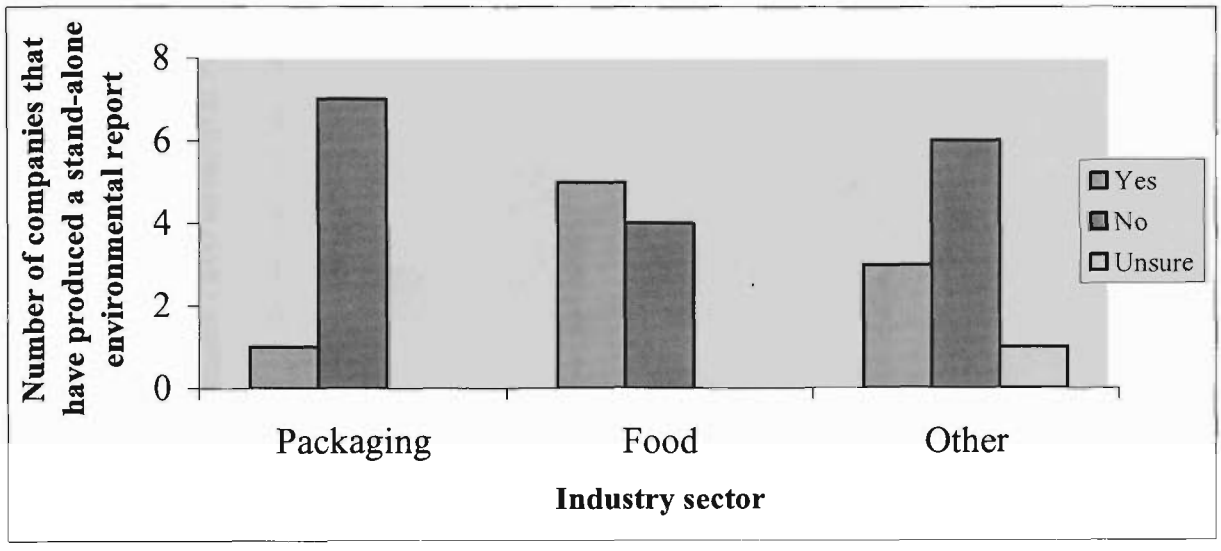
> *"Increasing business and community awareness of environmental issues, shareholder interest in environmental issues"* Interviewee 7.

Corporate governance and the legal requirements of doing business are other reasons why companies have included an environmental section in the annual report.

5.5.2 Stand-alone environmental report

Nine companies (33%) have produced a stand-alone environmental report (Figure 5.3) with three of these companies using the report for internal purposes only.

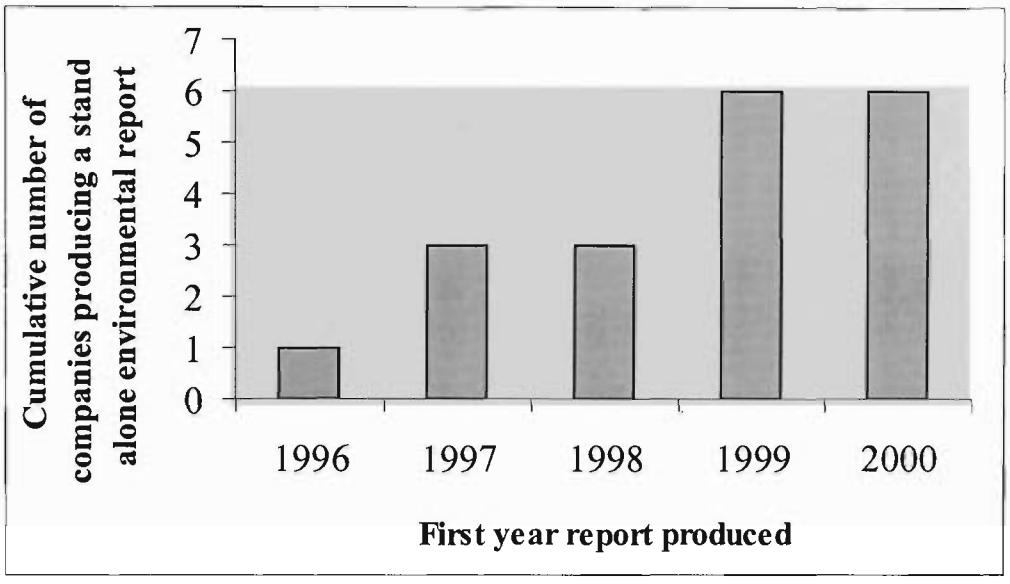
Figure 5.3 Number of companies with a stand-alone environmental report by industry sector



There is no statistically significant association between industry sector and the existence of a stand-alone environmental report ($\chi^2 = 3.47$, df = 2, P = 0.20). There is a statistically significant association between company structure and the existence of a stand-alone environmental report ($\chi^2 = 9.31$, df = 2, P = 0.01) as public companies are more likely to produce a stand-alone environmental report.

Figure 5.4 illustrates that at least six companies (66%) have produced a stand-alone environmental report since 1999.

Figure 5.4 Cumulative number of companies producing a stand-alone environmental report



Note: Three interviewees were unable to provide the first year in which a stand-alone environmental report was prepared.

Increased reporting standards by national governments and international bodies (e.g., Global Reporting Initiative), dissemination of information to stakeholders, awareness raising and issues of corporate governance are reasons why companies have produced a stand-alone environmental report. One company has produced an internal report since 1998-99 in preparation for future Australian-reporting standards:

> *"Environmental report to the Board only, and reference that report into the annual report. Just wanted to get ready and be prepared for when Australian standard came in"* Interviewee 4.

Producing a stand-alone environmental report can also provide a mechanism by which employees are informed of the company's operations and activities with respect to environmental issues:

> *"Awareness through organization (as in a lot of organizations which may have environmental management systems) that environment being managed by middle of organization trying to push it up and down from there. Used as a tool to increase awareness, as much up, as down"* Interviewee 14.

Providing information to external stakeholders, such as the community who are placing requirements upon companies to disseminate details on current environmental performance and future improvements, is another reason for producing stand-alone environmental reports:

> *"There is a growing awareness out there in the community that we have to publish our facts, figures and data as you like as a benchmark against which improvements can be taken"* Interviewee 23.

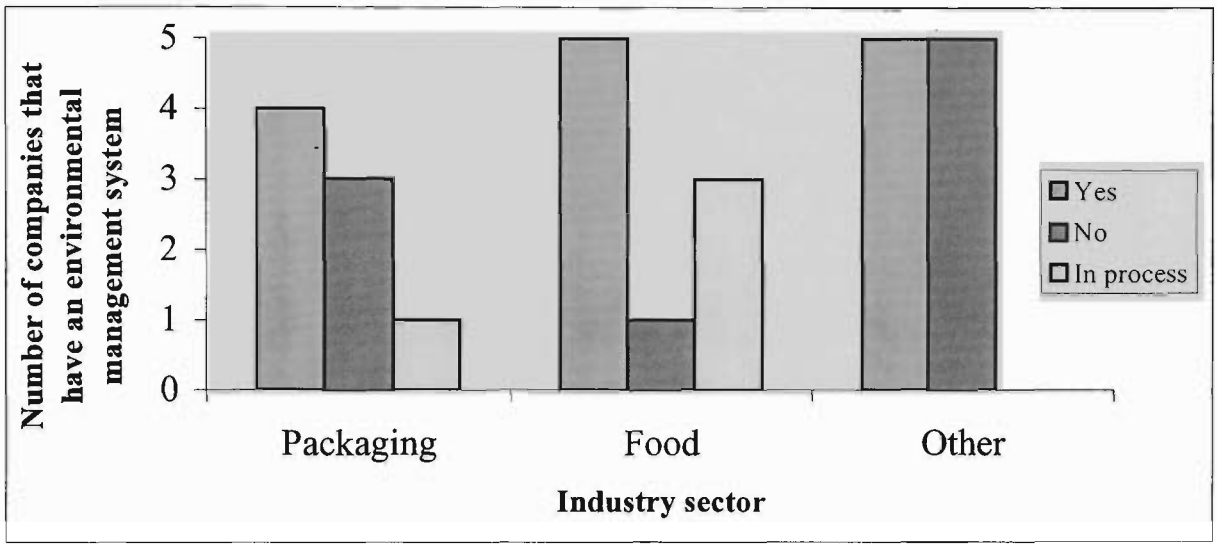
5.6 Environmental management system (EMS)

An environmental management system (EMS) (Section 3.5) provides for continual improvement in the management of environmental issues in a company. An EMS was in place in fourteen[21] companies (52%), with another four companies (15%) in the process of developing and implementing a system.

[21] One company did not have an EMS in place but had an environmental management plan as part of an EPA license.

Nine companies (33%) did not have either an existing or planned environmental management system in place (Figure 5.5).

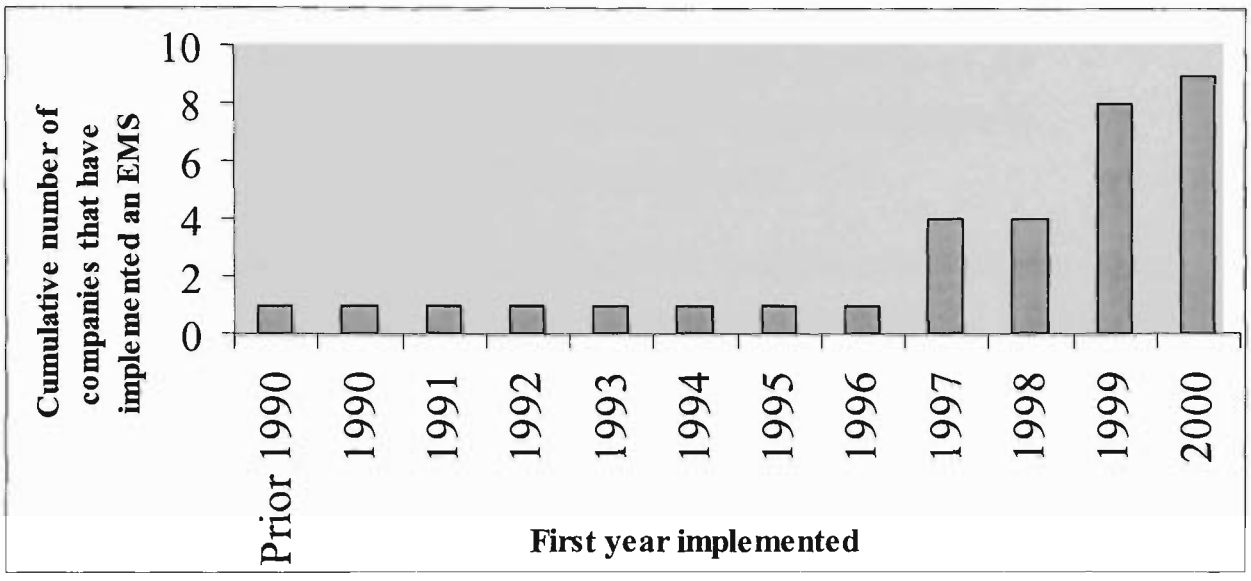
Figure 5.5 Number of companies with an environmental management system implemented by industry sector



There is no statistically significant association between the industry sector and the existence of an environmental management system (χ^2 = 3.31, df = 2, P = 0.20). There is a statistically significant association between company structure and the existence of an environmental management system (χ^2 = 9.11, df = 2, P = 0.02) as public companies are more likely to have implemented an EMS.

Since 1997, eight companies (57%)[22] have implemented an environmental management system (Figure 5.6).

Figure 5.6 Cumulative number of companies that have implemented an environmental management system



Note: Five interviewees were unable to provide a first year of implementation.

There are five key drivers that can be drawn from the analysis of reasons why companies have implemented an EMS. They are listed below and are also discussed individually:

- Compliance with regulations,
- Certification to international standard,
- Due diligence/legal liability,
- Corporate citizenship and
- Management of business systems.

[22] Five interviewees were unable to provide a first year of implementation

Compliance with regulations and certification to International Standards

Several companies have an accredited EMS in place in accordance with ISO 14001, while other companies have implemented their EMS in alignment with ISO 14001 to be prepared for future accreditation if necessary:

> *"System in place which is basically (aligned to 14001) not certified. We have developed it so that if we decide to go for certification in a year or two years time it is pretty compatible in terms of moving in that direction"* Interviewee 14.

There is also an awareness among companies that the community is placing greater pressure upon them to manage their operations, being accountable for their actions and having a management system in place that is recognised internationally:

> *"a growing awareness that you need an external standard, external auditing process that makes sure you maintain standards and you go on to improve, ... to operate is dictated by the community and you need those external reference points and standards. Just saying well I* [have an EMS] *does not satisfy someone from outside. You need a reference point from an independent body that says yes you do have a reasonable standard to an international basis. That really is the background to it"* Interviewee 23.

Due diligence/legal liability

Companies want to ensure that they are managing their legal liabilities and demonstrating due diligence:

> *"Ensure compliance with laws and demonstrate due diligence in relation to environmental management"* Interviewee 17.

Corporate governance and corporate citizenship

As Elkington (1997a, 8) suggests companies will increasingly operate within *"a global goldfish bowl"* where there will be growing pressures on *"right to know legislation and new corporate governance rules"*. Some companies in the sample

population have identified 'corporate citizenship' as a driver for EMS implementation - being seen by society as 'doing the right thing':

> *"Corporation sees itself as being a good environmental neighbour"* Interviewee 19.

and

> *"I think it is part of corporate citizenship these days. That is the environment you have to operate in"* Interviewee 22.

Management of business systems

The final theme relating to EMS implementation centres on the notion of having in place a good business management system. This includes having in place a formalised/uniform system of reporting and management of environmental issues across different sites, which can lead to continual improvement of the environmental performance of the company:

> *"All businesses through [the company] will consistently manage environmental systems under the same guidelines/rules"* Interviewee 10.

Companies in the process of implementing an EMS have similar responses to the reasons for implementation as those companies who have already done so, such as legislation, due diligence and certification. Additional reasons for implementing an EMS in one company include the improvements in material and energy efficiencies, increasing employees' self-esteem and the prevention of issues:

> *"... efficiency improvements in waste and energy management, self-esteem for employees, we find it is really good - people feel good about putting in an EMS, is a good confidence booster for the employees. Another important one is being in control of the issues rather than being controlled by them in a crisis situation. ..... The idea is we are actively identifying our issues and*

managing them and driving the debate and controlling and preventing stuff, rather than just responding" Interviewee 7.

The reason given by two of the nine interviewees for not having an EMS was the company's accreditation to the ISO 9001/2 quality assurance standards and which was seen as sufficient. The remaining seven interviewees did not supply a reason.

5.7 Drivers behind environmental reporting and EMS

The dissemination of information to stakeholders is the key driver behind the inclusion of an environmental section in the annual report and preparation of a stand-alone environmental report, which is consistent with Wilmshurt and Frost (2000). The key drivers for the implementation of an environmental management system (Table 5.10) are formal systems for the management of environmental issues and to have an accredited EMS in place, in accordance with the international standard.

Table 5.10 Number of responses received per key driver for environmental reporting and implementation of environmental management system

Key drivers	Inclusion of environmental section in annual report		Existence of stand-alone environmental report		Implementation of environmental management system	
Number of companies - Yes	10		9		14	
Compliance with law					3	*21%*
Accreditation to ISO 14001					4	*29%*
Due diligence (legal liability)					2	*14%*
Corporate citizenship (corporate governance)	3	*30%*	1	*11%*	3	*21%*
Management of business system	1	*10%*			5	*36%*
Dissemination of information and awareness	6	*60%*	6	*66%*		
Reporting requirements			2	*22%*		

Note:

- An interviewee may have given more than one response.
- Percentages calculated from the number of interviewees that indicated that company has report or EMS.

The common driver between environmental reporting and EMS implementation is corporate citizenship/governance as illustrated in Figure 5.7.

Figure 5.7 Drivers for environmental reporting and environmental management systems

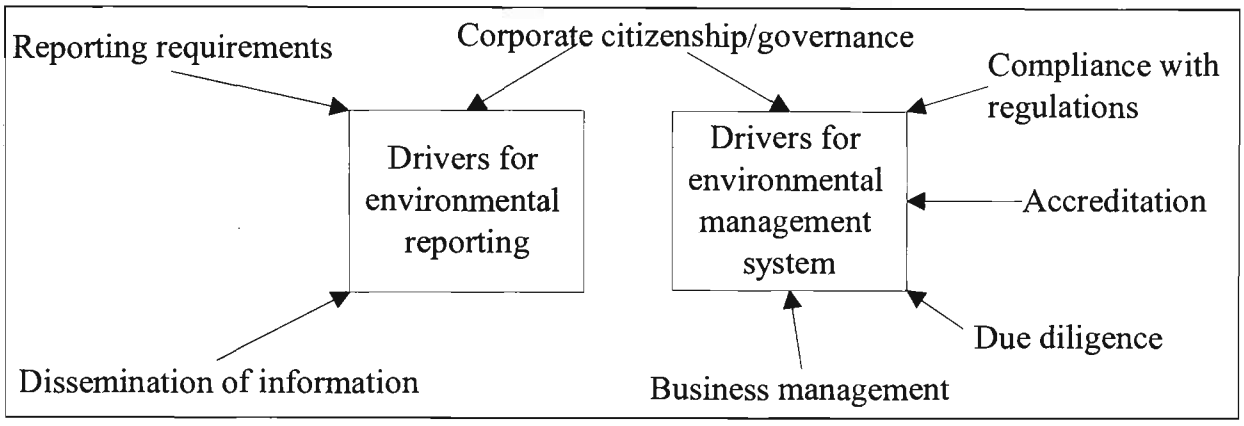
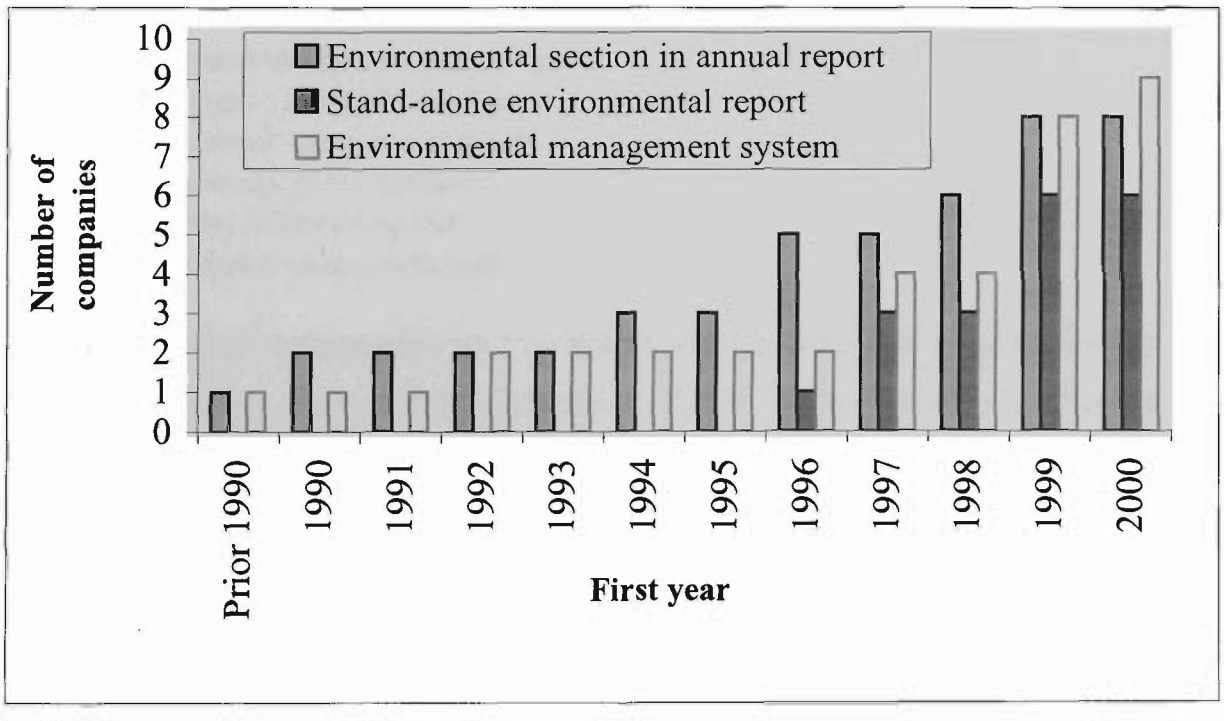


Figure 5.8 provides the cumulative years in which environmental reporting began and when companies in the sample population implemented environmental management systems.

Figure 5.8 Cumulative number of companies that undertake environmental reporting and have implemented an environmental management system.



Consistent with Elkington's (1997a) findings there is a trend of companies commencing with an environmental section in their annual report before implementing an EMS as a next stage, to be followed by a separate environmental report. An analysis was made of the number of companies that have a combination of environmental reports, an EMS and/or an environmental policy statement. Table 5.11 provides details on the number of companies that have: (i) an environmental section in the annual report and a stand-alone environmental report; (ii) an environmental section in the annual report and an EMS; (iii) a stand-alone environmental report and an EMS; (iv) an EMS and an environmental policy statement; and (v) all four.

Table 5.11 Number of companies that have environmental reports, EMS and/or environmental policy statement.

Number of companies that have....	Industry sector							
	Packaging		Food		'Other'		Total	
ESAR + SAER	1	*13%*	3	*33%*	2	*20%*	6	*22%*
ESAR + EMS	3[1]	*38%*	4[1]	*44%*	3	*30%*	10	*37%*
SAER + EMS	1	*13%*	5[1]	*55%*	3	*30%*	9	*33%*
EMS + EPS	4[1]	*50%*	8[2]	*88%*	5	*50%*	17	*63%*
ESAR + SAER + EMS + EPS	1	*13%*	3	*33%*	2	*20%*	6	*22%*

Notes:
ESAR = Environmental Section in Annual Report
SAER = Stand-alone Environmental Report
EMS = Environmental Management System
EPS = Environmental Policy Statement
(1) One company implementing EMS
(2) Three companies implementing EMS

An environmental management system and an environmental policy statement was the largest category, with seventeen companies (63%). A requirement of an EMS, in accordance to ISO 14001, is the development of an environmental policy statement and all companies with either an EMS in place or implementing one had an environmental policy statement except for one company. This company does not actually have an EMS but has an environmental management plan which does not require a policy statement. Only six companies (22%) produce a stand-alone environmental report (Section 5.5.2) and also include an environmental section in the

annual report (Section 5.5.1). More companies (37%) produce both an environmental section in the annual report and an EMS. Only six companies (22%) follow both types of reporting, and have an EMS in place including an environmental policy statement. These findings suggest that from the sample population there is a low adoption rate overall of a combined formal environmental management system and both types of environmental reporting within companies.

5.8 Voluntary environmental initiatives

Voluntary environmental initiatives relate to actions and/or activities that companies undertake or support (e.g., financially) towards the improvement of the environment. The initiatives referred to in this section are different to the voluntary environmental agreements presented in Section 2.7.2. They are different because the line of questioning relates to the types of voluntary programs that these companies provide (e.g., financial support to non-government organisations, community programs or local schools) - at a more "feel good" community level. The voluntary programs of the NPC and GHCP are at an industry/government level and findings on these two programs are presented in Chapter 6. The intention of questioning for the voluntary environmental initiatives was to obtain an indication of how many companies participate in voluntary environmental initiatives and to identify the types of initiatives undertaken. There is no elaboration on why companies participate in these initiatives or what benefits are envisaged.

Twenty companies (74%) undertake some form of voluntary environmental initiatives (Table 5.12).

Table 5.12 Number of companies undertaking voluntary environmental initiatives by industry sector

	Industry sector							
	Packaging		Food		'Other'		Total	
Number of companies that undertake voluntary environmental initiatives	7		7		6		20	
Percentage of companies	*87%*		*78%*		*60%*		*74%*	
Type of voluntary environmental initiatives	**Yes**	**%**	**Yes**	**%**	**Yes**	**%**	**Yes**	**%**
Education	2	*29*	3	*42*	2	*33*	7	*33*
Community	2	*29*	0	*0*	4	*66*	6	*29*
Sponsorship of non-government organisations (NGOs)	3	*43*	5	*71*	1	*17*	9	*45*
Restoration of natural resources	2	*29*	5	*71*	2	*33*	9	*45*
Recycling	3	*43*	2	*29*	1	*17*	6	*29*

Note:

- An interviewee may have responded with more than one type of initiative.
- The percentages are calculated in the columns (e.g., the number of packaging companies that undertake education (2) divided by the number of packaging companies that undertake voluntary environmental initiatives (7) 2/7*100=29%)

As Table 5.12 illustrates, sponsorship of NGOs and recycling are the most popular types of voluntary initiatives in which packaging companies participate. In the case of food companies it is sponsorship of NGOs and restoration of natural resources. Community programs, education and restoration of natural resources are the most popular voluntary initiatives in 'other' companies. There is no statistically significant association between industry sector and the participation in type of voluntary programs ($\chi^2 = 1.846$, df = 2, P>0.25). There is no statistically significant association between company structure and the participation in type of voluntary programs ($\chi^2 = 5.359$, df = 2, P = 0.10). The five categories of voluntary initiatives are described next.

Education

The types of voluntary initiatives that companies undertake that have an educational focus include producing science kits for local schools, providing financial support towards particular educational studies (e.g., water awareness study in schools) and supplying local schools with information on the activities and operations of the company:

> *"last year funded water awareness study through schools"* Interviewee 14.

Community initiatives

Three 'other' (chemical) companies work with the community in local habitat restoration (i.e., wetlands) and support the industry association's Responsible Care program. The interviewees identified these as voluntary environmental initiatives:

> *".. that has a spin off community right to know and community liaison processes, for instance yesterday ... had open day so had a couple of thousand people through the factory doors which is great"* Interviewee 23.

Sponsorship of NGOs

The sponsorship of organisations (e.g., Landcare, Earth Watch, Keep Australia Beautiful) that undertake activities to restore natural resources is a category in which ten companies are involved.

Restoration of natural resources

Tree planting, water conservation and wetland restoration are the three types of restoration of natural resources that nine of the twenty companies (45%) are involved in.

Recycling

The fifth type of voluntary initiative is recycling. In total six of the twenty companies identified voluntary recycling initiatives in which they participate.

5.9 Future environmental information

This section provides a list of environmental issues/information that interviewees believe will gain importance in the future. The timeline defined was the next five years. A summary of the key issues that were identified is presented in Table 5.13.

Table 5.13 Summary of future perceived key themes for environmental information collection requirements

Future environmental themes	Industry sector							
	Packaging		Food		'Other'		Total	
Carbon credits and taxes	1	*12%*	1	*11%*	4	*40%*	6	*22%*
Greenhouse/energy issues	2	*25%*	3	*33%*	1	*10%*	6	*22%*
Consumption of materials/resources/energy	3	*37%*	2	*22%*	1	*10%*	6	*22%*
Percentage rate of recycled material versus virgin material	2	*25%*	1	*11%*	1	*10%*	4	*15%*
Specific information through Covenant, NPI, waste to landfill	2	*25%*	3	*33%*	3	*30%*	8	*30%*
Other								
• Communication					1	*10%*	1	*4%*
• Employee health					1	*10%*	1	*4%*
• Environmental liability					1	*10%*		
• Greenhouse liability	1	*12%*					1	*4%*
• Sustainable index			1	*11%*			1	*4%*
• Internal reporting to industry association			1	*11%*			1	*4%*
• Emissions from vehicles					1	*10%*	1	*4%*
• Limits on emissions			1	*11%*			1	*4%*
• Show improvements in performance through environmental reporting			1	*11%*			1	*4%*
No response					3	*30%*	3	*11%*

Note:

- Interviewees may have given more than one response, which is recorded in the above table.
- Percentages calculated based upon number of companies per industry sector.

The four most common issues are: i) carbon credits and taxes; ii) greenhouse and energy issues; iii) consumption of resources, materials and energy; and iv) specific information related to various programs and categories. Another important issue was calculating the percentage rate of use of recycled materials versus the use of virgin material for the NPC.

5.10 Summary

Fourteen public companies, eleven private and two joint-venture companies were represented in the interviews. The three most important current environmental issues faced by these companies are legislative (in particular the National Packaging Covenant), and the management and minimisation of solid waste and emissions to air, land and water. More companies have an environmental policy statement than do those with an environmental mission or value statement. The sponsorship of non-government organisations (e.g., Landcare), support of community initiatives and restoration of natural resources (e.g., tree planting and wetlands) are the main types of voluntary initiative programs undertaken. Anticipated future environmental issues include providing information for specific programs (e.g., NPC and NPI), carbon credits and greenhouse/energy issues.

Disseminating information to stakeholders is the key driver behind environmental reporting. Having a formal system in place to manage environmental issues and having an accredited EMS in place, in accordance with the international standard are the key drivers for implementing an EMS. Public companies are more likely to have some form of environmental statement (e.g., policy), produce a stand-alone annual environmental report and to have implemented an environmental management system compared with private companies.

6 NATIONAL PACKAGING COVENANT, GREENHOUSE CHALLENGE PROGRAM AND NATIONAL POLLUTANT INVENTORY

6.1 Introduction

Voluntary environmental agreements aim to improve the environmental performance of industry and improve environmental conditions (Section 2.7.2). The drivers for companies in the Australian food packaging supply chain to sign onto the voluntary National Packaging Covenant and the Greenhouse Challenge Program are presented in this chapter. The effects of these voluntary programs upon the companies are also investigated and then compared with the effects of the regulatory National Pollutant Inventory.

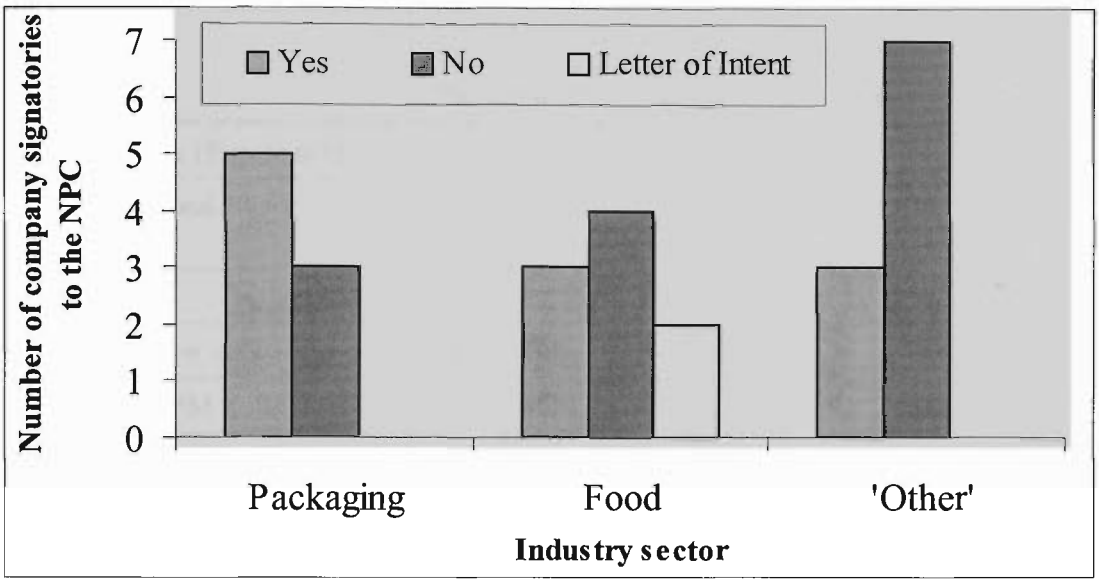
6.2 National Packaging Covenant (NPC)

The National Packaging Covenant (NPC) (Section 2.7.2.1) is a voluntary environmental agreement between various levels of the Australian government and the packaging supply chain. It is based upon the principles of product stewardship and shared responsibility regarding the environmental aspects of consumer packaging. The voluntary framework of the Covenant is complemented with a 'regulatory safety net' - the National Environment Protection Measure for Used Packaging Materials (NEPM) - which is designed to catch the "free rider" companies, those that do not voluntarily sign onto the Covenant.

Findings from this part of the study are presented in three sections. The first section discusses why companies signed the NPC, and is followed by an analysis of the effect that the NPC has or will have within the companies. The final section examines the reasons why the remaining companies have not signed.

At the time of the interviews eleven of the twenty-seven interviewed companies (41%) were signatories to the NPC with fourteen non-signatories (52%) and two companies (7%) having signed letters of intent to sign in the future (Table 6.1).

Figure 6.1 Number of company signatories to NPC by industry sector



Although the packaging companies represented the highest number of NPC signatories, there is no statistically significant association between industry sector and being a NPC signatory (χ^2 = 2.251, df = 2, P>0.25). There also is no statistically significant association between company structure and being a NPC signatory (χ^2 = 2.278, df = 2, P>0.25).

6.2.1 Reasons for signing NPC

The reasons why companies became signatories to the NPC are presented in Table 6.1.

Table 6.1 Reasons why companies became signatories to the NPC by industry sector

	Industry sector							
	Packaging		**Food**		**'Other'**		**Total**	
NPC signatories (Figure 6.1)	5		3		3		11	
Percentage of total sector population	*63%*		*33%*		*30%*		*41%*	
Reasons								
Avoid alternative regulation	2	40%	3	100%	3	100%	8	73%
Better than NEPM	2	40%	1	33%	1	33%	4	36%
Support the process	1	20%	2	66%			3	27%
Good business decision/commercial/marketing reasons	2	40%					2	18%
Have done our share in the past			2	66%			2	18%
Corporate citizenship			1	33%			1	11%
Involved in NPC development	1	20%					1	11%

Notes:

- Interviewees may have given more than one response.
- Percentages calculated based upon the number of signatories to the NPC per industry sector.

The covenant was signed by 73% of the signatories as they wanted to support the covenant framework and therefore avoid the introduction of some other form of legislation (i.e., if the NPC process is not successful then the federal government is likely to impose some form of regulation - Section 2.7.2.1):

> *"So signing the covenant is a pro-active opportunity for industry to work together with government and community and try and move forward in a realistic cost effective way"* Interviewee 23.

> *"I think the short answer to that is we looked at the options and the way that the legislation might have been going. We saw the*

> *covenant as the best vehicle to get some coordinated effort on waste management and recycling put together. That probably hasn't occurred as yet but certainly at the time of signing was the best methodology around. So that is why we joined. And we wanted to be part of something that was not fragmented. This gave us an option to pull things together in a conscience-managed fashion. So we signed on that basis"* Interviewee 24.

To avoid the regulatory safety net - the NEPM - is the reason why 36% of companies have become signatories:

> *"To avoid obviously having the NEPM enforced on us. Rather ... be in a position of pro-actively and controlling rather than reacting to legislation"* Interviewee 7.

Some of the packaging companies have become signatories, because they are very supportive of the initiative as is demonstrated by this involvement in the development of the Covenant:

> *"We have always been a very involved player in the whole packaging debate even before the covenant so we were involved right from the word go in its development and everything and therefore logical having been involved in its whole development that we would sign it and also to avoid obviously having the NEPM enforced on us"* Interviewee 7.

Companies see that becoming a signatory would improve the commercial aspects of the organisation:

> *"Whilst we would like to think also that there is a community thing (one of the main aspects of doing* [recycling at the] *beginning) it is now* [being done for] *a lot of commercial* [reasons]*"* Interviewee 4.

Beverage companies expressed their support of the NPC as a mechanism to make other companies in the packaging supply chain take responsibility:

> *"Very supportive of the covenant ... We feel like the beverage industry has done more of their share to contribute to waste management issues and that the packaging covenant finally represented an opportunity for that net to be cast wider than just* [the] *beverage industry ... Its introduction will also cast the net wider and cover more industry that, frankly, were not pulling their weight" Interviewee 17.*

The findings suggest that the main driver for companies to sign onto the voluntary NPC is to avoid 'alternative' legislation and to circumvent the application of the regulatory NEPM. This is consistent with prior research, e.g., (Harrison 1999).

6.2.2 The significance of the effect of the NPC

Interviewees in the three industry sectors provided different views on the expected effect of the NPC within signatory companies (Table 6.2). The NPC is expected to have a fairly significant effect within the packaging companies, whereas it is considered to have no significant effect within the food companies:

> *"I think it will have a fairly significant role ... but yet to be defined"* Interviewee 7, and
>
> *"It will not play a great role in the company again because most of what we think we are doing are the things that need doing"* Interviewee 17.

Table 6.2 Magnitude of the expected effect of the NPC within companies by industry sector

Magnitude	Industry sector							
	Packaging[a]		Food[b]		'Other'[c]		Total	
Number of signatories	5		3		3		11	
No effect			1	*33%*			1	*9%*
Not significant			1	*33%*			1	*9%*
Fairly significant	1	*20%*			1	*33%*	2	*18%*
Significant					1	*33%*	1	*9%*
Fairly major	1	*20%*					1	*9%*
Major	1	*20%*					1	*9%*

Note:

- Percentages calculated based upon number of signatories per industry sector.

a) Two packaging interviewees provided no response.

b) One food interviewee provided no response.

c) One 'other' interviewee provided no response.

The lack of a no significant effect within the food companies is mainly due to some of these companies, being part of the beverage industry, which indicated that they have been working on product stewardship and recycling of beverage containers for many years, i.e., there is no real new element in the NPC:

> *"Not going to play any role in the company - we have been doing a lot of the stuff in the past (due to beverage packaging and CDLs[23]...) for the past 20 years. We are packaging things together and working up and down the supply chain - business as usual..."* Interviewee 9.

[23] CDL = Container Deposit Legislation.

In one company the NPC is perceived to play no great role, although it is considered to place greater pressure upon decisions being made regarding the introduction of new packaging systems:

> *"It will not play a great role in the company again because most of what we think we are doing are the things that need doing. Guess what it will do is cement our involvement with* [industry association] - *it certainly will add weight to decisions that are made on what packaging is used"* Interviewee 17.

In the case of the 'other' sector, the NPC is expected to play a fairly significant to significant role within the organisations. The expected effects that the NPC will have within the organisations are presented in Table 6.3 and are defined in relation to four categories: decision making, partnerships, business management and competition.

Table 6.3 The expected effect of NPC within signatory companies by industry sector

	Industry sector							
	Packaging		Food		'Other'		Total	
Number of NPC signatories	5		3		3		11	
Effect on:								
Decision making	1	*20%*	1	*33%*	1	*33%*	3	*27%*
• Add weight to internal decisions			1				1	
• Change thinking					1		1	
• Set guiding principles	1						1	
Partnerships	1	*20%*	2	*66%*	0	*0%*	3	*27%*
• Strengthen strategic alliance with suppliers			1				1	
• Cement involvement with industry association			1				1	
• Identify partnerships	1						1	
Business management	4	*80%*	3	*100%*	1	*33%*	8	*72%*
• Focus on product lines	1						1	
• Identify activities/obligations/gaps	1						1	
• Focus on packaging waste			1				1	
• Provide information					1		1	
• Internal savings/reduce costs	1		1				2	
• Continual improvement	1						1	
• Business as usual			1				1	
Competition	1	*20%*	0	*0%*	2	*66%*	3	*27%*
• Competition of material					1		1	
• Close material loop	1						1	
• Identify viability of recycled material					1		1	

Note: Interviewees may have given more than one response.

- Percentages calculated per number of signatories per industry sector.

Decision-making

The three types of influences that the NPC will have upon decision-making are related to product development. In respect of decision-making one of the 'other' companies is discovering that their way of thinking about the issues of waste management is changing and that it is not just about recycling:

> *"It is starting to change our thinking there is no doubt about it. ... It has started to make us think and we have some tangible things that we can do - it is not just about recycling. Recycling is a good start and focus and there will be things that can help that won't change the perception of plastics and their recyclability. But until you physically start to move product in the right direction there are opportunities out there"* Interviewee 22.

In one packaging company, guiding principles will be established that will provide the company with a framework to achieve their action plan and for future decisions on product developments:

> *"Setting guiding principles - under the covenant we will produce an action plan and that will set down a number of written things we will endeavour to achieve and we will continue to improve - it is not a stationary document. It's alive and living"* Interviewee 6.

The NPC will also play a role in decision-making regarding new product releases:

> *"We are looking at a new product being introduced but can't go anywhere because environmental implications haven't been confirmed. Marketing and Advertising say it won't be a problem, but* [the product] *will not go anywhere until I see no problem. Without the covenant that probably would not have happened. Now* [being] *signed to covenant adds weight to my ability to say this product can't be launched"* Interviewee 17.

Partnerships

Partnerships with suppliers and industry associations will be strengthened or started according to some of the companies that have signed onto the NPC:

> *"Guess what it will do is cement our involvement with [industry association] ..... I think it will generate more co-operation between suppliers and users of packaging"* Interviewee 17, and
>
> *"We even try to encourage our customers to sign on - we wait for this stage" Interviewee 24.*

Business management

Better management of product lines and costs is another envisaged effect of the NPC within companies, which can also lead towards continual improvements:

> "[at the] e*nd of the day it comes back to reducing operating costs"* Interviewee 10.

Competition

Companies in the 'other' sector see the NPC assisting them in determining the viability of their material in the marketplace:

> *"Focus on whether* [material] *can be viably recycled, application wise, economical wise, as we face increase competition from other materials"* Interviewee 23.

In the case of one packaging company the programs implemented by the company under the NPC will increase the recovery of waste that they can then use in a closed material loop system. Changes that are occurring or are envisaged to occur within interviewed signatories are changes that have also been observed in other companies since the implementation of the NPC (Section 2.7.2.1). These changes include the focus turning towards waste management in general and not just upon recycling (Williams 2000; PCA 2002a), the evaluation and redesign of products (Seddon 2002),

and companies in the supply chain requiring suppliers to be signatories (Carroll 2002).

6.2.3 Reasons for not signing NPC

Fourteen companies had not become signatories to the NPC, with the reasons differing between industry sectors (Table 6.4).

Table 6.4 Reasons for not becoming a NPC signatory

Reasons for not signing	Industry sector							
	Packaging		Food[1]		'Other'		Total	
Number of non-NPC signatories	3		4		7		14	
Percentage of total sector population	38%		44%		70%		52%	
Investigations still needed			2	*50%*	2	*28%*	4	*29%*
Intend to sign	2	*66%*			1	*14%*	3	*21%*
Not discussed internally	1	*33%*			1	*14%*	2	*14%*
Not at this stage			1	*25%*	1	*14%*	2	*14%*
Relevance diluted					2	*28%*	2	*14%*

Note:

1. An additional two food companies have signed letters of intent to become signatories to the NPC.

In the case of the three packaging companies, two had intentions to sign in the future and in the other company discussions are still to be undertaken:

> *"Important for us to be signatories to the packaging covenant as two of our best customers .....are signatories and we see it as our responsibilities .... to manage our materials as a self regulated industry rather than have someone come in and say what to do"* Interviewee 5.

The food companies were still to investigate whether they will become signatories:

> *"Yes probably in the future - still need to look into it (not aware of the full impact yet). Investigation is still needed"* Interviewee 15.

In one of these food companies the interviewee stressed the potential disagreements within the different company departments that could be encountered between developing and marketing particular products and packaging systems, and the requirements of the covenant:

> *"One thing you must remember is with a market company - we are market driven - tomorrow we might decide that we should be out there in a bottle (glass) of* [product]. *All good things come in glass. Glass is perceived to be the ideal packaging. The product can take off in a whirl wind selling millions of these bottles but all of a sudden we have to look at our product to packaging weight or volume and we realise that we are really using a hell of a lot more packaging per tonne of product than we ever had in the past. Because of this very successful product. We wouldn't want to have anyone put pressure on us to get out of that glass bottle because we have committed ourselves to lowering the weight of our packaging. That's my personal concern (not sure whether the company would reflect on that) but I have made that clear to the company that it is one of my personal concerns about the company signing and we should be very careful about our commitments as far as lowering our packaging"* Interviewee 16.

In most cases, the reasons why the 'other' sector companies had not signed onto the covenant were because they were still considering internally what the implications were, what they would be committing themselves to, and developing an understanding of the framework of the covenant. In one company it was explained that downstream customers would be taking the action and, in this case, the comment demonstrates the shift of 'responsibility' from the material supplier through to the converter:

> *"Probably not, because we are a direct supplier of primary material to ... converters in the market (downstream companies to take action)"* Interviewee 18.

In contrast, in another company, even though the relevance of the covenant at its level is reduced, they intend to sign in the future for strategic reasons and because their customers are signatories:

> *"Probably will but not yet. Our customers ... the big converters of our [products] are signatories and selling to the food industry, we probably will sign. As a manufacturer the relevance of the covenant is kind of diluted at our level but as a strategic good corporate citizen decision probably will do it"* Interviewee 24.

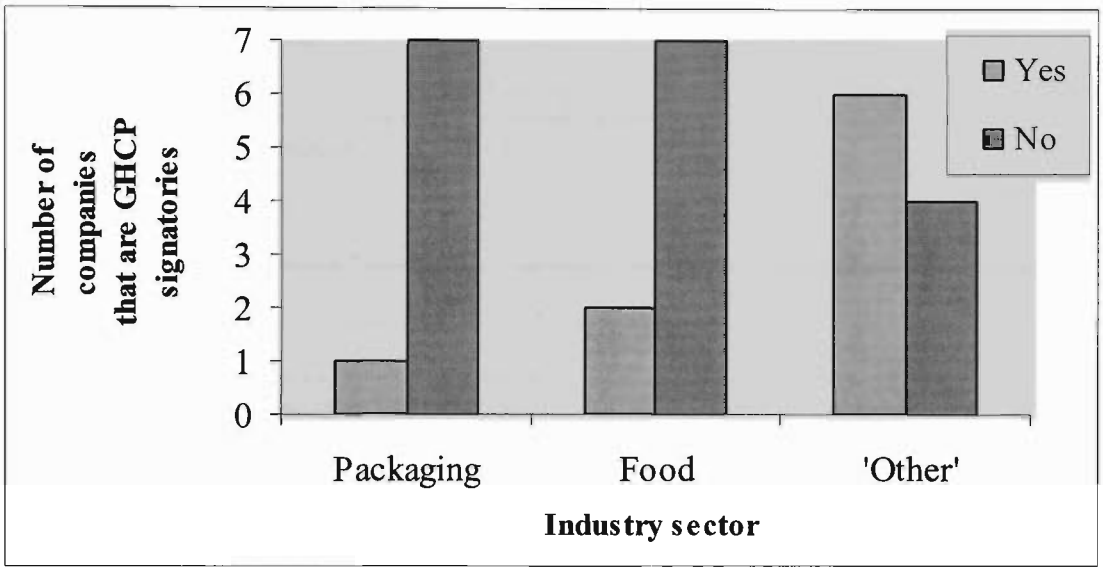
Two food-processing companies had signed letters of intent to become signatories because one company saw it as the responsible thing to do, and the other indicated that the NEPM was potentially too expensive, and therefore the NPC was seen as a cheaper option. Between conducting the interviews and 20th of September 2002, six of these fourteen companies became signatories to the NPC.

6.3 Greenhouse Challenge Program (GHCP)

Another voluntary environmental agreement, this time between the Australian government and industry in general, is the Greenhouse Challenge Program (GHCP) (Section 2.7.2.2). The GHCP aims to abate greenhouse gas emissions through the implementation of programs that reduce and monitor emissions. The reasons why companies have signed and the effect that the GHCP will have within the companies are presented in this section. This is then followed by a discussion of the reasons why the remaining companies have not become signatories.

Nine of the interviewed companies (33%) are signatories to the Greenhouse Challenge Program (GHCP) (Figure 6.2) with six of the nine representing the 'other' industry sector.

Figure 6.2 Number of companies who are signatories to the GHCP by industry sector



Note:

(1) One food company has signed a letter of intent and another interviewee did not know if the company was involved in the program (both marked in 'no' column).

(2) One 'other' company was actively involved in preparing to join and one interviewee did not know (both are marked in no column).

There is a statistically significant association between industry sector and being a GHCP signatory ($\chi^2 = 6.424$, df = 2, P = 0.05). Companies in the 'other' sector are more inclined to sign the GHCP than companies in the food and packaging sectors. There is no statistically significant association between company structure and being a GHCP signatory ($\chi^2 = 5.172$, df = 2, P = 0.10).

6.3.1 Reasons for signing the GHCP

The reasons why nine companies have signed onto the GHCP are presented in Table 6.5.

Table 6.5 Reasons for signing the GHCP by industry sector

Reasons for signing	Industry sector							
	Packaging		Food		'Other'		Total	
Number of GHCP signatories	1		2		6		9	
Percentage of total sector population	*13%*		*22%*		*60%*		*33%*	
Public recognition	1	*100%*	*2*	*100%*	2	*33%*	5	*55%*
Corporate citizenship					2	*33%*	2	*22%*
Formalise energy management			*2*	*100%*			2	*22%*
Reduce costs			*1*	*50%*	1	*16%*	2	*22%*
Increase employee involvement			*1*	*50%*			1	*11%*
Good business					1	*16%*	1	*11%*

Note:

- Some interviewees may have given more than one reason.
- Percentages based upon number of GHCP signatories per industry sector.

In all three sectors, the main reasons why companies have signed onto the GHCP are to demonstrate public commitment and to receive recognition in reducing greenhouse gas emissions. The two food companies have also signed to reinforce/formalise the programs in place for the management of energy consumption, to reduce costs and to increase employee involvement:

> *"Already doing energy management (but didn't have employee involvement they only saw it as cost saving exercise). Therefore wanting to broaden the reasons for energy management to give them personal reasons to become involved"* Interviewee 9.

In the 'other' companies, corporate citizenship and reducing costs are other reasons for joining the GHCP and in one company it was explained that it was good business:

> *"Good business and fits with corporate environmental objectives"*
> Interviewee 18.

Unlike the NPC, the companies that have signed the voluntary GHCP did not mention the avoidance of legislation as a driver for signing the GHCP. Five of the companies that have signed the GHCP are also NPC signatories. The avoidance of alternative legislation if the NPC was not successful was a driver for two of these companies to sign the NPC. Avoiding the NEPM was a driver for another two of the companies. The possibility of alternative legislation being introduced to replace the GHCP is probably very low and therefore may not be perceive as a driver.

6.3.2 The effect of the GHCP

Table 6.6 presents the effects of the GHCP on signatory companies.

Table 6.6 The effect of the GHCP in signatory companies by industry sector

Effect	Industry sector							
	Packaging		Food		'Other'		Total	
Number of GHCP signatories	1		2		6		9	
Percentage of total sector population	*13%*		*22%*		*60%*		*33%*	
Assist decision making	1	*100%*	1	*50%*	1	*16%*	3	*33%*
Reduce energy consumption & cost			1	*50%*			1	*11%*
Benchmarking					1	*16%*	1	*11%*

Note:

- Not all interviewees gave a response.
- Percentages based upon number of GHCP signatories per industry sector.

In 33% of the GHCP signatory companies, the GHCP will have an effect on the decision making process regarding energy related issues. In particular it will affect decisions relating to justifications for capital expenditure:

> *"Focus on reducing energy consumption and assist with justification of capital expenditure"* Interviewee 10, and
>
> *"Financially attractive projects are getting first priority and if more drastic action needs to be taken (in reducing emissions - re: carbon tax introduced) then the "more expensive projects" will be done"* Interviewee 18.

In another company, greenhouse gas emissions will be monitored to assist the company in benchmarking their performance:

> *"I think it will be more of a monitoring to see what our performance is – benchmarking"* Interviewee 21.

There will also be opportunities to reduce costs and contribute to the larger objective of reducing emissions:

> *"Signing the Greenhouse Challenge Program is the opportunity to make a contribution back against an opportunity. In reality we will save some money and make a profit from it and at the end of the day this is a commercial organization"* Interviewee 22.

6.3.3 Reasons for not signing the GHCP

The majority of the population (eighteen companies) are non-signatories to the GHCP (Table 6.7).

Table 6.7 Reasons why companies have not signed the GHCP by industry sector

Reasons for not signing	Industry sector							
	Packaging		Food		'Other'		Total	
Number of companies	7		7		4		18	
Percentage of total sector population	88%		77%		40%		67%	
No reason given	1	*14%*	3	43%	2	*50%*	6	*33%*
Thinking of joining	1	*14%*	3	43%	1	*25%*	5	*28%*
Haven't heard of program			1	14%	1	*25%*	2	*11%*
Not a major issue	2	*28%*					2	*11%*
Not discussed internally	1	*14%*					1	*6%*
No current requirement	1	*14%*					1	*6%*
No decision made	1	*14%*					1	*6%*

Note: Percentages calculated per number of non-GHCP signatories per industry sector.

The lack of awareness of the GHCP or the lack of consideration internally in the company is the reasons why companies have not signed the GHCP. Other reasons are that greenhouse gases are not considered a major issue to be dealt with and some operations may not generate emissions directly (though could indirectly through energy consumption):

> *"In the nature of our business we are not involved in direct emissions of any type. Secondly in the sense of emissions and reduction of (our power consumption) which indirectly releases carbon - we are continually trying to research methods to reduce our power consumption - both economically necessarily"*
> Interviewee 6.

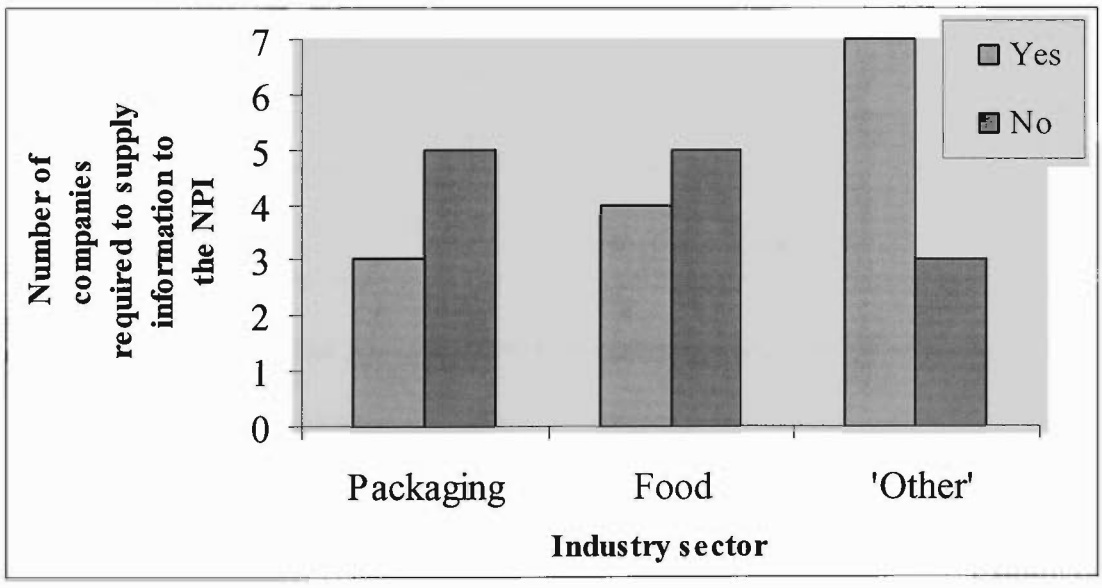
Several companies are thinking of signing onto the program in the future due to pressures from external stakeholders (e.g., from the Australian Greenhouse Office or

industry associations). Companies have not become voluntary signatories to the GHCP mainly because considerations to determine if the company should join are not finalised, as six interviewees indicated. Seven interviewees gave no reason.

6.4 National Pollutant Inventory (NPI)

The regulatory National Pollutant Inventory (NPI) is an internet database, accessible to the community, industry and government, which has been designed to provide information on the types and amounts of certain substances that are emitted in Australia to the environment via air, land and water. Only companies that exceed certain threshold levels of the chemicals on the NPI list are required to provide information (Section 2.7.1.1). Fourteen companies (52%) of the sample population are required to supply information to the NPI (Figure 6.3).

Figure 6.3 Number of companies required to supply information to the NPI by industry sector



Note: One food interviewee and one packaging interviewee were unsure if company was required to supply information. They are reported in the 'no' column.

There is no statistically significant association between industry sector and being required to provide information to the NPI ($\chi^2 = 2.177$, df = 2, P>0.25). There is no

statistically significant association between company structure and being required to provide information to the NPI ($\chi^2 = 5.386$, df = 2, P = 0.1).

6.4.1 The effect of the NPI within companies

The effect of the NPI within the companies that are required to supply information is presented in Table 6.8.

Table 6.8 The effect of the NPI on companies that are required to supply information

Effect	Industry sector							
	Packaging		Food		'Other'		Total	
Companies required to supply to NPI	3		4		7		14	
Percentage of total sector population	38%		44%		70%		52%	
Part of normal management and reporting	1	*33%*	1	*25%*	3	*43%*	5	*36%*
No effect	1	*33%*	1	*25%*	2	*29%*	4	*29%*
More a compliance issue	1	*33%*					1	*7%*
Minimal impact upon business			1	*25%*			1	*7%*
Insignificant			1	*25%*			1	*7%*
Public education					1	*14%*	1	*7%*
Waste of time					1	*14%*	1	*7%*
Cost to company			1	25%			1	*7%*

Notes:

- Some interviewees provided more than one reason and some interviewees did not provide a reason.
- Percentages based upon the number of companies required to supply information to the NPI per industry sector.

There are no significant effects that the NPI is perceived to have within the companies required to supply data.

From the findings (Table 6.8) it appears that the effect of the NPI upon the companies required to supply information is minimal and more part of normal management and reporting rather than an impact upon for example decision making such as that of the NPC and GHCP:

> *"We are intending to set up a KPI system as part of the EMS and we would have been doing that regardless of the NPI. So I mean a lot of that data for the NPI is gathered anyway for EPA, so it is sort of being done anyway. We just try to combine it so it is less bureaucratic to gather the data and give what we have to EPA and the rest for our KPI system. I don't think it is adding any value or changing the way we are doing things because we would be doing that anyway to make sure that the EMS is running effectively"* Interviewee 7.

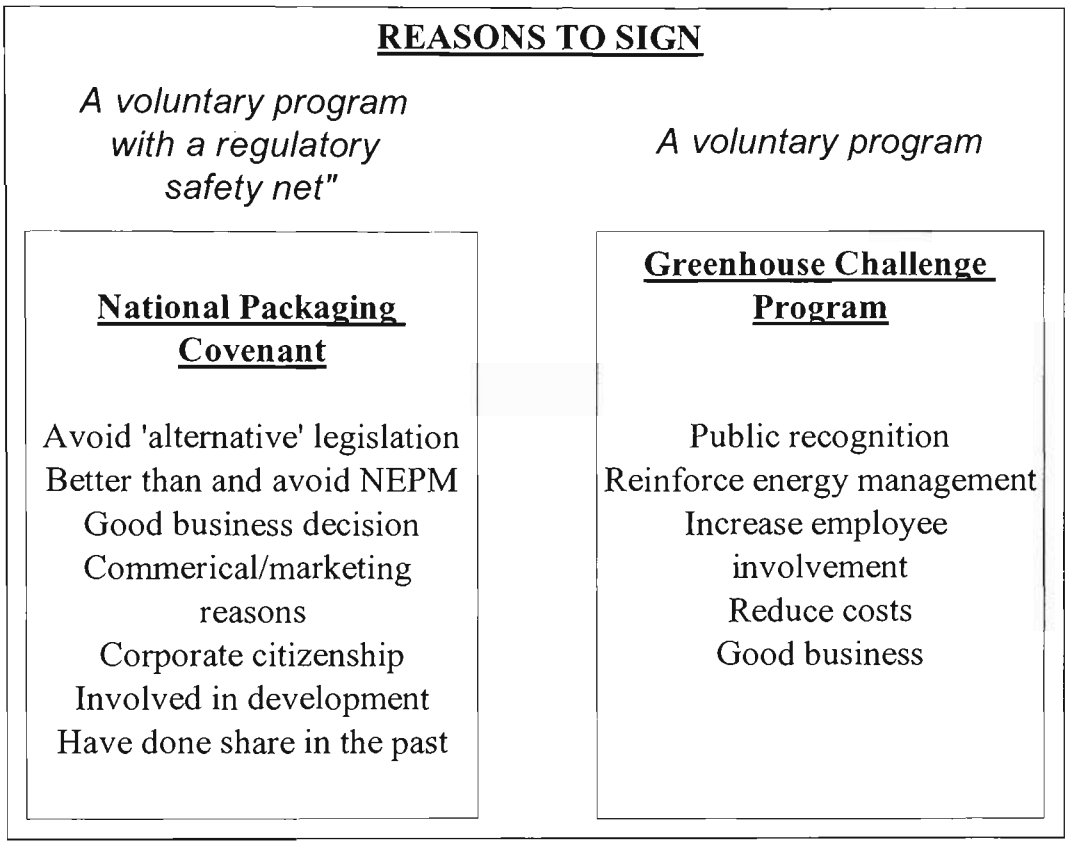
One interviewee spoke about the costs of the NPI to the company as a result of the time senior management was required to spend on NPI issues:

> "[it is an] *expense to the company (senior management spending time on NPI issues)"* Interviewee 10.

6.5 Drivers for voluntary environmental agreements and regulatory programs - an evaluation

Figure 6.4 summarises the different reasons why companies have become signatories to the NPC and GHCP, as discussed in Section 6.2.1 and 6.3.1. The avoidance of alternative legislation and avoiding the regulatory safety net are the main drivers for companies to become signatories to the NPC (Table 6.1), whereas the main driver for companies to sign onto the GHCP is receiving public recognition for reducing emissions (Table 6.5).

Figure 6.4 Drivers to sign NPC and GHCP



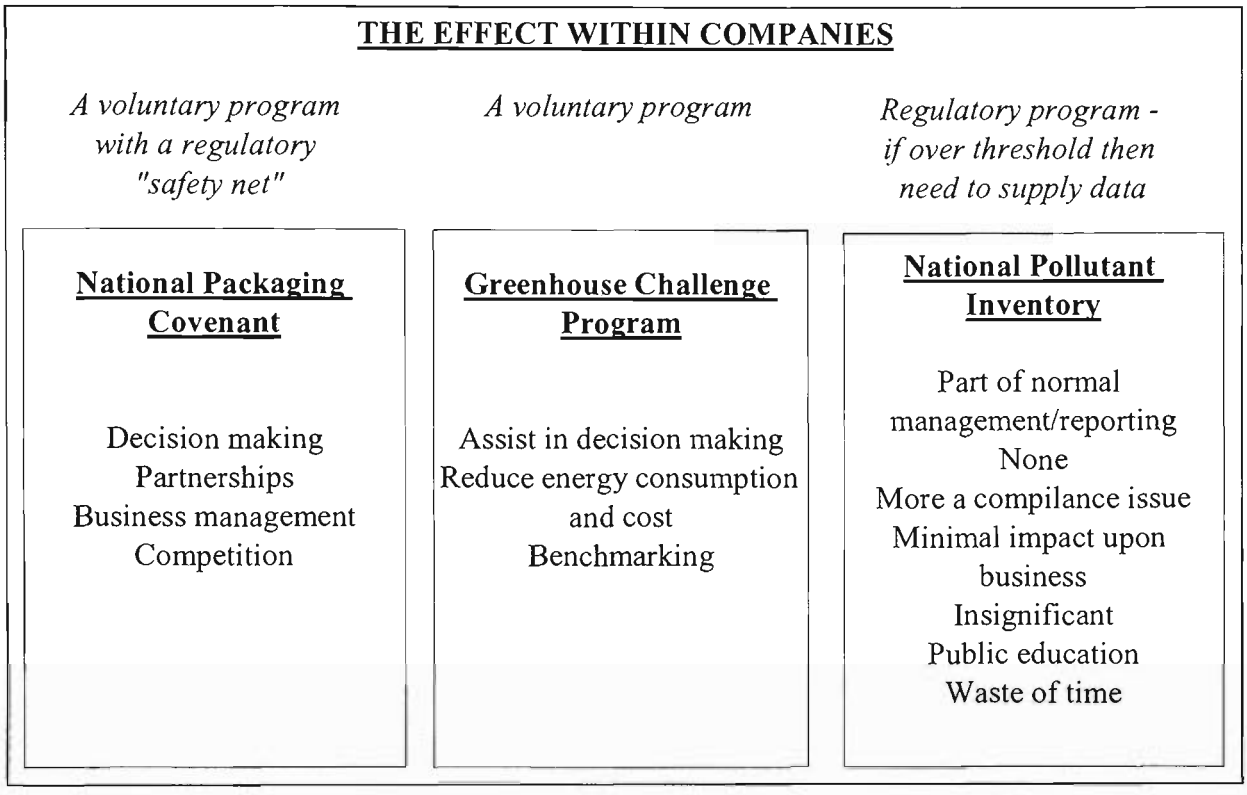
There could be several reasons why there are differences in the drivers for companies to sign onto these two particular voluntary environmental agreements. The first possible reason relates to a timing issue. The GHCP was developed in preparation of a possible carbon tax or other strict regulation and was launched in 1995. So there had been several years between the launch of the program and the interviews. By that time, the threat of some type of regulation had (probably) decreased and companies may have wanted to be seen to be taking positive action to reduce their environmental impact. In the case of the NPC, however, the interviews were conducted six to eight months after the launch of the NPC and therefore the 'reality' of the situation and the possible alternative outcomes (e.g., regulations) that could have eventuated (if the covenant was not accepted) were probably 'fresh' in the mind of interviewees.

Another reason why there could be a difference in drivers for signing on the NPC and GHCP could be the structure and design of the programs, relating to the focus of the programs, the target companies, the target environmental issue(s) and the

requirements for signatories. The focus of the GHCP is upon greenhouse gas emissions related to energy consumption, and is targeted at companies that consume large quantities of energy and emit large amounts of greenhouse gases. The NPC on the other hand, is focused upon product stewardship and shared responsibility with respect to consumer packaging, and is targeted at the entire packaging supply chain. Both programs are viewed as being good for business. Cost reductions/savings are mentioned, as effects of signing onto the GHCP and NPC though are not the major drivers.

Figure 6.5 compares the different effects within companies of signing onto the NPC and GHCP and supplying information to the NPI. The difference in effect of the voluntary programs upon the organisations compared with the regulatory NPI is quite significant. The regulatory NPI program is seen to have a minimal effect upon the organisations, being more a compliance issue and part of normal management and reporting. This is in stark contrast to the voluntary programs, which (will) have effects upon decision-making and business management activities including cost reductions. This may be associated with the 'flexibility' that is provided within the frameworks of voluntary programs compared with the 'rigidity' of regulatory frameworks. Companies may perceive that they have more control over voluntary programs and therefore see more benefits with them.

Figure 6.5 Effects within companies of signing NPC and GHCP and supplying information to NPI



6.6 Summary

The two main drivers for companies to sign the NPC are to avoid the 'alternative' - legislation, and to avoid the NEPM. Whereas the main drivers for companies to sign the GHCP are to demonstrate public commitment to and to receive recognition from reducing greenhouse gas emissions. The effect of the NPC upon signatory companies are related to decision making, particularly in relation to product design, the establishment of new and the continuation of existing partnerships with suppliers and customers, focusing upon business management systems and enhancing competition in the marketplace. The effect of the GHCP upon signatory companies relates to assisting in decision-making regarding energy and greenhouse gas emission issues, and reducing the energy consumption and subsequent costs. The regulatory NPI program is seen to have a minimal effect upon the organisations, being more a compliance issue and part of normal management and reporting.

7 LIFE CYCLE ASSESSMENT

7.1 Introduction

Life cycle assessment (LCA) (Section 3.9) is an environmental assessment technique, which assesses the potential environmental impact of a product, process, service or activity over its entire life cycle by taking account of material and energy inputs and outputs. The application of LCA by companies in the Australian food packaging supply chain is investigated along with the level of adoption of LCA. The drivers for using LCA and the features of the studies that have been conducted are presented. The reasons companies have not used LCA are also discussed.

7.2 Overview of LCA case studies

Six of the twenty-seven interviewed companies (22%) have used the LCA methodology to assess the environmental impact of their activities/processes and/or compare their product(s) with alternatives (Table 7.1).

Table 7.1 Number of companies that have used the LCA methodology

	Industry sector							
	Packaging		Food		'Other'		Total	
Yes	3	*37%*	2	*22%*	1	*10%*	6	*22%*
Indirectly	1	*12%*	1	*11%*	2	*20%*	4	*15%*
No	4	*50%*	6	*66%*	7	*70%*	17	*63%*
Total number of companies	8		9		10		27	

There is no statistically significant association between industry sector and undertaking a LCA study (χ^2 = 1.944, df = 2, P>0.25). There is no statistically significant association between company structure and undertaking an LCA study (χ^2 = 2.511, df = 2, P>0.25).

A summary of the LCA studies undertaken by the six companies is presented in Table 7.2 with the discussion following.

Table 7.2 Summary of LCA studies conducted

Questions asked in interview	Industry sector company					
	Packaging	**Packaging**	**Packaging**	**Food**	**Food**	**'Other'**
1. Year conducted	1996-1999	1997	2000	1997	Not given	1998
2. Focus of study[24]	Comparison of current product and a new alternative company product. In addition, assessment of different product filling locations.	Comparison of current product and a new alternative product.	All operations with focus on greenhouse gas emissions	Material reprocessing	Undertake top-line LCA to identify key issues and evaluate certain proposals[25]	Product from extraction to processing with focus on greenhouse gas emissions
3. Reasons for conducting the LCA	Validation of material A versus material B environmentally. Were there any major positives? What were the environmental aspects of different locations for product filling?	Conducted comparison of products using LCA as a defence against claims of one product versus another. To be prepared for future defence if necessary.	Look at environmental impacts of operations.			Wanted information on strengths and weaknesses of product. Use to support strengths and look at reducing weaknesses (footprint, market vulnerability).

[24] Reference to the companies and products have been removed from this table to ensure confidentiality is maintained.

[25] Worldwide organisation has conducted LCA studies. The Australian operations have called upon European studies for consideration of decision-making, e.g., change from board to shrink-wrap (top-line), e.g., change from glass to PET (detailed LCA information).

Table 7.2 Summary of LCA studies conducted (continued..)

Questions asked in interview	Industry sector company					
	Packaging	**Packaging**	**Packaging**	**Food**	**Food**	**'Other'**
4. People from company involved	Production Manager along with Sales and Marketing Manager.	Corporate environmental manager and marketing side of product development in packaging group. Used an external consultant.	Contract managers and energy manager.		R&D packaging group as part of packaging development and environmental manager.	Environmental Advisor, Industry Council consisting of CEOs and whole industry through working group of technical and environmental personnel.
5. Outcomes (results of the LCA study)	Material B worse on environmental aspects due to being imported (transport) and greater weight of packaging system.	The outcomes were interesting! There were issues associated with the product but they were outweighed by product content loss. Though debate came back to the product itself and the impact associated with its production.	Application for internal and external use.			Understand National and International differentiation. Recognize advantages and weaknesses.

Table 7.2 Summary of LCA studies conducted (continued..)

Questions asked in interview	Industry sector company					
	Packaging	**Packaging**	**Packaging**	**Food**	**Food**	**'Other'**
6. Difficulties encountered	Understanding whether it was a realistic evaluation in a practical situation, a whole lot of assumptions were made, lot of leeway on results.	Data gathering, quality and breadth of data, Australian settings and applicability.			Setting the boundaries.	Expensive, time consuming, access to "quality" data, and what to do with the collected data.
7. Application of results	Would not have been applied.	Have not been widely applied as development of product at a standstill for technical reasons. If project goes ahead will use LCA to promote or defend product.				Directly applied to automotive industry in USA and Europe.
8. Exposure of LCA study	Internal use	Internal use	Internal use		Internal use	Internal use

Table 7.2 Summary of LCA studies conducted (continued..)

Questions asked in interview	Industry sector company					
	Packaging	**Packaging**	**Packaging**	**Food**	**Food**	**'Other'**
9. Is LCA being used now	No	Not really[26]			Principles of LCA are being used.	Yes
10. Will it be used in the future	Can see application but not determining factor, will form some part of the information needed for decision making.	Yes, but in a modified form.	Yes	Yes - essential tool for marketing and decision making by Management.	Yes	Yes
11. Has the company been asked for LCA data	No.	Not aware	Most possibly		Possibly through consumer complaints when company changed packaging from glass to PET.	Yes with confidentiality agreement with inventory + report.

[26] Not really. Looking at LCA approaches in wine group but problems with integrating something that is streamline and not very expensive. It should systematically address environmental impacts through all life cycle stages, but not a full-blown LCA. Want to take LCA philosophy and use on a daily basis. It could result in a checklist.

The LCA studies were conducted in the time period between 1996-2000. The focus of two studies was on product comparisons, whereas the others were on the collection of environmental data on a particular product or the company's operations. The main reason for conducting the studies was the collection of environmental information in order to obtain a better understanding of the environmental strengths and weaknesses:

> *"Within the world wide organization we have done LCAs and I have called upon European LCAs for consideration of decisions within our organization. ...We do a lot of top line LCAs just in terms of the way we evaluate certain proposals but not talking broad base ...Very general ... What are the key issues that we need to weigh up into the decision - there is economic, environment, and so forth. Part of that decision making process ....So when I talk about top line I am really saying we take those sort of things into account but not to the extent of detailed LCA"* Interviewee 14.

In one company the LCA was conducted to be used as a 'defence mechanism' to possible market reactions of an alternative product:

> *"The* [lobby] *were promoting their product as being environmentally superior than [our product] and we had our doubts about various aspects. So what we wanted to do was to do a cradle to grave comparison. I guess we had it as a defence against claims coming out of the [other] group that their product was environmental friendly and that [our product] was environmentally bad. To actually get the facts so we could defend ourselves if we had to"* Interviewee 7.

This application of LCA - defending - has been raised by researchers such as Baumann (2000), Frankl *et al* (2000) and Heiskanen (2000) as a common use of LCA. As stated by the interviewee the results had not yet been used in a defensive fashion because the technical development of the product had been halted. It appears that generally studies were not conducted to support a particular decision, but were used more in a 'learning' capacity (Baumann 2000; Frankl *et al.* 2000) - to gain a better understanding of where environmental impacts are occurring. In addition to

obtaining environmental inventory and impact data as a result of conducting the LCA study, other outcomes included learning about the impact of transport (e.g., importing materials from overseas), the impact of product content loss compared with the impact of packaging, and understanding differences between Australian and international processes. These outcomes are similar to those in Heiskanen *et al* (1995, original not sighted) quoted in Heiskanen (2000) where managers gained new perspectives that were not perceived in the initial stages of conducting the LCA.

Personnel who were involved in conducting the LCAs ranged from a corporate environmental manager to a production manager, an energy manager, a sales and marketing manager, a technical manager and the research and development packaging group. These are consistent with findings from other studies (Frankl *et al.* 2000; Heiskanen 2000) where the 'environmental department or related' is principally involved in conducting the studies.

The findings of the six studies have not been publicly released. Only in two companies have the results been used. In one instance the information has been used to educate employees about environmental issues and in the other company the data has been applied in the industry sector overseas. Generally the findings and learnings gained from conducting the LCA are not integrated within the company, which Heiskanen (2000) also found. In three companies, aspects of LCA are currently being used and all six identified that LCA will be used in the future. However, specific details on how and to what degree LCA will be used was not further investigated for this particular study.

Difficulties that were encountered in conducting the studies included: data gathering and access to data, the quality and breadth of data, Australian settings and applicability, the setting of boundaries and the time and cost resources required. These are common difficulties experienced by all who undertake LCA studies (Section 3.9.2). Other difficulties included how to use the information once the study was completed, and understanding whether the study was a realistic evaluation in a practical situation (due to having to make assumptions).

7.2.1 Indirect involvement in LCA studies

Four companies in the sample population have 'indirectly' been involved in an LCA by supplying data. In three companies it has been the industry association, which has undertaken the study, and members of the specific associations have been asked to contribute data. In the remaining company, customers downstream in the supply chain conducted two separate studies, and information on its process inputs and outputs were supplied to the study.

7.3 Reasons for not using LCA

Seventeen companies in the sample population have not used LCA. The reasons given by them are presented in Table 7.3.

Table 7.3 Reasons for not using LCA

	Industry sector							
	Packaging		**Food**		**'Other'**		**Total**	
Companies that have not used LCA	4		6		7		17	
Percentage of total sector population	*50%*		*67%*		*70%*		*63%*	
Reasons for not doing LCA								
Have not needed to go to that level			2	*33%*	2	*29%*	4	*23%*
Not considered	1	*25%*	2	*33%*			3	*18%*
Not applicable					3	*43%*	3	*18%*
Time consuming/limited resources	2	*50%*	1	*17%*			3	*18%*
Different products in market segments	2	*50%*					2	*12%*
Question benefits, no perceived value	1	*25%*	1	*17%*			2	*12%*
Costs	1	*25%*					1	*6%*
Limited Australian data	1	*25%*					1	*6%*
Customers have not asked	1	*25%*					1	*6%*
Not aware that we have					1	*14%*	1	*6%*
Thinking of doing an LCA					1	*14%*	1	*6%*

Note: Some interviewees gave more than one reason.

- Percentages based upon the number of companies that have not used LCA per industry sector.

The reasons companies decide not to conduct LCA studies range from limited human resources to timing and cost issues. Others have not considered LCA or do not see it

as being applicable to their operations. Two interviewees question the value of doing LCA and what the benefits would be, whereas four interviewees explained that it is not necessary for them to go to the level of detail of analysis that an LCA does. In the case of two packaging companies some of their reasons for not doing LCA are related to customers and the problems encountered when the company supplies to different market segments and customers with different products:

> *"Don't really get asked about environmental issues at all from our customers really. Some see the need but that they do not want to face up to the problems and there is also a conflict as well because they use many forms of packaging and for them to raise that issue may jeopodise their business"* Interviewee 4, and

> *"We have many different products going to many different customers and market segments - it gets a little bit complicated to try and apply something as sophisticated as LCA to that"* Interviewee 6.

These responses are in direct contrast to comments of two food interviewees in which the interviewees explained that LCA has not been applied because they believe the system in place for the packaging materials that they use, if anything, is sufficient and they said that the packaging companies would be the ones to perform the studies:

> *"Haven't felt the particular needs to do it. Again because we do not produce the packaging we would tend towards saying if there is a question of the LCA of a particular packaging it would be something that the packaging suppliers would do not ourselves"* Interviewee 17.

Problem shifting and not taking responsibility for the company's contributions through the supply chain are issues that can be summarised from the examples given above. The issues are specifically indicated by a select number of companies and it is not the intention to generalise to a wider population, though they justify further research to gain a better understanding of how companies take up their responsibilities. These issues are, for example, in conflict with the principles of the

NPC where product stewardship and shared responsibility are the primary objectives (Section 2.7.2.1).

7.4 Summary

LCA has not been widely used within the Australian food packaging supply chain. Where LCA has been used, it has been to conduct an environmental assessment of company product(s) and or processes. Of the LCA studies conducted, they are not generally to support a specific decision but to collect environmental information on processes or to compare products with alternatives. The findings of the LCA studies have not been used (i.e., integrated) into the operations of the respective companies and none of the studies have been publicly released. Reasons for companies not using LCA include limited human resources, time and costs considerations, or no current applications for the methodology.

8 ACCOUNTING APPROACHES AND ENVIRONMENTAL COSTS

8.1 Introduction

Life cycle costing (LCC) (Section 3.6), value chain analysis (VCA) (Section 3.7) and activity based costing (ABC) (Section 3.8) are three cost accounting approaches that may have merit in determining and managing environmental costs. They differ in methodology, system boundary and outputs and produce information on different aspects of costing relevant to the organisation. They may be used singly or together. The findings on the level of adoption of these three approaches, the reasons for using them (i.e., benefits achieved) and explanations for why companies do not use them are described in this chapter. Findings on which environmental costs companies identify and how they allocate them within the business are also presented. The chapter concludes with findings of the costing philosophies used by the companies and how upstream and downstream costs are considered.

8.2 Accounting approaches

8.2.1 Life Cycle Costing (LCC)

There are numerous definitions that have been found in the literature to describe life cycle costing (LCC) (Section 3.6). In principle it is a methodology that allows costs that occur at various stages of the 'life cycle' to be calculated. The life cycle costing definitions that were supplied by the researcher to the interviewees during the interviews are those by Weitz *et al* (1994) and White *et al* (1996) (Table 3.5).

The extract is shown below:

> *"Life cycle cost is defined as all internal and external costs associated with a product, process, project or activity throughout its entire life cycle - from raw materials acquisition to recycling/final disposal of waste materials. Internal costs are those directly incurred by an organisation (e.g., capital, labor, energy and regulatory compliance costs). External costs are those not directly incurred by the organisation (e.g., resource depletion, water contamination, and human health effects)"* (Weitz *et al.* 1994, 28).
>
> *"Life-cycle costs include all internal costs plus external costs incurred throughout the entire life cycle of a product, process, or activity"* (White *et al.* 1996, 7.11).

There is some conflict between the definition given by the researcher during the interview, and the understanding of the interviewees, as evidenced by the definitions that they provided during the interviews (Table 8.1). From the definitions (and interpretations) supplied by the interviewees, there seems to be some understanding and acknowledgment of particular life cycle costs. This is however, limited and selective to certain activities. Costs occurring downstream from the company are not considered. With the difference in definitions, compared with the literature, it could be concluded that these companies are not actually using full life cycle costing as it is defined in the literature. These points are elaborated below.

Table 8.1 Interpretation of LCC supplied by those interviewees whose companies use LCC

A.	*"Closing the loop".*
B.	*"Closing the loop on plastic recycling. LCC is cradle to grave - raw materials through to transport and distribution - take some attention to waste management but not involved in the actual. Purchase raw material so the raw material is costed. The life cycle costing - plastic, metal, glass - what life span do you give products, how safe, weight of packaging materials, what is the utility of the product, the convenience of the product, and not just look at waste generated at the end".*
C.	*"Looking at raw materials, processing (energy, water use, additives, wastes and disposal)".*
D.	*"Life of an asset (which will be built into a product) and site remediation, downstream products costs not included - only"* [from material extraction to when product leaves our factory gate][(1)].
E.	*"Capture all of the cost from start and finish of the business - call it cost of business".*

Notes:

- One interviewee did not provide a definition.

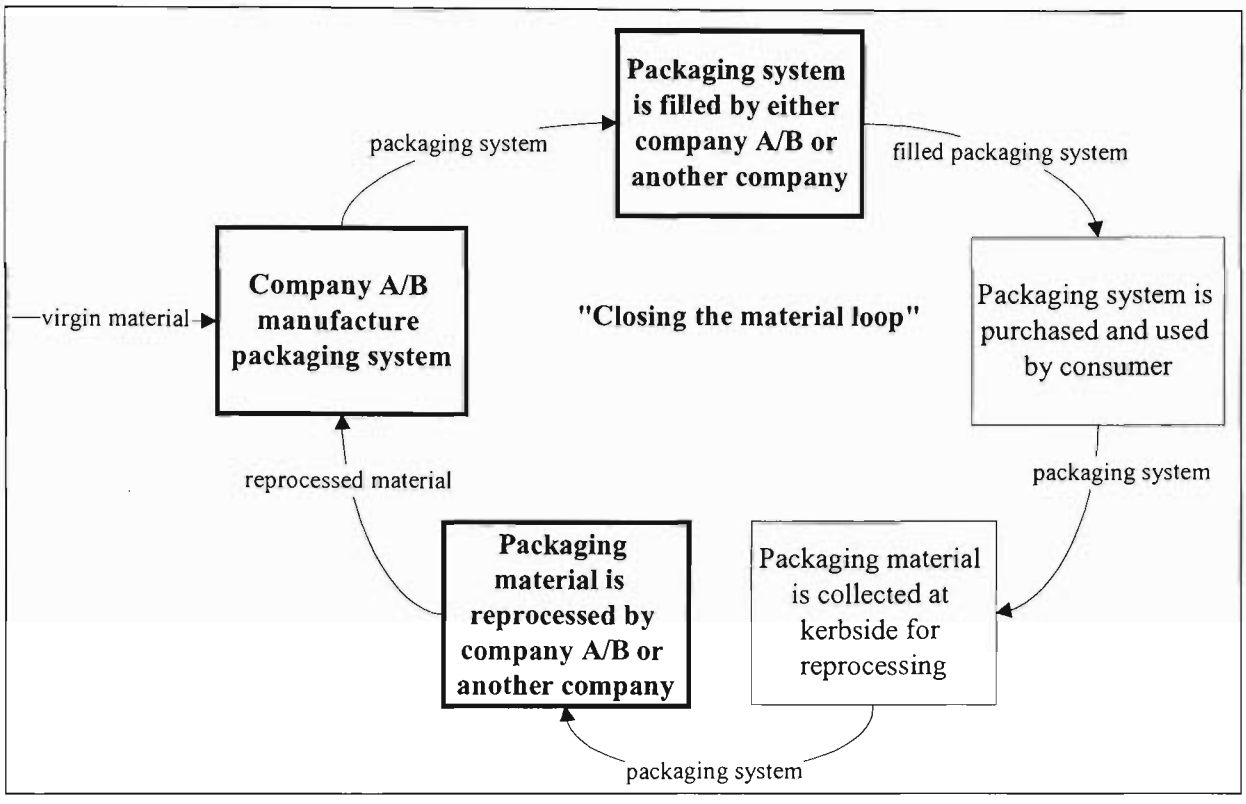
(1) Text in square brackets inserted by researcher to describe generally the operations and to remove direct reference to company operations to maintain confidentiality.

Descriptions A and B (Table 8.1) describe the operations whereby companies use recycled material (i.e., packaging material which has been collected in the post-consumer stage, and also possibly at the commercial stage, and reprocessed) to replace virgin material. The companies refer to this activity as "closing the loop" because they use recycled material to reduce the need to use virgin materials. It is difficult to determine exactly which costs company A collects from the limited description supplied. It appears that A and B perform several activities across the value chain though internal costs are the focus, in contrast to the definitions which include external costs (Weitz *et al.* 1994; White *et al.* 1996) (Figure 8.1).

Companies C, D and E focus on life cycle costs incurred within the boundaries of the company operations and not beyond (Table 8.1). Therefore, these costs do not span the entire life cycle (supply chain). It appears that the responsibilities of costs that are incurred upstream or downstream of companies are passed from one company onto

another (e.g, in the price of the end product). In the case of two food companies, LCC has been applied on selected projects.

Figure 8.1 The internal costs considered by companies A and B



Note: The coloured boxes are the possible activities that company A and B are involved in across the supply chain, and also represent where costing would be performed.

Another company applies 'life of an asset' to selected plant decisions:

> *"Everything we do is driven by maximising return to shareholders - make long term horizon decisions on the plant"* Interviewee 18,

and another captures the costs of the business from start to finish, excluding downstream costs:

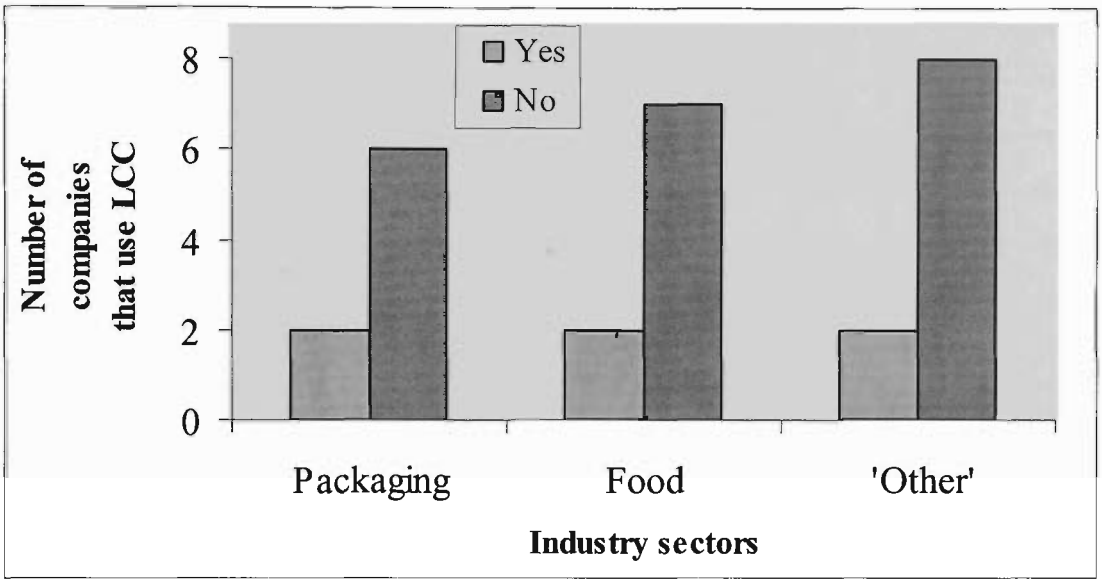
> *"Everything, except the use stage, I don't obviously count the costs of what someone else does with my* [product] *once they have bought it unless I am going to be liable there afterwards"* Interviewee 22.

As the literature review revealed there is an array of definitions that have been given to describe LCC (Section 3.6) and the findings of this study indicate a similar trend.

8.2.1.1 Use of LCC

Six interviewees (22%) from the sample population indicated that life cycle costing, although not defined by them as it is in the literature, is used in the operations of their business (Figure 8.2).

Figure 8.2 Number of companies that have used LCC by industry sector



There is no statistically significant association between industry sector and using LCC (χ^2 = 0.064, df = 2, P>0.25). There is no statistically significant association between company structure and using LCC (χ^2 = 0.738, df = 2, P>0.25).

8.2.1.2 Non-use of LCC

Twenty-one companies (77%) have not used LCC within their organisation (Table 8.2). Limited understandings of the LCC concept or having not considered it are the main reasons for non-use of LCC:

a) *"Hasn't been a priority or necessarily been fully understood"* Interviewee 20,

b) *"Don't see a need to do it"* Interviewee 23, and

c) *"Difficulty in trying to understand it, been no need to measure it"* Interviewee 25.

Table 8.2 Reasons for non-use of LCC by industry sector

	Industry sector							
	Packaging		**Food**		**'Other'**		**Total**	
Non-use of LCC	6		7		8		21	
Percentage of total sector population	*75%*		*78%*		*80%*		*78%*	
Reasons for not using LCC								
Not considered			1	*14%*	5	*62%*	6	*29%*
Limited understanding of concept	1	*16%*	1	*14%*	4	*50%*	6	*29%*
Other analysis undertaken			3	*43%*			3	*14%*
No external requirements	2	*33%*			1	*12%*	3	*14%*
Limited company resources	1	*16%*					1	*5%*
Short term focused company	1	*16%*					1	*5%*
No current application			1	*14%*			1	*5%*

Note: Percentages calculated based upon number of companies not using LCC per industry sector.

Findings indicate that some companies will not use LCC unless it is required through regulations:

> *"I can't see it happening for quite a long time...the more likely way of it coming about is from a government. It is a long way from happening unless there are regulatory requirements to do it"* Interviewee 2,
>
> and
>
> *"Hasn't been the pressure to do so - need outside stimulant to do so"* Interviewee 21.

The short-term focus of companies is also a reason for not using LCC, for example in one packaging company:

> *"Don't think there is any recognition within the company on that bigger scale. All the direct costs and the short term costs if you like and the pressure of the short term is much greater"* Interviewee 2.

Three companies that are not using LCC have other systems in place that consider aspects of the life cycle:

> *"Starting to do life time cost of plant (building maintenance and operating costs than just straight capital costs). By default when making purchasing decision look at cash flow analysis over life cycle of the plant. Lifetime projected internal costs of using/running equipment, no external costs included. Boundaries are internal costs, - processing and manufacturing only, no transport stage"* Interviewee 9.

Another company is in the process of implementing an activity-based system and sees no particular need to use LCC:

> *"Operate with a standard costing system. See no particular need to change. Will change costing system to reflect more activity based costing. But no particular need to go to life cycle costing"* Interviewee 17.

In one company a corporate change would be required to use life cycle costing:

> *"Finance have guidelines to work with and they are rock solid, so to get that to change is a corporate change"* Interviewee 23.

Of the companies that have not used LCC, one interviewee indicated that the company would implement LCC in a trial process in some facilities:

> *"In the future it will, but won't include post-consumer waste management and limited raw material acquisition"* Interviewee 3.

Life cycle costing appears, from the literature, to provide companies with an approach to assess the internal and external environmental costs that are incurred across the life cycle of products, though, as discussed above, this is not occurring within the interviewed companies. Companies might be using a limited form of LCC for internal costs but external costs are not considered. This is quite different from the life cycle assessment approach that looks at externalities. However, companies interviewed in this study also rarely have used LCA. Therefore, the LCC and LCA use is consistent and demonstrates that companies are not actively using these

approaches to assist them in taking a life cycle perspective of their products and activities.

8.2.2 Value Chain Analysis (VCA)

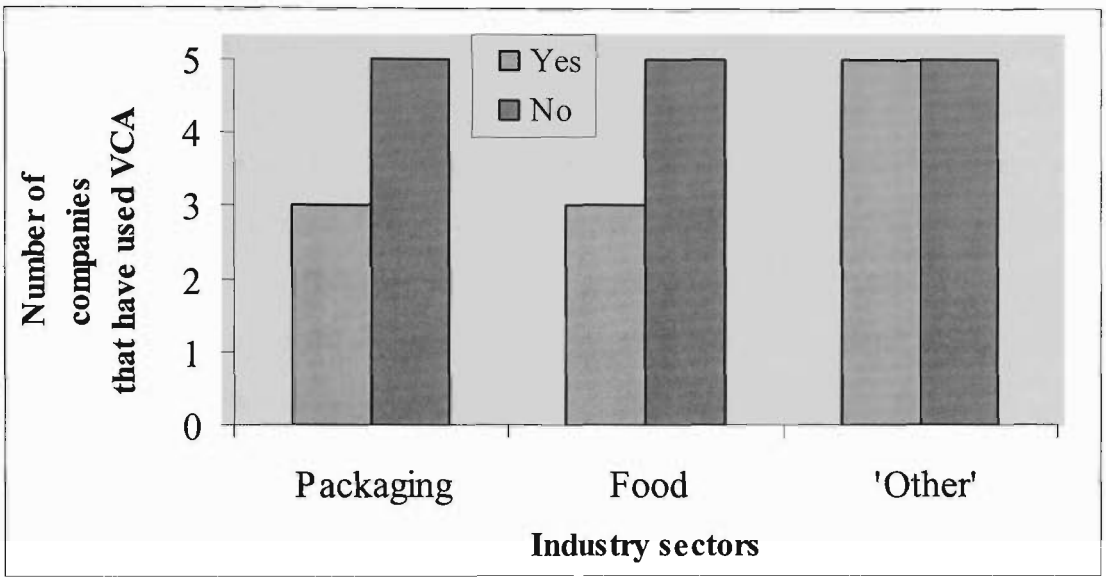
Value chain analysis (VCA) (Section 3.7) is a systematic way of examining the activities that a company performs and how these activities interact with the supply chain. VCA is defined by Shank and Govindarajan (1993, 13) as:

> *"for any firm in any business is the linked set of value-creating activities all the way from basic raw material sources for component suppliers through to the ultimate end-use product delivered into the final consumers' hand. This focus is external to the firm, seeing each firm in the context of the overall chain of value-creating activities of which it is only a part, from basic raw material components to end-use consumers".*

Figure 3.6 demonstrates how LCA and VCA can be combined to place economic costs and value on the consumption of materials and energy, the production of products, generation of emissions and waste and the impact of competitors. It therefore, offers strong opportunities in managing environmental issues and costs along the supply chain. In particular the external focus would be useful for environmental life cycle management.

Eleven companies (41%) out of the sample population have used VCA, fifteen companies have not and one interviewee was unsure if the company has used VCA (Figure 8.3).

Figure 8.3 Number of companies that have used VCA by industry sector



Note: One food company interviewee was unsure if the company used VCA.

There is no statistically significant association between industry sector and using VCA (χ^2 = 0.393, df = 2, P>0.25). There is no statistically significant association between company structure and using VCA (χ^2 = 3.95, df = 2, P = 0.15). Therefore public companies are no more likely than private companies to use VCA.

8.2.2.1 Use of VCA

Four companies apply VCA to (a) product(s) and six companies apply it on a company wide basis. One interviewee did not provide details on the type of application. In the case of two companies where VCA is applied on a product basis, it is used in a limited way indicating that the company does not use it on a regular basis:

> *"Attempted to try and apply it with various degrees of lack of success, more on a case by case basis"* Interviewee 25.

Of those companies in which VCA is used on a company wide basis, maintenance, procurement, logistics, human resource management, process optimisation, resource changes through the whole organisation, and plant management are areas within the organisations where VCA is used:

> *"What we are doing is looking at things like we used to shut down lines for two weeks to do the annual maintenance on the lines. Now we are doing preventive maintenance and now we are questioning it. Certainly putting a lot more focus into this area now because we can see a lot more value. This is an area - logistics - that we are discovering like the rest of the industry. In fact, we are now sponsoring scholarships to study logistics because we believe this is an area where it could really add value to the business by operating more efficiently"* Interviewee 10.

One company analyses the supply chain from the raw materials through to the consumer:

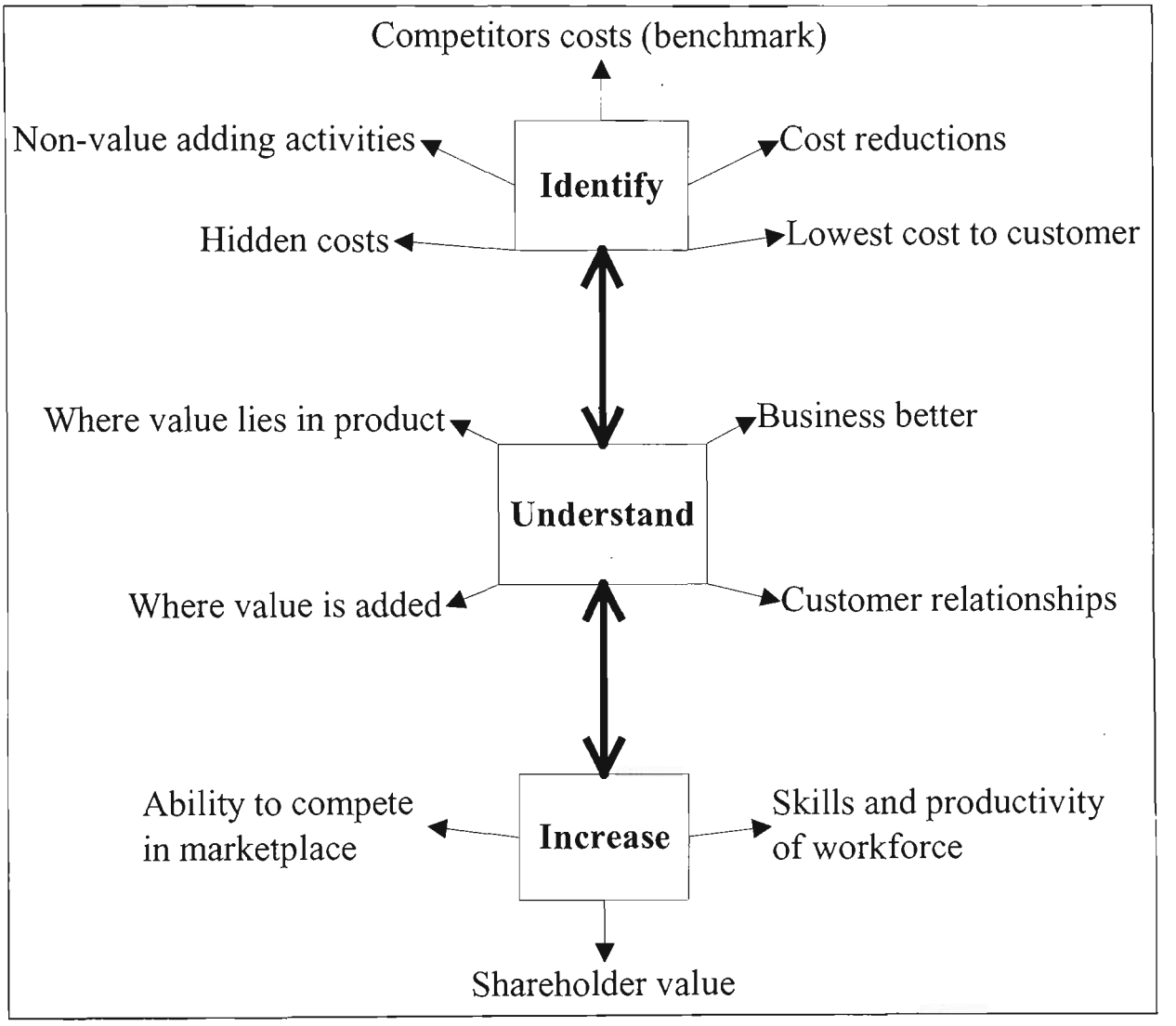
> *"We look at total added value between a raw material and the material in the hands of the consumer. We analyse that entire value chain and what areas we control and seek to understand and risk manage those components to see where we can contain best value. At a broad business level (not at individual products) - raw material through to consumer purchase"* Interviewee 9.

One interviewee discussed the issue of identifying non-value adding activities and reducing the hidden costs associated with dealing with customers:

> *"Also identified non-value-adding activities - not just administration, but also manufacturing areas...There are a lot of hidden costs when dealing with customers (rather than cost of* [product], *focus on cost of doing business), but very hard work"* Interviewee 4.

Figure 8.4 identifies the benefits of VCA under three broad categories - identify, understand and increase.

Figure 8.4 Categories of benefits of using VCA



The identification of non-value adding activities and hidden costs and the opportunity to minimise and reduce costs from the business are benefits of using VCA:

> *"Pulling costs out of the business - that is just a fact of life, that is what it is all about"* Interviewee 14.

It also allows for a better understanding of the costs and the business and therefore the companies have a greater ability to compete in the marketplace and allows for competitors' costs to be benchmarked:

"We do what is known as value based management...We are also looking at competitors' cost structures and then using it as a basis for comparison and finding opportunities to have an advantage of closing the gap that someone else had an advantage over. That type of thing. A type of benchmarking you could call it" Interviewee 20.

8.2.2.2 Non-use of VCA

Having a costing system that is not detailed enough to accompany the implementation of VCA, not seeing the benefits of using VCA, or not considering that VCA is necessary are the main reasons why companies do not use VCA in their businesses (Table 8.3).

Table 8.3 Reasons for non-use of VCA by industry sector

	Industry sector							
	Packaging		**Food**		**'Other'**		**Total**	
Number not using VCA	5		5		5		15	
Percentage of total sector population	*63%*		56%		*50%*		*56%*	
Reasons for not applying VCA								
Not required/applicable			1	*20%*	2	*40%*	3	*20%*
Not considered	1	*20%*			1	*20%*	2	*13%*
No perceived value / Not convinced			1	*20%*	1	*20%*	2	*13%*
Costing system not advanced	1	*20%*			1	*20%*	2	*13%*
Don't have market share			1	*20%*			1	*7%*

Notes:

- Not all interviewees provided a reason for non-use and some interviewees gave more than one answer.
- Percentages based upon the number of companies that have not used VCA per industry sector.

In two companies, VCA has not been considered, is not required or people have yet to be convinced of the value or benefits of using the system:

a) *"No perceived value"* Interviewee 16 and

b) *"Maybe there is value in it, but I guess we haven't been convinced yet"* Interviewee 22.

In one company, VCA is not used specifically though in their strategic planning the company determines where value is added for their customers:

> *"In your strategic plans you try to work out where you add value for your customers and what your advantages are from primary activities. But in terms of using it in other than having it as your strategic plan, no, we don't specifically use it as a value chain analysis"* Interviewee 2.

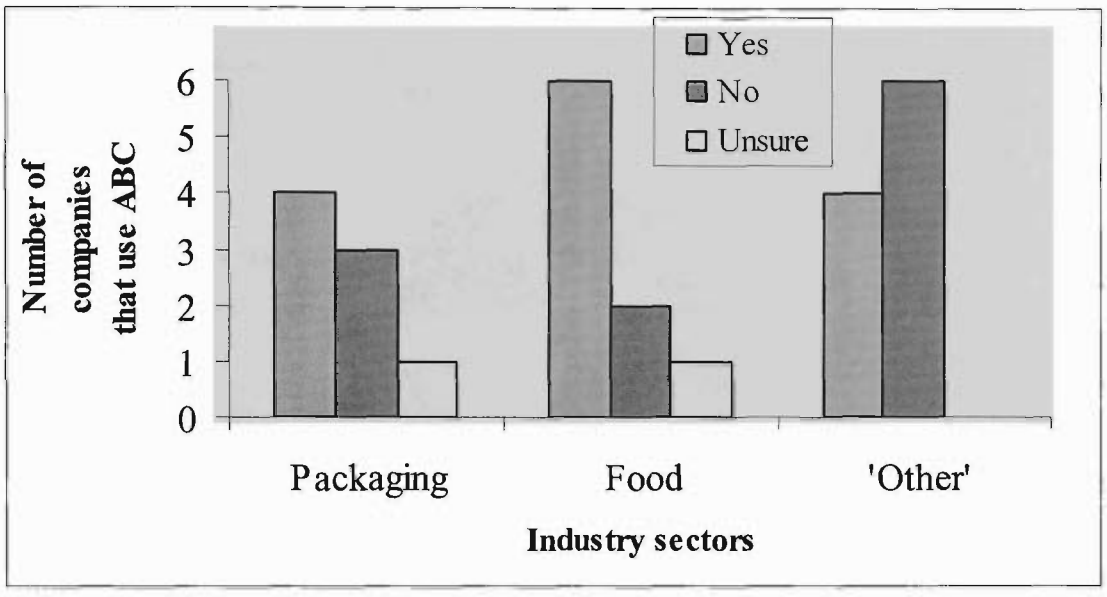
Although 41% of companies use VCA, the use is generic and not specifically upon the identification of environmental costs. However, this does provide a good basis for the technique to be used for environmental management. The understanding of VCA is more wide spread than LCC.

8.2.3 Activity Based Costing (ABC)

The activity based costing (ABC) (Section 3.8) methodology provides a mechanism for the more accurate allocation of costs to responsible activities or products (i.e., the activities or products that consume the resources). ABC has been widely disseminated in many business sectors over the last decade. It is a more accurate way of allocating overhead, for instance, energy or emissions to air. ABC would enable comparisons of the electricity consumption or fees for emissions and other associated costs of individual products and provide an insight into which products have a greater environmental impact. Products with a higher environmental impact and cost can be identified and can either be priced higher to the consumer, re-designed to reduce environmental impact, or removed from production.

Fourteen companies (52%) in the sample population are using ABC, eleven are not and two interviewees were unsure (Figure 8.5).

Figure 8.5 Number of companies that use ABC by industry sector

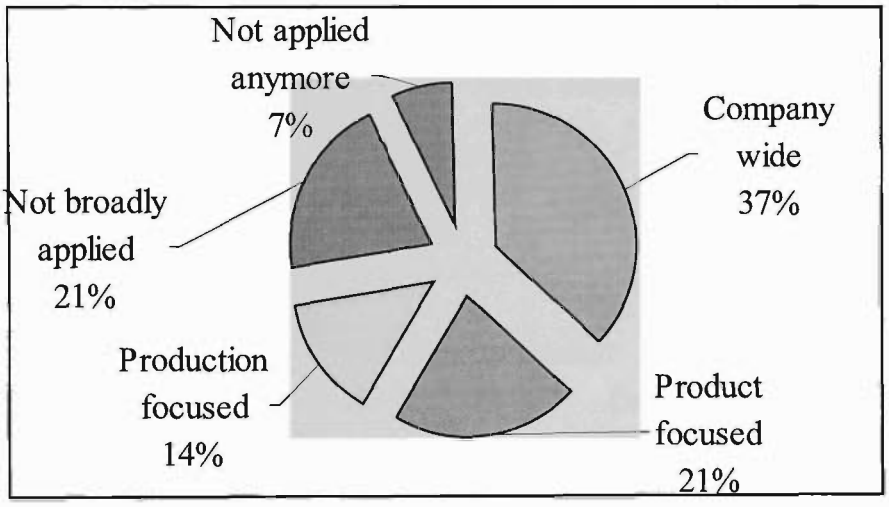


From the sample population, the data indicates that within the three industry sectors, on a percentage basis, more food companies (66%) use ABC compared with packaging companies (44%) and 'other' companies (40%). There is, however, no statistically significant association between industry sector and use of ABC (χ^2 = 1.364, df=2, P>0.25), so no particular industry sector is more or less inclined to use ABC. Ten of the companies (71%) that use ABC are public companies. There is a statistically significant association between company structure and the use of ABC (χ^2=14.489, df=2, P = 0.001), which demonstrates that public companies are more likely than private companies to use ABC. Public companies are often larger than private companies and can therefore command more financial resources. ABC is costly to implement, thus it is not surprising that more public companies use it.

8.2.3.1 Use of ABC

ABC is used in four different ways within the fourteen companies as illustrated in Figure 8.6.

Figure 8.6 Ways in which ABC is used within companies



ABC is used on a company wide basis in 37% of companies and 56% of companies do not use ABC broadly though they use it on specific product(s) or use it on a production line.

Examples of responses as to how ABC is used are:

(a) *"Company wide, is applied on everything. On the whole company, every department, every plant"* Interviewee 20 and

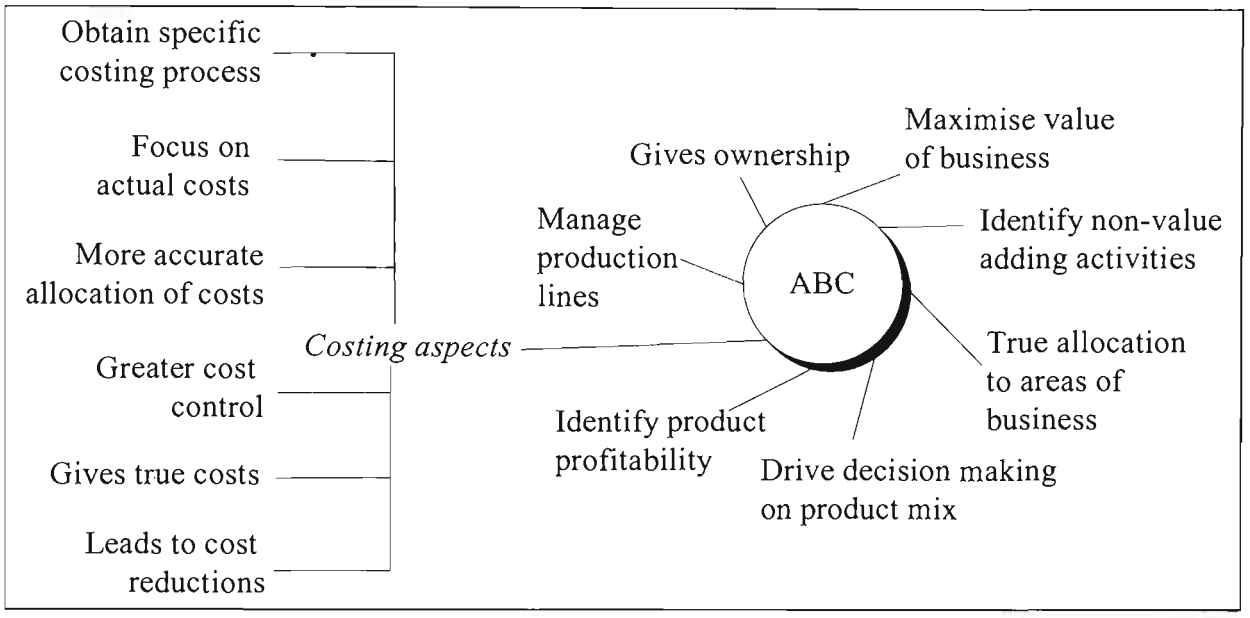
(b) *"On all costs of production"* Interviewee 16.

One company began the process of investigating the possibilities of ABC by piloting the implementation of it, though it was not continued:

"I know it has been looked at but other things came up. It was never implemented - there was some pilot type stuff done on it" Interviewee 21.

The benefits that interviewees defined as having been achieved when ABC is used within the companies are presented in Figure 8.7.

Figure 8.7 Benefits of using ABC within companies



Some of these benefits are consistent with those identified by (Kaplan 1992; Innes and Mitchell 1993; Landry *et al.* 1997). Other benefits identified in the literature such as product pricing (Innes and Mitchell 1993; Eunsup and Stagliano 1997), supplier relationships (Kaplan 1992) and strategic cost information (Cooper and Kaplan 1998) have not been identified by the interviewees.

The opinions expressed by interviewees indicate that companies which use ABC obtain greater control over their costs. This is achieved because ABC has enabled them to focus upon the actual costs of their operations and identify non-value-adding activities. One interviewee explained it was difficult to understand why companies have not been able to calculate the cost of their products:

> *"I was speaking with the financial controller yesterday. He was saying within six months we should be able to have an activity based cost on each product. I have only been here 15 years - staggering. I mean my wife and kids at home who have never been involved in business before are staggered that you can't work out the price or cost of each product. Staggering, the logic is 100% there - its just actually getting it to happen*

> - *getting people to understand, the formats and processes and information systems in to allow you to do it, recording systems. Cultural change is difficult"* Interviewee 2.

As one interviewee indicated, once an ABC system is in place it can give employees ownership and provide them with the tools to reduce operating costs in their areas of responsibility:

> *"Will give production lines ownership of their particular operations and they will be able to concentrate on reducing costs in their areas and benefiting their areas"* Interviewee 10.

ABC can also influence decision-making regarding product mix and product categories as in the case of one company:

> *"It can drive decisions we make about products and product categories that we should and should not be in. Force us into decisions that people external to a business would say well* [company] *is* [product 1 and 2]. *But we are no longer because we couldn't justify being in that business with the margin basis. And you can sort of argue in some ways that it might have only come about a time when we started to focus a lot more strongly on true allocation to that area of the business*" Interviewee 14.

Several interviewees indicated that implementing an ABC system is very time consuming and in two cases the companies would have abandoned the implementation but for the directive from the parent company to continue:

> *"To be perfectly honest wouldn't be doing it if it wasn't a directive from parent company. Probably would have given up by now!"* Interviewee 17.

The findings from this study differ from those of Eunsup and Stagliano (1997) reported in Section 3.8.1, that found companies with a turnover of less than US $500 million (AUD $1 billion) are more likely to use ABC. In this study, it is found that ABC is used widely by public companies and companies that have an annual turnover in excess of AUD $1 billion. It is likely that larger companies are more inclined to

use ABC due to greater availability of human resources and financial capacity for such systems. ABC systems are costly and time consuming to develop and implement. This is confirmed in the next section.

8.2.3.2 Non-use of ABC

The reasons why eleven companies (41%) have not used ABC are presented in Table 8.4.

Table 8.4 Reasons why companies do not used ABC by industry sector

	Industry sector							
	Packaging[1]		**Food**[1]		**'Other'**		**Total**	
Number of non users of ABC	3		2		6		11	
Percentage of total sector population	*38%*		22%		*60%*		*41%*	
Reasons for not using ABC								
Not applicable			2	*100%*	3	*50%*	5	*45%*
Time consuming/resource intensive	1	*33%*	1[2]	*50%*	1	*17%*	3	*27%*
Not sure of relevance/difficult to see benefits	1	33%			1[3]	*17%*	2	*18%*
Not aware of it	1	*33%*					1	*9%*
No particular reason					1	*17%*	1	*9%*

Notes:

- Percentages based upon number of non-ABC users per industry sector.

(1) One interviewee is unsure if the company has ABC.

(2) Company experimented with ABC and after six months abandoned it.

(3) Is to be implemented at the direction of parent company in coming years.

Two clear reasons why companies do not use ABC are:

(a) the relevance is questioned (which could result from a limited understanding of the method), or it is not applicable for the activities undertaken by the company in question (e.g., a distributor of goods only):

"Have looked at it but nothing done. Not sure of its relevance to the company" Interviewee 6 and

(b) it is too time consuming and resource intensive:

> *"The time that was needed to implement and maintain the system was too much. The whole thing looked good but with limited human resources was not taken up"* Interviewee 1.

In the following section data is presented which illustrates the number of companies that use one or more of the accounting approaches that have been presented. The section also includes a summary of the reasons why companies do not use one or more approaches.

8.2.4 Adoption of accounting approaches

Table 8.5 illustrates the number of companies sampled that use more than one accounting system.

Table 8.5 Number of companies that use one or more accounting approaches by industry sector

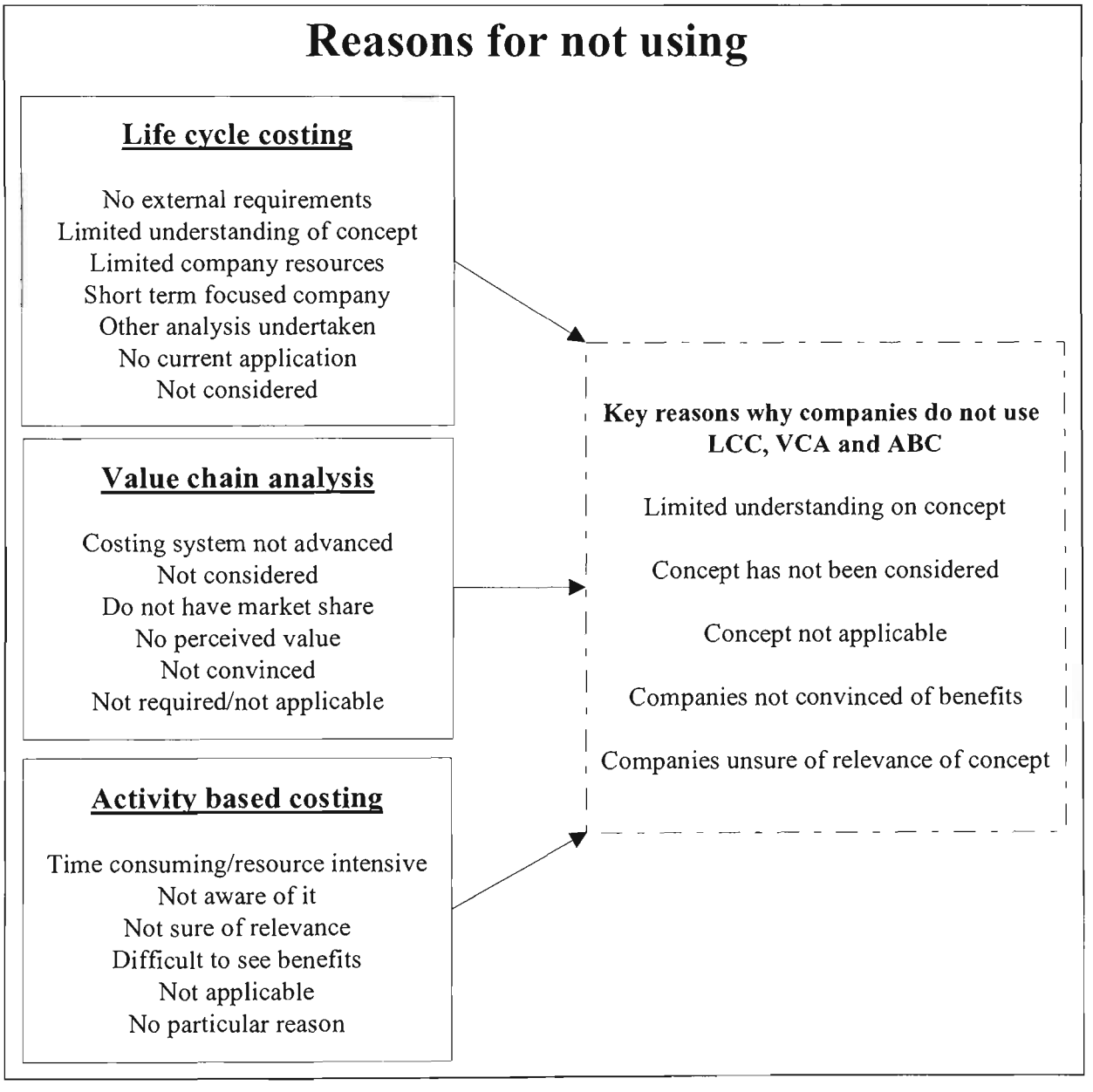
Accounting approaches	Industry sectors							
	Packaging		Food		'Other'		Total	
LCC, VCA and ABC			1	*11%*	1	*10%*	2	*7%*
Only LCC and VCA								
Only LCC and ABC			1	*11%*			1	*4%*
Only ABC and VCA	3	*37%*	1	*11%*	1	*8%*	5	*19%*
Only LCC	2	*25%*			1	*8%*	3	*11%*
Only VCA			1	*11%*	3	*25%*	4	*15%*
Only ABC	1	*12%*	3	*33%*	2	*20%*	6	*22%*

There are only two companies that use all three accounting approaches. These two are both public companies with annual turnovers greater than AUD $500 million. No company uses LCC in combination with VCA, whereas one-food company uses LCC and ABC. In total there are five companies (three of these being packaging companies) that use ABC and VCA. Overall, eight companies (30%) use more than one accounting approach.

There are more companies that only use ABC, compared with the number of companies that use only LCC or VCA (Table 8.5). Overall, thirteen companies (48%) use only one of the three accounting approaches. Six companies (22%) do not use any of the three accounting approaches.

Recurring themes of reasons why companies do not use a particular costing system are presented in Figure 8.8.

Figure 8.8 Reasons why companies have not used LCC, VCA and/or ABC



The key reasons why companies do not use LCC, VCA and/or ABC are:

a) limited company resources;

b) concepts have not been considered or are not considered applicable; and

c) managers are not convinced of the benefits or sure of the relevance of the particular concepts.

8.3 Costing philosophies

Companies in the sample population do not have separate costing philosophies for environmental costs. Environmental costs are treated like other business costs and the common general costing philosophies adopted by the companies are conventional product or service costs (63%), full costs (41%) and/or value-added costs (33%) (Table 8.6).

Table 8.6 Costing philosophies by industry sector

Costing philosophy categories	Industry sector							
	Packaging		Food		'Other'		Total	
Conventional product/service cost	5	*63%*	6	*66%*	6	*60%*	17	*63%*
Full costs	4	*50%*	2	*22%*	5	*50%*	11	*41%*
Value added costs	2	*25%*	5	*55%*	2	*20%*	9	*33%*
Strategic costs	1	*13%*	2	*22%*	2	*20%*	5	*19%*
Target costs	2	*25%*	2	*22%*			4	*15%*
Cradle to grave costs			1	*11%*			1	*4%*
Cradle to cradle costs								

Note:
(1) Costing philosophy categories from Parker (1998).
(2) Some interviewees provided more than one category.

The consideration of environmental costs as just another cost of business and not separately identifying them is consistent with findings by Parker (1998). He also discovered that the majority of the companies he interviewed used a full costing philosophy, though it must be remembered that his sample included company's predominately from the mining sector. The dominance of the use of a conventional costing philosophy and degree of detail in the identification and allocation of environmental costs are demonstrated below.

8.4 The collection of environmental costs

In the majority of cases (18 out of 27 companies) environmental costs are treated like any other cost of doing business and are not separately identified:

> *"It is a cost of doing business for whatever reason. If environmental reasons or a legal obligation or emotional one. Those costs are treated no differently from manufacturing costs, marketing or sales costs. All costs of doing business"* Interviewee 17, and
>
> *"Environmental costs treated the same as any other cost"* Interviewee 25.

In some circumstances, companies are not proactive in isolating specific environmental costs though they are aware that they will need to be in the future:

> *"We believe we will have to segregate them in due course but not at the moment"* Interviewee 16 (with respect to a conventional costing philosophy).

Specific examples of environment-related items that are currently separately identified are presented in Table 8.7.

Table 8.7 Examples of environment-related items identified by interviewees

Running environmental policies as part of the quality system and industry education and awareness programs are just part of general business costs.	Environmentally related items are generally part of daily operations with monthly key performance indicators (KPIs) being reported in physical quantities per product and only some in costs, these are compared across operations.
We do monthly KPI reporting of environmental activities and benchmark across Australian operations (physical units).	Industry association levy is incorporated into the price of the product.
Environmental issues are used as a justification for capital expenditure and identified in project documentation.	Occupational health and safety (OHS) treated differently - there is no excuse if something needs to be done the rigours of accounting not applied.

Conventional operating costs include for example capital facilities, labour and material. Hidden costs include regulatory compliance, whereas contingent liability costs can comprise penalties and fines. Externalities can include the cost of pollution and resource depletion (Table 3.2).

The four most important categories in which companies in the sample population collect environmental costs are (in decreasing order): capital, hidden, conventional and contingent (Table 8.8).

Table 8.8 The number of companies that collect (identify) environmental costs per category by industry sector

Environmental cost categories	Industry sector							
	Packaging		Food		'Other'		Total	
Capital costs	3	*37%*	7	*78%*	5	*50%*	15	*55%*
Conventional costs	1	*12%*	4	*44%*	5	*50%*	10	*37%*
Hidden costs	3	*37%*	3	*33%*	5	*50%*	11	*41%*
Contingent costs	3	*37%*	1	*11%*	4	*40%*	8	*30%*
Externalities					1	*10%*	1	*4%*
Other								

As Table 8.8 illustrates, the identification of environmental costs under particular categories across the three industry sectors is low with the highest category being capital (i.e., only 55% of companies identifying capital environmental costs). In addition to indicating which environmental cost categories are identified, twelve interviewees gave an outline of how environmental costs are identified in the business. An overview of these responses indicates that some companies select specific costs to be isolated, while the remaining companies treat these environmental costs as just "business" costs and do not specifically isolate them. There are three ways environmental costs are treated. Some companies do not isolate them, others are attempting to isolate them, while a third group of companies have isolated them.

Examples of these three environmental cost classifications are listed in Table 8.9.

Table 8.9 Examples of how environmental costs are identified

Not isolating
1. *"Deliberately do not isolate environmental cost. A philosophical issue that isolating them puts them higher in the profile for managers as a cost to the business. Whereas we include it as normal day-to-day operations. Two choices: totally bury costs and not able to identify them or isolating them and being able to hold up the hand and say we spent money on environmental matters. A decision has been made to totally bury them within standard management system. And by coding we could go in and look at/monitor them. Relative to the overall costs of running the business, environmental expenditure is quite low, and it is unavoidable and therefore no need to isolate"* Interviewee 9.
Attempting to isolate
2. *"Capital costs and all of that stuff. Well that is just general operating stuff and if we have to put in an afterburner it is not seen as a environmental cost, it is seen as a general running cost. So we would not have separated any of that out. We would not be able to easily identify environmental costs - corporate is encouraging them to identify what the environmental costs are so they become part of EMS.....It requires them to look at information from an environmental risk point of view and cost to business risk point of view as well as the legal overlay"* Interviewee 7. 3. *"We would attempt to split out things like operating costs, labour and materials in general though I guess we see health safety and environment an integrated part of the business and not something you separate out very specifically to show what the costs are. All that does is provide more response like gosh! There is no way right now that the management team would look at environmental as a one off - if you don't meet environment then not doing your job and you have no business"* Interviewee 22.
Isolating
4. *"We would certainly identify capital expenditure related to environmental issues. We have an account for environmental expenses so any costs incurred that are generally related to environmental issues (at least 50% related) charge them and separately identify in operating costs as environmental costs"* Interviewee 17.

The examples in Table 8.9 illustrate the variety of choices that companies make regarding acknowledging environmental costs. Some companies appear to have chosen the approach to consider any cost as a business cost with no 'label' on it. Other companies identify a cost as environmental if it fits a particular category/definition and these cost categories are used to assist/provide input information for decision making.

8.5 Environmental cost allocation decisions

This section presents the findings of an analysis of how costs, and in particular environmental costs, are allocated within the participating companies. The analysis has used an ABC framework. Although it is recognised that not all companies use ABC, by using the ABC categories of unit, batch, product, process or facility level, companies not using ABC have the option of categorising their overheads at facility level. The framework used has the benefit of identifying the extent to which environmental costs are being associated with the products and processes that are contributing to those costs, and therefore environmental impact.

The 'allocation' is how a particular cost is treated within the business. If it is allocated on a 'facility' level this would indicate that there is an allocation of that cost across the entire facility and each product would receive a proportion of the cost. This could result in "clean" products being allocated environmental costs from "dirty" products (Schaltegger and Muller 1998). If it is allocated on a process level then the occurring cost is allocated to the specific process in which that cost was incurred. The latter allocations will ultimately identify which products and processes have the greatest or least environmental impact. This will enable management to make more informed decisions whether products need to be priced at a higher level, removed or re-designed in order to reduce the environmental impact of the business (Bennett and James 1998a; Ditz *et al.* 1998; US EPA 1998b; Schaltegger and Burritt 2000; Gray 2001).

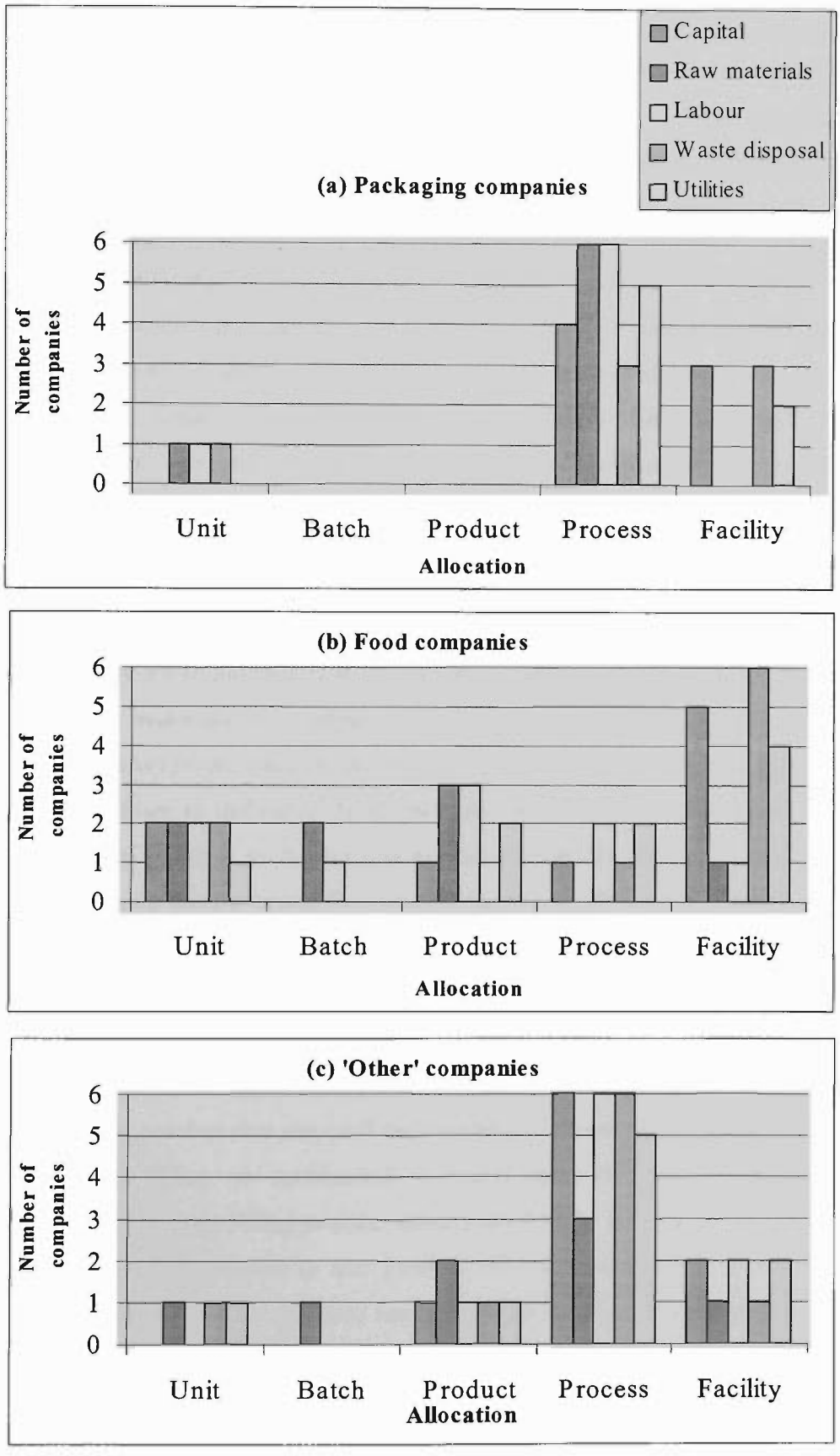
In order to better understand how environmental costs are identified and allocated throughout the sampled companies, three different categories of costs are presented as separate sub-sections with a select number of cost items within each category are

presented. The categories, sourced from White *et al* (1996), are conventional costs (Section 8.5.1), indirect/hidden costs (Section 8.5.2) and less tangible costs (Section 8.5.3). A full list of all the cost items and how companies in each industry sector allocated them are presented in Appendix H.

8.5.1 Conventional costs

The number of companies, and how they allocate conventional costs of capital, raw materials, labour, waste disposal and utilities, by industry sector, is presented in Figure 8.9. Generally, packaging companies are more inclined to allocate these costs on a process level, along with 'other' companies, whereas, there is no one type of allocation used in the food companies (i.e., it is more diverse). These figures provide an indication as to the level of detail of costing systems within the companies and can also reflect the types of processes that are actually being undertaken. For example, there are at least three companies that operate a batch process (Graphs (b) and (c) in Figure 8.9) - two in the food industry sector and one in the 'other' sector. Raw materials are treated in a similar way as capital costs in packaging companies. In the food and 'other' sectors, however, there is more diversity. Seven of the food companies (77%) allocate raw materials either on a unit, batch or product level. Waste disposal, on the other hand, is treated by food companies as a facility cost, and in companies in the 'other' sector as a process cost. Within the packaging companies, waste disposal is allocated either on a process or facility level.

Figure 8.9 Direct conventional cost allocations by industry sector



As the quotes from interviewees presented in Table 8.10 indicate, the level of detail in regard to allocating environmental costs still remains 'traditional/conventional'.

Table 8.10 Examples of responses reporting allocation procedures within companies

"At the moment [environmental costs are] *allocated across the board but there are attempts at different times to try and get it to a specific costing. ...What the company is aiming to do is try and get specific costs so you can see where your profitability is in a much better way between one process and another process"* Interviewee 2.
"If your suggestion is, if to produce a ton of product A took twice as much energy than to produce a ton of product B do we allocate that accordingly? I think at the moment no. I know at the moment we don't. We just measure the amount of electricity going into factory and divide it against the amount of tonnes produced in that factory and per tonne of product. All products will get a share of that cost. Not the most ideal way. The ideal way obviously would be to determine what each product's consumption of energy is and have it allocated accordingly. Don't believe we have reached that sort of sophistication yet. In history, that is the way it has been handled" Interview 16.
We don't formally try to allocate costs to specific products when it comes to the costing other than raw materials and labour. The direct manufacturing overheads (e.g., electricity and water) pretty much in line with amount of product produced. Tend to do on per litre basis...down to individual pack sizes and determine how much each attracts. Now in process of trying to go further and get more sophisticated so we can say 600 ml bottle is produced on this particular line, what is electricity for that line? More specific to individual line than product. About ten years ago all the products were quite similar in their make up. All carbonated beverages, which were filled cold and warmed up before packaging. ...In last ten years product range has changed so much that we have still bottled water that you don't chill - only fill it, no chilling, no warming up. So energy costs totally different to product that you chill then warm up. Other products are hot filled so pasteurised before filling, not carbonated, so energy going into that. Even carbonated product recent technology-filling process doesn't need to be so cold (from 4°C to 14°C now). Trying to identify down to that product level of what are the costs. Not for environmental reasons but for business reasons for us to identify what products do we make money on - to properly identify the costs - getting better information about energy use etc. as part of it" Interviewee 17.

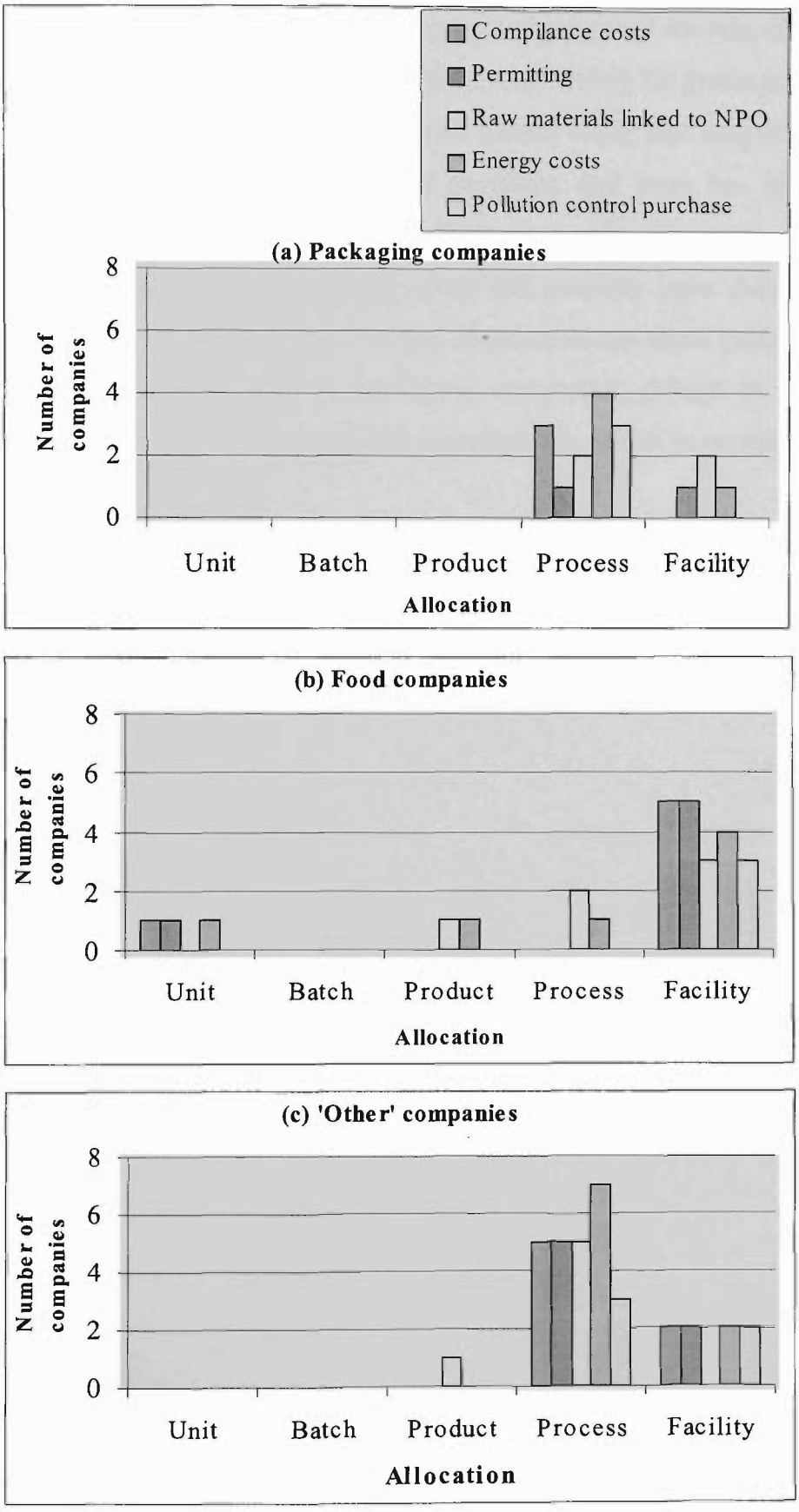
As the above three quotes demonstrate, companies are generally using a traditional approach to the allocation of environmental costs, though there appears to be some recognition that this will need to change. Even when costs are more accurately allocated to products this is usually not for environmental reasons but for economic reasons (i.e., increased profitability). However, if companies are reducing costs for economic reasons this still has a positive effect as they reduce environmental costs resulting eventually in reduction of environmental impact. It appears that despite the increase in external environmental pressures, such as the NPC, GHCP and NPI, companies still do not focus upon environmental costs on a day-to-day basis. With the existence of the NPC, GHCP and NPI companies are working on addressing the issues of the associated programs though there appears to be a disconnect between their actions and the cost of these activities and products.

8.5.2 Indirect and hidden costs

Figure 8.10 presents the number of companies and the manner in which they allocate indirect or hidden costs (White *et al.* 1996). Compliance costs, permitting, raw materials linked to non-product output, energy costs and pollution control purchase are the examples of indirect and hidden costs presented below.

The trend is similar as with the conventional costs, with packaging and 'other' companies generally allocating indirect costs on a process level. Food companies show more of a clustering of allocation of these costs on a facility level than with conventional costs, with less variety. The lack of identification of, for example, compliance costs is a concern when attempting to manage environmental costs. If these costs are charged to a general overhead account there is no awareness of their existence and size in relation to a certain product or process. The lack of allocation of indirect costs to lower levels of the organisation further compounds this problem. Managers who are unaware of costs do not have incentives to manage and control them. Managers therefore are not likely to understand the implications of their actions on the overall environmental impact, resulting in sub-standard environmental performance of the organisation.

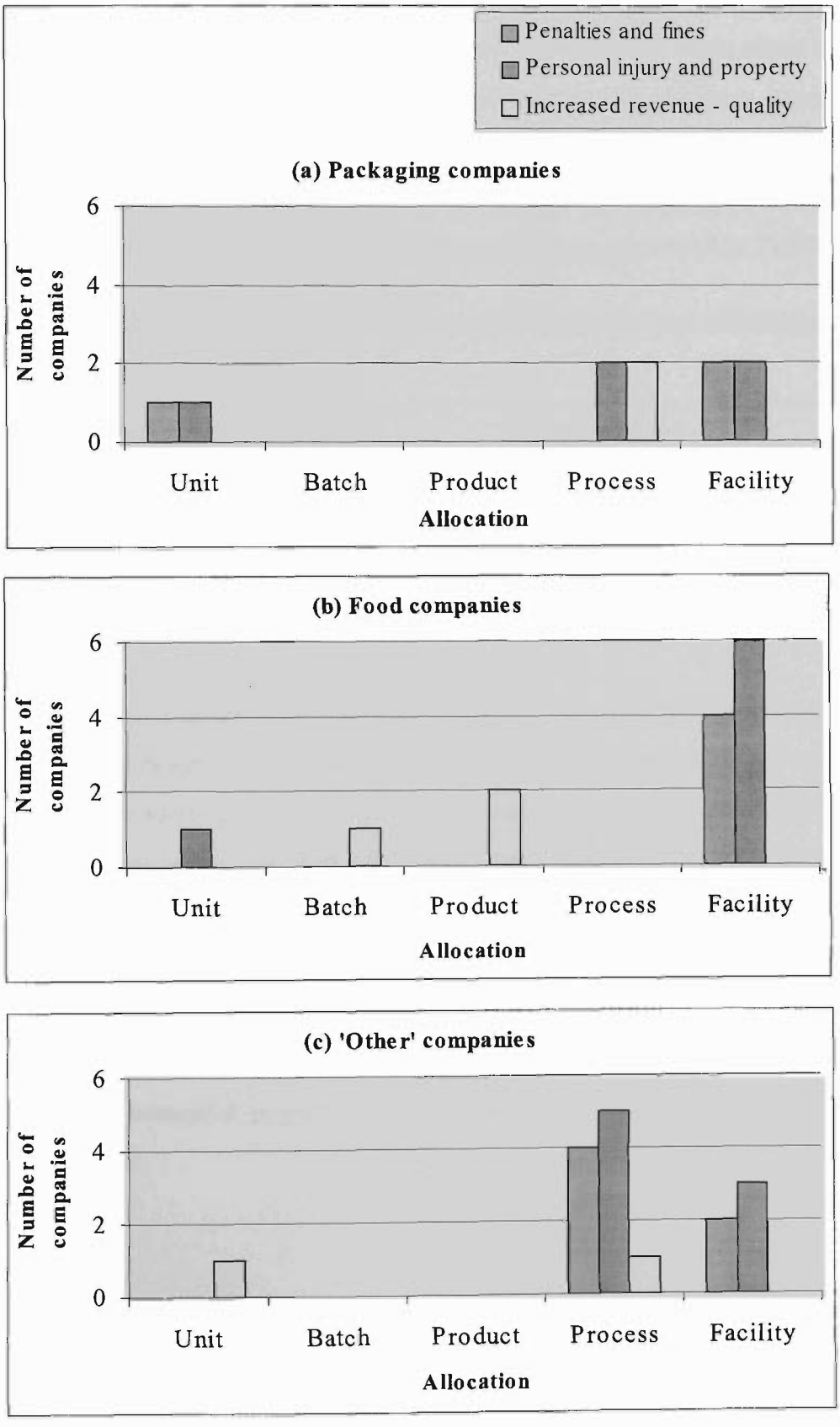
Figure 8.10 Indirect and hidden cost allocations by industry sector



8.5.3 Less tangible costs

Penalties and fines, personal injury and property, and increased revenue (quality) are the three selected less tangible cost items (White *et al.* 1996) for presentation in this section (Figure 8.11). Along with indirect and hidden costs, less tangible costs are harder to allocate to specific products and processes and even less likely to be identified and allocated than indirect costs. More food and 'other' sector companies allocate penalties and fines and personal injury and property costs than packaging companies. This could be an indication that these costs are more prevalent in the food and 'other' companies than in packaging companies, though to justify this assumption would need further testing and investigation, which is outside the scope of this thesis.

Figure 8.11 Less tangible cost allocations by industry sector



8.6 Upstream and downstream costs

Upstream and downstream costs may have significant environmental impacts and should be considered in product design. Upstream costs are product costs that occur prior to the operations of a specific company and downstream costs occur after the operations of a company (e.g., for a packaging company that produces glass bottles, upstream costs could include the sourcing of raw materials and downstream costs could include kerbside recycling costs). The number of companies that consider upstream and downstream costs in each industry sector are presented in Table 8.11.

Table 8.11 The number of companies that consider upstream and downstream costs by industry sector

Considering upstream and downstream costs	Industry sector							
	Packaging		Food		Other		Total	
Yes	5	*63%*	3	*33%*	4	*40%*	12	*44%*
No	1	*13%*	5	*55%*	4	*40%*	10	*37%*
Not applicable	2	*25%*	1	*11%*	2	*20%*	5	*19%*

Table 8.12 displays examples of responses regarding upstream and downstream costs considered by the sample population. This table illustrates the majority of costs being considered are downstream and related to customers' costs and improving business efficiencies. There is however some evidence of the impact of the NPC by means of recognition that these costs exist. This is having an impact upon customer-supplier relationships. It also highlights that companies are considering how their activities and products are impacting upon the next user (i.e., their customer) and even though the focus may be upon increased efficiency and reduction of costs, it could ultimately reduce the environmental impact of the activities performed, processes used and products produced.

Table 8.12 Upstream and downstream cost examples

Upstream costs
"Upstream dealing with raw material purchase cost" Interviewee 24.
Downstream costs
"*Supply chain management - try and work with customers and suppliers ... to reduce costs in doing business. Work with customers in their process, how they order, use products etc. Not seen as environmental costs more business costs*" Interviewee 4.
"*Working with customers to increase packaging cost efficiency, as they will be the ultimate disposers of the packaging under the Covenant*" Interviewee 8.
"Do consider downstream that affects customers. We certainly consider our customers' costs of doing business because that may represent an opportunity for competitive advantage out of being able to say we can do this differently thereby you can save money.....Changing operations to be more efficient with customers in mind.....Environmental costs to consider? Less likely - it really depends on how legislation changes and how quickly or what sort of profile environmental issues take in political landscape....Any pressure to look at up/down stream costs from an environmental point of view will come about because of political pressure.....External pressure needs to make environmental costs a real focus for companies" Interviewee 17.
"We recognize to seek and manage the downstream impacts of what we do. But putting a dollar costs (you can't put a dollar cost against litter) you can't put a dollar cost against our products going to landfill instead of being recycled. ... Do we consider it – no, we do not consider the costs, we do consider the impacts....We want to seek and understand and provide information that assists in appropriate decisions" Interviewee 9.
"Certainly consider costs downstream like costs resulting from product design. Might share costs with suppliers to develop a new packaging, kerbside recycling for instance through industry association and National Packaging Covenant, we will be putting in resources to improve the efficiency" Interviewee 10.

As responded by some interviewees, 37% of companies do not consider upstream or downstream costs because they are considered outside the company's boundaries of operation and are therefore seen as someone else's costs:

> *"We have clearly defined the boundaries of costs control - and therefore these are outside boundaries (and they become someone else's costs)"* Interviewee 16, and
>
> *Largely beyond our control.....you can't be held responsible for that which you do not have control over"* Interviewee 25.

8.7 Summary

Conventional costing is most widely used. Activity based costing is used more widely than value chain analysis and life cycle costing, with public companies more inclined to use ABC than private companies. The identification of non-value and value adding activities and hidden costs and better allocation of costs to responsible products and processes are benefits realised by using VCA and ABC. The key reasons why companies do not use LCC, VCA and/or ABC are limited company resources, non-consideration of the approaches or not considered applicable, and people being not convinced of the benefits or sure of their relevance. If environmental costs are selectively identified, it is for specific purposes. Indirect and less tangible costs are less widely identified and not specifically allocated to products and processes than are conventional costs. Even with increasing external pressures, such as the NPC, GHCP and NPI, there still exists a missing link between the actions of companies and the supporting costing information to aid in appropriate decision making. The majority of downstream costs being considered are related to customers' costs and improving business efficiencies.

9 SUMMARY, PROPOSITIONS, OPPORTUNITIES FOR FURTHER RESEARCH AND SIGNIFICANCE OF THE RESEARCH

9.1 Introduction

The purpose of this chapter is to present the conclusions in light of the research questions (Section 3.10). The chapter begins with an overview of environmental challenges in the packaging supply chain industry with examples of challenges for the Australian food and packaging supply chain and then the findings for each research question are presented. The theoretical implications of the research (i.e., the propositions) are then presented. Opportunities for further research are discussed along with the constraints of the methodology. The chapter concludes with the presentation of the significance of the research

9.2 Review of environmental challenges in the packaging industry

The packaging industry is composed of inter-related, multi-disciplinary processes where raw materials from nature are converted and processed into materials that can be shaped and formed into a variety of shapes and sizes for the protection, containment and distribution of goods. Value is added to the product at each stage along the supply chain and environmental impacts occur at different degrees throughout. As the amount of packaging materials and applications have increased over the years, pressure has emerged from governmental and societal stakeholders for companies in the packaging supply chain to increase the environmental accountability for their product(s).

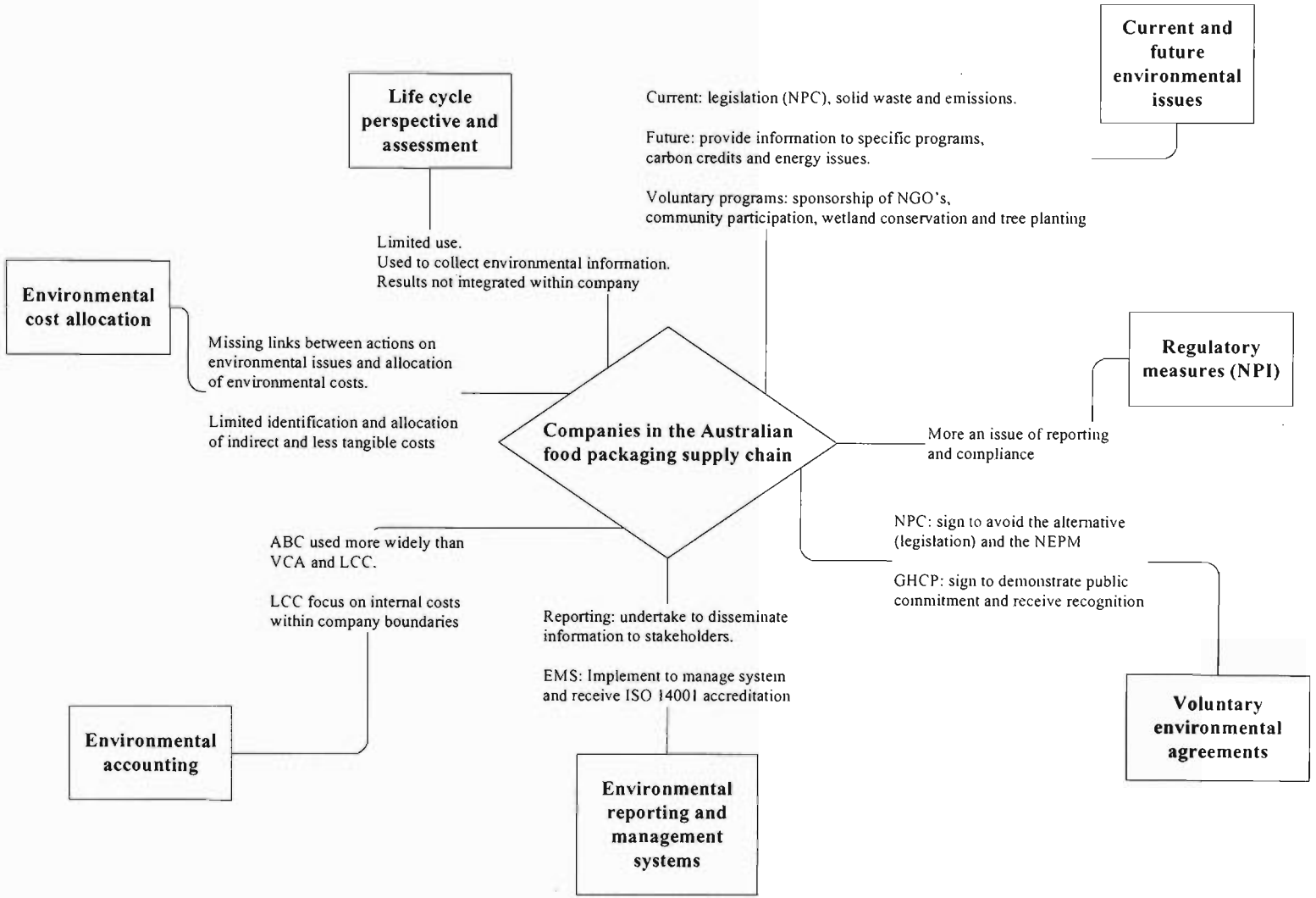
Presently companies in the packaging supply chain need to acknowledge, understand, address and manage a range of issues related to the design, manufacture, use and disposal of their packaging systems. These issues include the use of renewable and non-renewable resources, generation of greenhouse gases, management and reduction of emissions and waste generated from processes, material recyclability, and post-consumer waste management options

for the materials of their packaging systems. Key influences expected to dominate the use of packaging in Australia in the coming decade are demographic and life-style changes, technology changes, consumer demands, supply chain management and the environment. The latter in particular is important, via the National Packaging Covenant (Williams 2001; PCA 2002a).

There is also pressure for companies to communicate their environmental impacts to external stakeholders through environmental reporting. Guidelines for environmental reporting have been developed on a national (Environment Australia 2000) and international (GRI 2002) level to assist companies. Literature indicates that companies generally disclose information that is favourable to their image (Deegan and Rankin 1996; Deegan and Rankin 1997; Deegan *et al.* 2000; O'Donovan 2000; Wilmshurst and Frost 2000; O'Donovan 2002). The level of disclosures in environmental reporting has also been the focus of research (Guthrie and Parker 1990; Deegan and Gordon 1996; Hackston and Milne 1996; Wilmshurst and Frost 2000; Tilt 2001). Other research literature (Porter and van der Linde 1995; Epstein and Roy 1997; Quarles and Stratton 1998; Schaltegger and Muller 1998; Stuart *et al.* 1999; Schaltegger and Burritt 2000; Wilmshurst and Frost 2001) suggests that companies need to employ approaches that allow a more accurate allocation of environmental costs to responsible products and processes. It has been argued that by using these techniques, managers can have a better understanding of the environmental impacts of processes and products.

As has been presented and discussed in this thesis, there are many important issues that need to be considered by companies in the Australian food packaging supply chain. This research has added to the literature by examining a broad set of issues within a specific supply chain. Six specific research questions were developed from the literature (Section 3.10) and the answers to these questions are presented in Section 9.3 to 9.8. These key findings are also graphically presented in Figure 9.1.

Figure 9.1 Overview of findings for research questions



9.3 Summary of findings: Current and future environmental issues

The first research question relates to understanding **what the current and future environmental issues of companies in the Australian food packaging supply chain are**.

As outlined in Sections 2.6, 2.7 and 9.2 there is an array of issues that need to be taken into consideration by companies with respect to existing and new packaging systems. Eight broad (environmental) issue categories (Section 5.4) were detected. They are, in decreasing order of significance, legislation (in particular the NPC), solid waste generation, emissions to air/land/water, miscellaneous, energy consumption, water use, land use, and use of resources. There are differences in the identification of environmental issues between industry sectors, though these are not statistically significant. Packaging companies identify legislation, and in particular the National Packaging Covenant (NPC), as the most significant current environmental issue that they have to address followed by energy related issues. Water management and legislation (again the NPC) are significant current environmental issues for the food companies, which is consistent with findings presented in the industry environment report of the AFGC (2001). For companies in the 'other' sector, the management and reduction of emissions and management of solid waste are significant current environmental issues. The comparison of environmental issues between industry sectors provides some preliminary insight into the types of environmental issues considered and where they are dealt with along the packaging supply chain.

Future environmental issues identified in this research are carbon credits and taxes; greenhouse and energy issues; consumption of resources, materials and energy; and specific information through various programs and categories. Most of these are continuations of current issues with some companies also identifying that there will be future requirements for them to report usage quantities of materials under the NPC.

The second part of the first research question relates to understanding **the types of voluntary initiatives that companies in the Australian food packaging supply are involved in.** A high level of participation in, and voluntary contribution to,

environmental programs (such as tree planting and wetlands conservation) and non-government organisations is observed. Packaging companies are more likely to sponsor non-government organisations (NGOs) (e.g., Landcare) and participate in recycling programs. The food companies voluntarily participate in financially sponsoring tree planting and NGOs. Community programs such as open plant (facility) days and local community/company meetings, tree planting and wetland conservation are the main types of voluntary environmental initiatives undertaken by companies in the 'other' sector. Even though there are some differences in the actual programs that companies participate in, there is no statistically significant difference observed between industry sectors. Why companies choose a particular direction or approach is not the focus of this research, though these results provide an initial glimpse and potential starting point for future research into the drivers and motivations for companies to support voluntary programs.

The third part of the first research question relates to determining **if companies have some type of environmental statement.** It was found that more companies have an environmental policy statement rather than an environmental mission or values statement.

9.4 Summary of findings: Environmental reporting and management systems

The objective of research question 2 is to investigate **why companies in the Australian food packaging supply chain produce environmental reports and implement environmental management systems.** Research to date has investigated the content of disclosures made by companies in annual reports and stand-alone environmental reports (Guthrie and Parker 1990; Deegan and Gordon 1996; Hackston and Milne 1996; Wilmshurst and Frost 2000; Tilt 2001). Other research has tested legitimacy theory to explain why companies disclose information and the types of disclosures made (Deegan and Rankin 1996; Deegan and Rankin 1997; Deegan *et al.* 2000; O'Donovan 2000; Wilmshurst and Frost 2000; O'Donovan 2002).

This research found that the drivers for companies to include an environmental section in the annual report (Section 5.5.1) are to disseminate information about the operations and activities of the organisation to stakeholders and also to

increase the stakeholders' awareness of environmental issues. The percentage of companies that include an environmental section in the annual report is low (37%); with most companies including this section in the annual report from 1996. The percentage of companies producing a stand-alone environmental report (Section 5.5.2) is even lower (33%) with most of these companies first producing the report in 1999. The increase in the development of national and international reporting guidelines and the desire to disseminate information to stakeholders are the key drivers for the production of a stand-alone environmental report. Public companies are more likely to produce a stand-alone environmental report compared with private companies. Only six companies (22%) produced both a stand-alone environmental report and an environmental section in the annual report. It can be suggested that these companies render some recognition and/or desire to report on their environmental impacts. The actual types of disclosure and the reason why specific disclosures are made is not the purpose of this research but has been the focus of other research (Deegan *et al.* 2000; Wilmshurst and Frost 2000; O'Donovan 2002).

Half of the companies (52%) have an environmental management system (EMS) (Section 5.6) in place, with eight of the fourteen EMS's (57%) implemented in 1997. Drivers for implementation of an EMS include the management of the business systems and some have implemented their EMS in alignment with ISO 14001 to be prepared for future accreditation if necessary. Public companies are more likely to have an EMS compared with private companies. Public companies are also more likely to have some form of environmental statement (Section 5.3), which correlates with the requirement of producing an environmental policy when implementing an EMS (Section 5.6). Half of the companies that undertook the inclusion of an environmental section in the annual report did so before producing a stand-alone environmental report and/or implementing an environmental management system. This supports in some way Elkington's (1997b) suggestion that companies start reporting on environmental issues before they have in place the internal systems to assist them in the supply of information. Only four companies undertook environmental reporting at the same time as implementing their EMS. These findings indicate that there is room for improvement among companies in the food packaging supply chain to implement formal systems to

manage their activities on an environmental basis and to report on their impacts to the environment.

9.5 Summary of findings: National Packaging Covenant, Greenhouse Challenge Program and National Pollutant Inventory

Research question 3 relates to voluntary environmental agreements. The first objective of research question 3 relates to investigating **the drivers for companies in the Australian food packaging supply chain to sign onto the voluntary National Packaging Covenant and the voluntary Greenhouse Challenge Program.** Throughout the world, the growth in the number of voluntary environmental agreements has dramatically increased in recent years (Section 2.7.2) to replace or to supplement regulations. The National Packaging Covenant (Section 2.7.2.1) is a voluntary agreement between all levels of the Australian government and the packaging supply chain industry. It is based upon the principles of product stewardship and shared responsibility and relates to post-consumer packaging waste management.

Under half of the companies (41%) in this study were signatories to the NPC at the time of the interviews. Although the packaging companies represent a higher number of NPC signatories, there is no statistically significant association between industry sector and being an NPC signatory. Of the companies that have become signatories to the NPC, 73% have done so to avoid alternative regulation and 35% indicated that avoiding the NEPM was also a driver to signing. The threat of the alternative legislation and the inclusion of a regulatory safety net appear to be successful incentives to motivate companies to voluntarily sign. This is consistent with findings by Harrison (1999). As of 20th of September 2002, nineteen of the companies that participated in the interviews were NPC signatories.

The Greenhouse Challenge Program (GHCP) (Section 2.7.2.2) is another voluntary agreement in Australia between the federal government and Australian industry with respect to greenhouse gas emissions. Those organisations that participate in the GHCP sign agreements with the government to reduce their emissions through implementation and monitoring of actions to abate emissions

(Parker 1999; AGO 2000). Around 30% of the companies in the study are signatories to the GHCP with a statistical association of 'other' sector companies more likely to be a signatory. This is due to the fact that the GHCP is targeted to companies that generate larger quantities of greenhouse gas emissions, either directly through emissions or indirectly through, for example, consumption of energy. Just over half (55%) of the companies signed to obtain "public recognition" for reducing their emissions. Companies are not primarily signing the NPC or GHCP to reduce their environmental impact, this is a consequence. The main drivers are the threat of exposure to regulations as an alternative and improving their corporate image.

The second part of research question 3 relates to understanding the **effect of these two voluntary environmental agreement programs within the participating companies**. It appears that the effect of the NPC within signatory companies varies dependent upon where in the supply chain a company operates. Packaging companies view the NPC as having a fairly significant to a major effect upon their operations, whereas the food companies earlier in the supply chain, view the effect as of low significance. It must be remembered that only three food companies in the sample are NPC signatories and two of these are beverage companies. The latter believe their companies have been working on reducing their environmental impacts over the past couple of decades, which they will continue under the NPC. This is in contrast with the majority of companies in the packaging supply chain that are only now feeling the external pressures to reduce their environmental impact. The transition to the NPC, as viewed by the beverage companies is expected to have a minimal impact. The 'other' sector companies view the NPC will have a significant effect within their operations, similar to the packaging companies. In the case of the GHCP the focus is specifically upon reducing greenhouse gas emissions.

Companies view the effect of the GHCP as assisting them in decision making regarding energy related activities and impacts, whereas for the NPC it is expected to influence decision making regarding packaging in general, partnerships, business management and competition. Note that the interviews were conducted only six months after the implementation of the NPC, so companies were only in the initial stages of NPC implementation in their own companies. Evidence over the past three years of the NPC indicate that there are changes occurring within

companies (Shmigel 2001; Williams 2001; PCA 2002a) though it is difficult at present to obtain a clear understanding of the degree of changes, its quality and if the objectives of the NPC are being achieved. As the focus of each of these two voluntary agreements is different this may explain the differences in the effects. The NPC also has a "supply chain" focus and this may be another reason for the differences.

The third part of research question 3 relates to distinguishing any differences between **the relative effect of the voluntary NPC and GHCP when compared to the regulatory National Pollutant Inventory (NPI)**. In attempts to reduce the environmental impacts associated with packaging, regulations have been a means by which governments have enforced requirements upon industry to improve its environmental performance. The National Pollutant Inventory (NPI) (Section 2.7.1.1) is an internet database, accessible to the community, industry and government that has been designed to provide information on the types and amounts of certain substances that are being emitted to the Australian environment via air, land and water. Only companies that exceed the threshold levels of the chemicals on the NPI list are required to directly provide information.

There are observed differences in the effects of the voluntary NPC and GHCP programs in contrast with the regulatory NPI upon the organisations. The regulatory NPI program is seen to have minimal effect upon the organisation's operations, due to it being more of a compliance issue and, hence, part of normal management and reporting. This is in stark contrast to the voluntary programs, which are viewed to have effects upon organisation's operations such as decision-making and business management activities including costs. An explanation for this difference in effect may be related to the 'flexibility' of frameworks of voluntary agreements compared with the 'rigidity' of regulatory frameworks. Companies may also perceive that they have more control over and therefore see more benefits with voluntary programs. A more detailed investigation regarding how companies perceive voluntary agreements and regulations would provide more insight into this dynamic.

9.6 Summary of findings: Adoption of the life cycle assessment approach

Research question 4 deals with understanding **how life cycle assessment (LCA) is used within the Australian food packaging supply chain**. The second part of research question 4 relates to determining **the level of adoption of LCA**. Understanding **the drivers for and features of the LCA studies that have been undertaken** is the third part of research question 4.

Life cycle assessment (Section 3.9) is an environmental management tool that identifies the environmental impacts of products and processes across the life cycle. It is based upon material and energy flows and the interactions with the natural environment. Research has investigated how LCA is used within business (Baumann 2000; Frankl *et al.* 2000; Heiskanen 2000). These studies found that LCA has been used to improve the environmental reputation of an industry, to prove the environmental benefits of an industry, to identify bottlenecks and provide information to stakeholders. The purpose of many LCAs in the past has been to deflect environmental concerns and to legitimate the status quo, though it has been suggested that LCA should be used as a learning device (Baumann 2000; Frankl *et al.* 2000) to better understand environmental impacts.

The observed level of adoption of LCA among the Australian food packaging supply chain is low (only six companies - 22%). Within this small population the purpose of the LCA studies is to compare the environmental impact of products or to assess the environmental impacts of company activities/processes. Studies were conducted during the period 1996-2000 with the main driver for using the approach primarily the collection of environmental information (i.e., strengths and weaknesses). The knowledge gained includes understanding the impacts of transport stages, understanding the impact of product content loss compared with the impacts of the packaging and understanding differences between Australian and international processes. Only two companies have incorporated the results of their LCA into the business, though LCA is expected to be used in one form or another, by all six companies in the future. All of the studies have not been publicly released.

The fourth part of research question 4 relates to understanding **the reasons why companies do not use LCA**. The reasons why companies have not used LCA are limited human resources, time and costs considerations, or no current applications for the methodology. These findings are consistent with prior research

9.7 Summary of findings: Adoption of life cycle costing, value chain analysis and activity based costing approaches

The main objective of research question 5 is to improve the understanding of **the levels of adoption of LCC, VCA and ABC by companies within the Australian food packaging supply chain**. It is posited that these three approaches are most likely to be used to recognise environmental costs and assess environmental impacts. Many different methodologies and models have been developed to assist companies in the identification of environmental costs for input into decision-making. Reasons to consider environmental related management accounting and environmental costs to manage the business include better understanding of environmental costs and performance of products and processes, identifying environmental risks and opportunities, and strategically preparing for future changes in the business environment.

Definitions and terminology used to describe LCC vary, though an underlying principle is that it relates to the identification and calculations of costs that occur across the life cycle of the system under study (Section 3.6). Value chain analysis methodology allows for the identification of 'value-adding or non-value adding' activities throughout an organisation and the interactions with the supply chain (Section 3.7). Activity based costing methodology allows for the more accurate allocation of costs to responsible products and processes (Section 3.8).

Activity based costing is used more widely than VCA and LCC, with public companies more inclined to use ABC than private companies. Just over half of the companies (54%) that use VCA use it on a company wide basis, while the remainder apply it at a product level. These trends are similar, though reversed, with respect to how ABC is used, with over half of the companies that use ABC applying it on specific product(s) and/or production lines and the reminder apply it at a company wide level.

The second part of research question 5 relates to identifying the **benefits of using VCA and ABC.** The identified benefits of using VCA (Section 8.2.2.1) range from identification of non-value adding activities and hidden costs, and cost reductions through to understanding customer relationships and increasing the ability of the company to compete in the marketplace. Benefits of ABC (Section 8.2.3.1) include arriving at (improved) allocation of costs to responsible areas of the business, managing production lines, identifying non-value adding activities, and the ability to focus upon actual costs of the business. Some of these benefits are consistent with those identified by (Kaplan 1992; Innes and Mitchell 1993; Landry *et al.* 1997). Other benefits of ABC identified in the literature such as product pricing (Innes and Mitchell 1993; Eunsup and Stagliano 1997), supplier relationships (Kaplan 1992) and strategic cost information (Cooper and Kaplan 1998) are not identified. These other benefits are outside the scope of this research and are therefore not considered further.

The third part of research question 5 relates to understanding **which cost accounting system or systems companies do not use**. Reasons for companies not using one or more of the above three accounting approaches included limited understanding of the concept(s), current costing system not sophisticated enough for incorporation of another system (e.g., ABC), no external requirement to use such a concept, other programs being used, relevance and applicability questioned, through to too time consuming and resource intensive (Sections 8.2.1.2, 8.2.2.2 and 8.2.3.2). This indicates that more attention needs to be focused upon explaining these concepts to managers, conducting studies to illustrate the benefits that can be achieved and possible simplification of the approaches to increase the level of uptake.

The fourth section of research question five relates to determining **which accounting costing systems are the most appropriate for use in conjunction with LCA to identify environmental costs**. The three accounting approaches each bring a specific perspective and it is suggested that they can each contribute to providing particular environmental cost information. Frankl *et al* (2000) and Baumann (2000) suggest that LCA be used more as a learning device than to address a particular decision, and this should also apply to LCC, VCA and ABC. Each approach provides a different perspective, with ABC providing better allocation of internal environmental costs to responsible products and processes,

VCA enabling the identification of value and more particularly the non-value adding items with a supply chain focus and LCC incorporating the inclusion of external costs across the supply chain.

The definitions and terminology used to describe LCC vary throughout the literature (Table 3.5) with no consensus upon a standard definition. Until this consensus occurs there will continue to be misunderstandings, misinterpretations and inconsistencies. These inconsistencies are evident in the findings of this research (Table 8.1) with extreme varying interpretations of LCC among the six interviewees who indicated that their companies apply LCC. Agreement reached among researchers and practitioners as to the definition of LCC is necessary for the approach to gain wider adoption. LCC can incorporate internal and external environmental costs from cradle-to-grave for products including items such as environmental restrictions at end of product life. Presently it appears that companies are using a limited form of LCC for internal costs but external costs are not considered.

VCA can be used to identify non-value added costs of environmental impact. Reducing environmental costs would increase the value of the products. VCA also provides a systematic way of examining how the activities of a company perform and interact with activities of other companies in the supply chain. Companies are already working with downstream customers to improve business efficiency (Section 8.6) and there is some evidence of the impact of the NPC upon recognition that these costs exist. This is having an impact upon customer-supplier relationships. It also highlights that companies are considering how their activities and products are impacting upon the next user (i.e., their customer) and even though the focus may be upon increased efficiency and reduction of costs, it could ultimately reduce the environmental impact of the activities performed, processes used and products produced. There is a recognised trend that companies need to take a greater involvement in product stewardship and life cycle perspectives of products and activities and VCA could be one approach to assist.

ABC can be used to allocate environmental costs to products thus providing information on the economic impact of environmental issues and costs. Products with a higher environmental impact and cost can be identified and can either be

priced higher to the consumer, re-designed to have a lower impact or removed. Activity based costing allows improved cost allocation to responsible products and processes.

9.8 Summary of findings: Environmental cost identification and allocation decisions

Research question 6 relates to examining **(a) the environmental costs companies in the Australian food packaging supply chain identify and (b) how these costs are allocated throughout the organisation**. Environmental accounting has emerged in recent decades to address the identification and calculation of environmental issues and related costs within accounting processes. Environmental costs can be classified as capital, conventional, hidden, contingent liability and externalities (Weitz *et al.* 1994; Sharma and Weitz 1995; White *et al.* 1996; Kreuze and Newell 1997). Research indicates that traditional accounting practices, originally designed for manufacturing facilities in the early 1900s, are limited because many environmental costs are grouped together in overhead costs. This can result in environmental costs being misrepresented, difficult to identify and therefore collection and allocation of such data is restricted.

Changes in customer requirements for suppliers of packaging materials or packaged product systems to be NPC signatories and "preferred suppliers" have been observed. Therefore companies need to have in place the systems that will help them identify costs, and understand their make-up so that they can react to the changes and better position themselves in the marketplace, while reducing environmental impacts.

The majority of companies employ a conventional costing philosophy (Section 8.3). Most companies treat environmental costs like any other cost of doing business and do not separately identify them, which is consistent with findings from Parker (1998) (Sections 8.4 and 8.5). Some companies appear to have chosen the approach to consider any cost as a business cost without 'labelling' it, whereas others identify particular costs as environmental if it fits a particular category/definition. These costs are identified and used to assist in decision making, for example in capital equipment purchases.

Generally conventional costs (Section 8.5.1) and indirect/hidden costs (Section 8.5.2) are allocated on a process level (except in food companies where it is generally on a facility level), and less tangible costs (Section 8.5.3) are allocated on a facility level. This demonstrates that companies in the Australian food and packaging supply chain are still allocating environmental costs in overheads which indicates that "cleaner" products and processes are sharing the environmental impacts and costs burdens of "dirty" products and processes. Companies are generally using a traditional approach to the allocation of environmental costs, though there appears to be some recognition that this will need to change. Even when costs are more accurately allocated to products, this is not for environmental reasons but for internal management reasons (i.e., increased profitability). If companies are reducing costs for internal management reasons this should still be viewed as positive as they should eventually reduce their environmental impact by reducing environmental costs. It is disappointing though that with the increase in external pressures, such as the NPC, GHCP and NPI, companies are still not focused upon environmental costs on a day-to-day basis. With the existence of the NPC, GHCP and NPI companies are working on addressing the issues of the associated programs though there appears to be a missing link between their actions and the cost of these activities and products. The lack of allocation of indirect costs to lower levels of the organisation further compounds this problem. Managers who are unaware of costs do not have incentives to manage and control them. Managers therefore do not understand the implications of their actions on the overall environmental impact of the organisation. Less tangible costs are even less likely to be identified and allocated than indirect costs.

The majority of costs being considered are downstream and related to customers' costs and improving business efficiencies. If companies consider costs outside the company boundaries, these are downstream costs related to customers' costs and improving business efficiencies (Section 8.6). By adopting a value chain focus and considering downstream and upstream costs, companies can improve the supply chain environmental performance.

This concludes the summary of the findings in relation to the research questions. In the following section the theoretical implications of the research (the

propositions) are presented followed by a discussion of opportunities for further research.

9.9 Theoretical implications of the research

There are potentially several theories (e.g., legitimacy, stakeholder and political economy) that may explain certain aspects of this research. However, a grounded theory approach was used to allow the data to dictate the theoretical framework as the intention of this research was not to test or develop one particular theory. Using exploratory techniques diverse data spread across a wide number of issues was collected. The aim was not to confine the data within existing theoretical boundaries. The findings may be used however, to add to the knowledge base by collecting data to provide a platform to test existing theories and to enhance the development of new ones. In light of this a series of propositions deduced from a review of the literature and collection and analysis of qualitative case study data, are presented. It is likely that:

Proposition 1: Flexible voluntary environmental agreements motivate companies to reduce the environmental impacts of their activities and products, more than regulatory measures.

Proposition 2: Gaining public recognition for reducing environmental impacts will motivate companies to sign voluntary environmental agreements.

Proposition 3: The existence of voluntary environmental agreements and regulatory measures do not motivate companies to identify environmental costs.

Proposition 4: Companies taking a value chain perspective to environmental issues will realise improved supply chain environmental performance.

Proposition 5: Companies that adopt value chain thinking will improve their customer-supplier relationships and improve supply chain environmental performance.

Proposition 6: Companies do not use environmental accounting information to assist in linking the activities they undertake to reduce environmental impact with the identification and calculation of environmental costs.

Proposition 7: Companies disclose environmental information to stakeholders prior to implementing environmental management systems.

Proposition 8: Differing definitions of life cycle costs leads to companies using life cycle costing in a limited form and for internal costs only.

Proposition 9: Managers do not consider environmental costs to be material enough to identify and separately disclose.

9.10 Opportunities for further research

Research is currently underway throughout the world to investigate the experiences with the development and operation of voluntary environmental agreements, in particular the process aspects of such agreements, stakeholders involved, along with the presentation of tools and instruments to assist people in the development of new agreements or refinement of existing environmental agreements (Ten Brink 2002). Further research could build up the learnings gained across the world to develop new or refine existing agreements to ensure that environmental impacts and costs are reduced and managed appropriately in conjunction with other measures.

Investigation about the possible refinement of existing methods and approaches to assist companies in adopting a value chain perspective to environmental impacts is an area worthy of further investigation. This would need to be accompanied by an educational program whereby managers are introduced to life cycle thinking and supply chain management and shown how reducing resources in downstream activities will provide benefits up and down the life cycle. This research could extend upon the work by Elkington (1997a) whereby preparing companies for the *X-ray* environment and demonstrating to them that they need to take more responsibility for their products beyond their factory gate.

Moreover, further research could refine and extend upon methods that would encourage better customer-supplier relationships with the aim of reducing environmental impacts. This could involve the encouragement of companies to re-design products, re-design the logistics chain or identify new or existing technology or processes where waste products can be recycled or reused. This would lead to companies working more closely with their customers and suppliers to improve performance and efficiency throughout the supply chain and understand how changes made at one stage of the supply chain can impact upon another.

Why has environmental accounting not been fully adopted by companies? Further research could investigate the methods needed to make it easier for adoption or to question whether managers need to be better informed about the benefits of using such methods. This research could link the awareness of how the activities that are performed and products produced to serve particular needs and how they impact upon the natural environment. Until more managers in companies adopt this type of thinking, methods such as environmental accounting will not be implemented and used.

Investigating the reasons why companies begin reporting on environmental issues in company reports before implementing an environmental management system would be useful research. This research, for example, could involve the study of legitimacy theory to help explain the actions of companies. It could also investigate the process undertaken by managers to collect information for such reports, the type of information they use, where they obtain it and any difficulties experienced. This could be compared with the way data is collected once an EMS is in place and could provide insights into the effectiveness of the EMS to provide information for reporting.

Developing a clear, consistent definition of life cycle costing is crucial if full environmental impacts are to be measured and reported. The development of a framework to enhance the understanding of life cycle costing needs to be undertaken. At present there are a number of definitions and these are disparate and inconsistent. Consensus and consistency is necessary for further adoption of the use of this technique.

Finally, research could be undertaken to improve the understanding of the reasoning behind managers' thoughts about environmental costs. At present environmental costs are not perceived to be important for separate identification and research could investigate whether this is due to the way costs are calculated. The focus on the refinement of mechanisms and tools that will enable the appropriate allocation of environmental costs would be a useful extension to this research.

9.10.1 Additional further research

Other areas for further research not directly connected with the developed propositions are presented in this section. Research opportunities exist in the assessment of the NPC on a number of levels, which include: evaluating the NPC with regard to achieving its objectives; identifying changes in the decision making processes within companies to address NPC issues; determining to what extent the Environmental Code of Practice for Packaging is being adopted and if evaluation techniques like LCA are being used; and investigating if companies are using their NPC commitments to better understand the environmental cost structures of their products and processes.

In addition, researchers could investigate what level of authority in a company creates and drives the adoption of environmental management and environmental accounting methods through the company. Researchers could also investigate how other staff in the organisation learn about environmental management and environmental accounting. It could also investigate how environmental accounting and environmental management information is transmitted throughout the organisation, what form it is distributed in, and the usefulness of the information.

Additional research could involve comparative international studies, whereby food and/or packaging companies in other countries are investigated and/or other industry sectors.

9.11 Constraints

Care and attention has been taken to ensure that the research was designed and conducted to optimise the ability to achieve the objectives of the thesis. There

are, however, some methodological constraints, that do not invalidate the research, but should be acknowledged. A grounded theory approach was utilised to develop propositions from the collected data and analysed findings. As has been discussed in Section 1.3, 1.4 and 9.9 the aim of the research was to collect data across broad categories to develop propositions that could lead to the development of new, or refinement of existing, theories. A grounded theory approach may need to be replicated a number of times before any clear theoretical framework may emerge. By using a grounded theory approach, the intention was not to link to existing theories.

The nature of the grounded theory approach lends itself to exploratory research and this investigation was not designed to establish generalisable findings. The data analysis, while producing preliminary findings, led to the development of a series of propositions, which should form the basis of future empirical research.

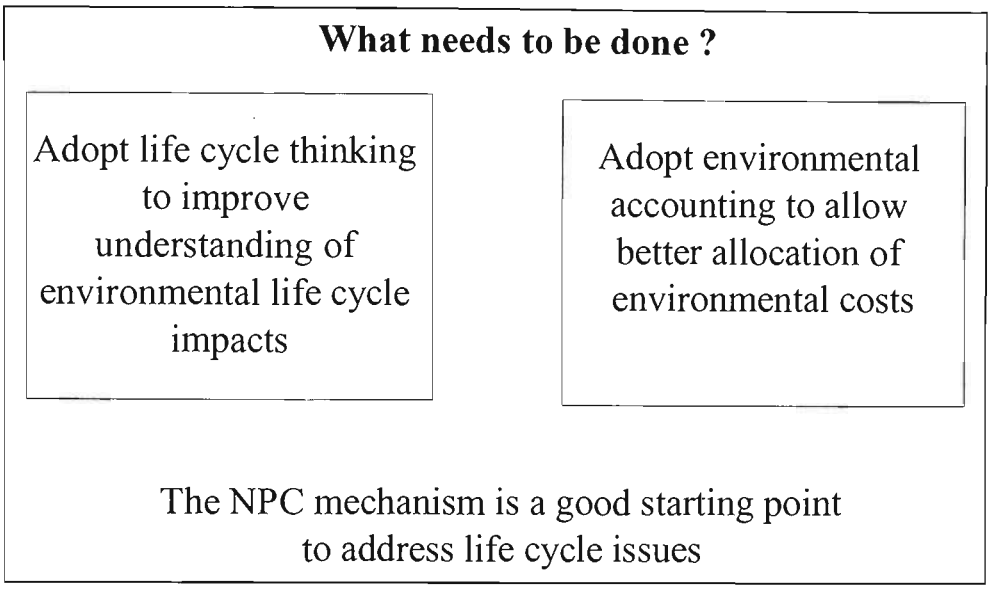
The intention of the statistical chi-square tests (χ^2) was not to generalise to the industry as a whole, but to provide some insight into the contribution of each industry sector in the sample population. Therefore, the aim of the statistical tests was not to generalise to a wider population.

9.12 Significance of the research

Prior research has investigated why companies report environmental information, how they report this information and why they should identify and allocate costs to specific processes and products. This research should help entities better identify and manage their environmental impacts. This research is unique as it has investigated and enhanced the relevance of these issues generally, and, more specifically, for the first time has used the Australian food packaging supply chain as a context for research. The packaging industry has for many decades been the focus of stakeholders such as government and consumers for issues centred upon packaging design (e.g., returnable versus one-way and "excess" packaging), litter, and waste management including recycling. The packaging industry has reacted with focus upon, for example, light-weighting of materials and using materials that are recyclable. The industry is now faced with the increasing pressures to become more transparent and accountable for its activities, to better understand

the supply chain activities, to reduce its environmental impact, and also to be more transparent, through reporting the "good" and "bad" news (Figure 9.2).

Figure 9.2 Adopting a life cycle perspective: what needs to be done by companies?



Environmental issues identified in this thesis as being the most important for the companies involved, included legislation, solid waste and emissions to air, land and water. The key issue within the legislation issue is the National Packaging Covenant. This research has provided an insight into the thoughts of companies signing onto the NPC, the drivers and the possible effects of the NPC internally within the companies. Comparing the principles of the NPC with how companies perceive environmental impacts and costs, it became apparent that companies are only at the embryonic stage of acknowledging, managing and demonstrating accountability of life cycle impacts and costs. This research has laid the foundations for further research to investigate the reasons, among a wider sample population, of how companies view 'taking on and being accountable on a life cycle perspective' and how environmental accounting and mechanisms such as voluntary agreements allow this to be achieved.

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APPENDIX A - CONSENT FORM

Victoria University of Technology

Consent Form for Subjects Involved in Research

INFORMATION TO PARTICIPANTS:

We would like to invite you to be a part of a study into the *development of a model that identifies life cycle costs in association with environmental life cycle assessment.* This is a PhD research titled *The Integration of Life Cycle Assessment and Life Cycle Costing for Food Packaging Applications.* The research questions that have been developed to address this main aim are:

- Which costing systems are the most appropriate for use in conjunction with life cycle assessment?
- What processes are required to develop a holistic costing model for LCA?
- What are the significant cost categories that should be included in the model?
- Should a company acknowledge upstream and/or downstream costs that do not have a direct impact on its own economic performance?
- If upstream and downstream costs are to be acknowledged, how should this be achieved?

The methodology that has been developed for this research consists of seven components (which are outlined below):

- Continuing review of academic literature, industry publications and public documents regarding cost reporting.
- Interviews with managers in selected companies to determine what costs they believe should be included.
- Development of generic model.
- Life cycle assessment goal and scope definition.
- Collection and calculation of life cycle assessment and life cycle costing data from participating companies.
- Validation of model.
- Modifications (if applicable) and finalisation (including documentation) of the model.

If you agree to be part of this research your direct involvement (and the reason for this form and your consent) is to participate in stage two of the above outlined methodology (*Interviews with managers in selected companies*).

The researcher (Karli L James) will interview you where you will be asked a series of unstructured open-ended questions related to environmental costing systems in your organisation.

Your responses will be recorded and will form a component of input data into the development of the conceptual life cycle costing model.

Your name and your organisation's name will in no way be identified in the final PhD thesis (and academic publications produced). Results will be disguised (e.g., manager A from company A), and the model will be an amalgamation of information from several participates so that no commercially sensitive information will be known to anyone other than the researchers.

The researchers guarantee complete confidentiality of any and all data (interviewed and numerical).

CERTIFICATION BY SUBJECT

I, ...

of .....

certify that I am at least 17 years old* and that I am voluntarily giving my consent to participate in the interview study for the PhD research entitled:

The Integration of Life Cycle Assessment and Life Cycle Costing for Food Packaging Applications

being conducted at Victoria University of Technology by:

Dr Louise Kloot, Associate Professor Kees Sonneveld and Karli L James.

I certify that the objectives of the study have been fully explained to me by:

Karli L James

and that I freely consent to participate in the interviews.

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this interview at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Signed: ..... }

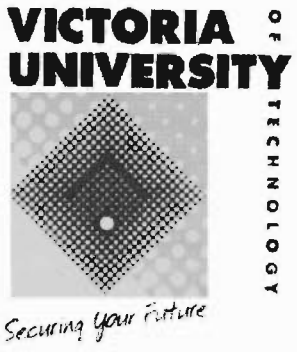
Date: .....

Any queries about your participation in this project may be directed to the researcher (Name: KARLI L. JAMES ph. 03-9216 8050).

If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University of Technology, PO Box 14428 MCMC, Melbourne, 8001 (telephone no: 03-9688 4710).

[**please note: Where the subject/s is aged under 18, separate parental consent is required; where the subject is unable to answer for themselves due to mental illness or disability, parental or guardian consent may be required.]*

APPENDIX B - INVITATION LETTER



Thursday February 10, 2000

Name of addressee

Address

Re: PhD Interview Series

To Whom it May Concern

I am writing to you and [company name] to invite you to participate in an interview, which is part of a series which form a component of my PhD research on the topic "The Integration of Life Cycle Assessment and Life Cycle Costing for Food Packaging Applications". This PhD is currently being undertaken through the Department of Accounting and Finance at Victoria University of Technology. The aim of the PhD is to develop a model that considers life cycle costs in association with life cycle assessment.

As you will know, there is increasing evidence that external and internal pressures are being placed upon companies to acknowledge, characterise and analyse environmental issues, impacts and costs. International markets, supply chain requests, government regulations and policies, and social and environmental reporting requirements are some examples of external influences. The National Packaging Covenant that was signed in 1999 is an ideal example. A reliable, consistent and transparent model for life cycle costing would be a significant contribution to the acknowledgment and understanding of environmental impacts, issues and costs throughout the supply chain. This research will contribute significant understanding to the interaction between life cycle assessment and life cycle costing and begin to set the frameworks for the integration of the two disciplines, allowing business to understand the impact of environmental issues on the bottom line.

The aim of these interviews is to speak with managers in the food and packaging industry and record their perceptions of environmental costing, life cycle assessment and environmental issues. These perceptions will be used in the development of the life cycle costing model. It is envisaged that the interviews will be held with a total of approximately 15-20 managers from different business units in your company and other companies. The interviews will consist of a series of questions ranging from company structure, general environmental information, life cycle assessment, costing systems and environmental costing methods. All names of interviewees and companies represented will be held in confidence and in no way will they be reported directly in the final thesis or resulting publications. The interview series is planned to be conducted during the months of March to June 2000. The interviews are planned to take around one hour.

Once I have completed the interviews and analysed them I will supply you with a summary of my findings for your internal use. If you have any questions, please do not hesitate to contact me, or my supervisors, Associate Professor Louise Kloot (9688 4333) or Associate Professor Kees Sonneveld (9216 8043). I will call you the week of February 14th to discuss in more detail the interviews and to arrange interview times. Thank you for taking the time to consider my invitation.

Yours sincerely

Karli L James

APPENDIX C- INTERVIEW QUESTIONS

Section 1 – Company Structure

1.1 What industry sector(s) does this company operate in (Parker 1998):

Give % ranking if more than one.

I) Packaging	II) Food	III) Other
Natural Resource Extraction	Growing	Retailing
Processing	Harvesting	Waste Management
Manufacturing	Processing	Other (specify)
Transport		
Distribution		

1.2 How would the company's business structure (Parker 1998) be categorized?

Publicly listed,
Public,
Private,
Wholly owned government,
Joint venture *(please specify whom)*
Other *(please name)*

1.3 Is the company a subsidiary of an overseas company (Parker 1998)? YES/NO *(Please name companies).*

1.4 What is the approximate turnover of the company (Parker 1998)?

1.5 How many people does the company employ in Australia (Parker 1998)?

1.6 Where does the company operate its non-office base processes?

(Specify Locations)

Section 2 – General Environmental Information

2.1 Is there a written company environmental statement under the following categories?

YES/NO (*Obtain copy where applicable*)

	Yes	No
Mission Values Policies		

2.2 For each of the following listed documents, please answer the three questions below.

	Annual Environmental Report (accompanying Annual Report)	**Annual Environmental Report (Stand-alone)**	**Environmental Management System (EMS)**
2.2.1 Are the above documents *in place, being developed, or not in existence.*			
2.2.2 If they are in place what was the first year in which they were produced?			
2.2.3 What where/are the reasons for its production?			

2.3 Which regulatory compliance(s) have a greater emphasis that the company has to comply with? *Eg. to Air, Land, Water, Noise and/or Odour*

2.4 Does the company undertake any voluntary environmental initiatives? YES/NO

Eg. Community tree planting. If yes, can you please name them?

2.5 Can you please name three environmental issues/concerns that will/are being facing by the company?

2.6 National Packaging Covenant (NPC)

a) Is the company a signatory? YES/NO (If yes go to question c; If no go to question b)

b) If no, does the company plan to be in the future? YES/NO (If yes go to question c; If no go to question 2.7)

c) What were the reasons for signing the Covenant?

d) What role is the Covenant to play in the company?

2.7 Greenhouse Challenge Program (GHCP)

a) Is the company a signatory? YES/NO (If yes go to question c; If no go to question b)

b) If no, does the company plan to in the future? YES/NO (If yes go to question c; If no go to question 2.8)

c) What were the reasons for signing the Greenhouse Challenge Program?

d) What role is the GHC Program to play in the company?

2.8 National Pollutant Inventory (NPI)

a) Is the company required to provide information to the NPI? YES/NO (If yes go to question c; If no go to question b).

b) If no, does the company envisage it may have to in the future? YES/NO (If yes go to question c: If no go to question 2.9)

c) What were the reasons for providing information to the National Pollutant Inventory?

d) What role is the NPI to play in the company?

2.9 Can you envisage (and name) particular environmental information that the company will have to collect in the future? *Eg. carbon credits and taxes.*

Section 3 – Life Cycle Assessment

3.1 Has a Life Cycle Assessment (LCA) been conducted and/or used in the company? YES/NO (If yes go to (b), If no go to (c))

a) If yes, on what, and when? (*Go to question 3.2*)

b) If no LCA has been conducted, can you please list the reasons why? *(Go to question 3.7)*

3.2 What were the reasons for conducting the LCA?

3.3 Who in the company was involved in conducting the study? (e.g., Environmental Manager, Production Staff, CEO)

3.4 What were the outcomes, difficulties encountered, and application of the results?

3.5 Has the LCA been used internally, externally, or as a component of another company's LCA?

3.6

a) Is LCA being used now? YES/NO

b) Will it be used in the future? YES/NO

3.7 Has the company been asked for LCA data? YES/NO If yes, was information supplied and in what form?

Section 4 – General Costing Philosophy

4.1 Of the listed philosophies below which ones apply to general costing and which ones apply to environmental costing (Parker 1998)?

a) Conventional product or service cost

b) Value added (R&D to market) product or service cost

c) "Full cost"

d) "Cradle to grave" cost

e) "Cradle to cradle" cost

f) "Target cost"

g) "Strategic cost"

Section 5 – Environmental Cost Classification

FOR THE FOLLOWING SECTION THE FOCUS IS UPON ENVIRONMENTAL COSTS

5.1 Does the company collect environmental costs under any of the categories in the list below? If yes can you please specify where applicable. If no can you please specify what is used.

a) Capital costs

b) Conventional operating costs such as labour and material

c) Hidden costs e.g., regulatory compliance

d) Contingent liability costs e.g., penalties and fines

e) Externalities like cost of pollution and resource depletion

f) Other (please specify)

Section 6 – Environmental Costs

FOR THE FOLLOWING SECTION THE FOCUS IS UPON ENVIRONMENTAL COSTS

6.1 Environmental Costs can be dis-aggregated into two categories - internal and external costs.

a) Does the company identify internal costs? YES/NO

b) Does the company identify external costs? YES/NO

6.2 Of the list (from (White *et al.* 1996)) of *direct conventional costs* below can you please answer the following.

a) Select, which costs the company, identifies and which it does not.

b) What type of allocation is used

	a)	b)	
	Identify	**Allocation**	**Allocation Unit**
	Yes/NO	[u] unit; [b] batch, [p] process, [f] facility	[v] volume; [w] weight; [n] number of.., [d] dollar/margin [dlh] direct labour hours, [mh] machine hours, [mc] material costs
a) Capital			
b) Buildings			
c) Equipment			
d) Utility connect			
e) Equip install			
f) Project engineering			
g) Operation and Maintenance			
h) Raw materials			
i) Labour			
j) Waste disposal			
k) Utilities			
l) Revenue recovered			
m) Other			

6.3 Are any external environmental aspects quantified? Eg. to Air, Land, Water, Noise, Odour

6.4 Of the list (from (White *et al.* 1996) and (Parker 1998)) of Indirect or Hidden Costs below can you please:

a) Select, which costs the company, identifies and which it does not?

b) What type of allocation is used?

	a)	b)	
	Identify	Allocation	Allocation Unit
	Yes/NO	[u] unit; [b] batch, [p] process, [f] facility	[v] volume; [w] weight; [n] number of.., [d] dollar/margin [dlh] direct labour hours, [mh] machine hours, [mc] material costs
a) Compliance costs			
b) Permitting			
c) Reporting			
d) Tracking			
e) Monitoring			
f) Manifesting			
g) Training			
h) Waste Handling			
i) Record-keeping			
j) Labelling			
k) Testing			
l) Emergency preparedness			
m) Medical surveillance			
n) Waste storage			
o) Waste disposal			
p) Waste reuse			
q) Waste recycling			
r) Waste treatment			
s) Pollution control equipment			
t) Raw mat linked to non-product output			
u) Insurance			
v) Value of lost inputs			
w) Energy costs			
x) Products reused			
y) Products recycled			
z) Emission costs			
aa) Pollution control purchase			
bb) Pollution control maintenance			

6.5 Of the list of *Probabilistic and Less Tangible Costs* below can you please:

a) Select, which costs the company, identifies and which it does not?

b) What type of allocation is used?

	a)	b)	
	Identify	Allocation	Allocation Unit
	Yes/NO	[u] unit; [b] batch, [p] process, [f] facility	[v] volume; [w] weight; [n] number of.., [d] dollar/margin [dlh] direct labour hours, [mh] machine hours, [mc] material costs
a) Penalties and fines			
b) Personal injury/prop			
c) Increased revenue-quality			
d) Increased revenue-"green prods"			
e) Land pollution			
f) Air pollution			
g) Water pollution			
h) Noise pollution			
I) Odour pollution			
j) Visual pollution			

6.6 Life Cycle Costing

a) Has *Life Cycle Costing (LCC)* been applied in the company? YES/NO (If yes go to question b, If no go to question e)

b) If yes, when, on what and what methodology was applied?

c) How would the company define LCC? [Refer to Figure D.3 in background brief]

d) What kinds of benefits would the company see with using life cycle costing? (Go to question 6.7)

e) If LCC has not been used can you please explain the reasons why?

6.7 Value Chain Analysis

a) Has *Value Chain Analysis (VCA)* been applied in the company? YES/NO (If yes go to question b, If no go to question d*)*

b) If yes, when, on what and what methodology was applied?

c) What kinds of benefits would the company see with using value chain analysis? *(*Go to question 6.8*)*

d) If no, why?

6.8 Activity Based Costing

a) Has *Activity Based Costing (ABC)* been applied in the company? YES/NO (If yes go to (b), If no go to (d*)*)

b) If yes, when and on what?

c) What methodology was applied? [Refer to definitions in background brief]

d) If no, what are the reasons for not applying it?

6.9 Can you name three items that currently do not exist in the company's costing system that would be valuable to have?

Section 7 – Environmental Cost Method

7.1 Do you gather your "general" and "environmental" costs by identifying (Parker 1998)?

a) Direct/variable costs

b) Full costs

c) Activity based costs

d) Job order costs

e) Process costs

f) Contingent costs

g) Intangible costs

h) Any other costs

Section 8 – Environmental Costing Focus

8.1 Would it be valuable to have a costing system that identifies costs with a particular focus, e.g., action for end-of-pipe activity; action for cleaner production activity, action for input efficiency control?

8.2 Does the company consider any costs upstream and/or downstream of the company boundaries?

YES/NO

a) If yes can you please identify them.

b) If no what are the reasons and do you think the company will have to in the future?

FINAL - Why did you participate (volunteer) for this interview?

Thank you for your time, it is greatly appreciated!

APPENDIX D - BACKGROUND BRIEF

Definition of terms for PhD interview series (March/April 2000)

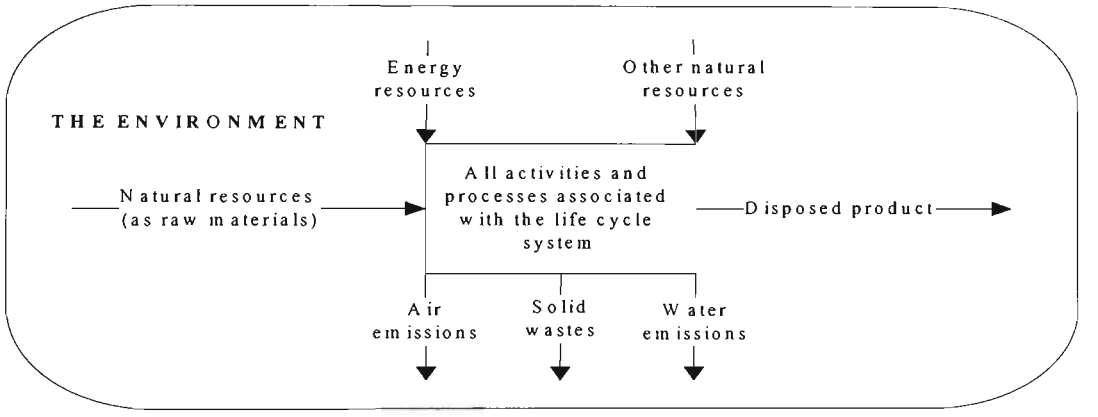
Life cycle assessment

Life cycle assessment (LCA) is defined as:

> 'an environmental assessment technique which quantifies the material requirements, energy use, emissions and waste and environmental impacts that are associated with the provision of a product, service or activity throughout its life cycle' (Allen *et al.* 1997).

Figure D.1 illustrates the system concept of life cycle assessment.

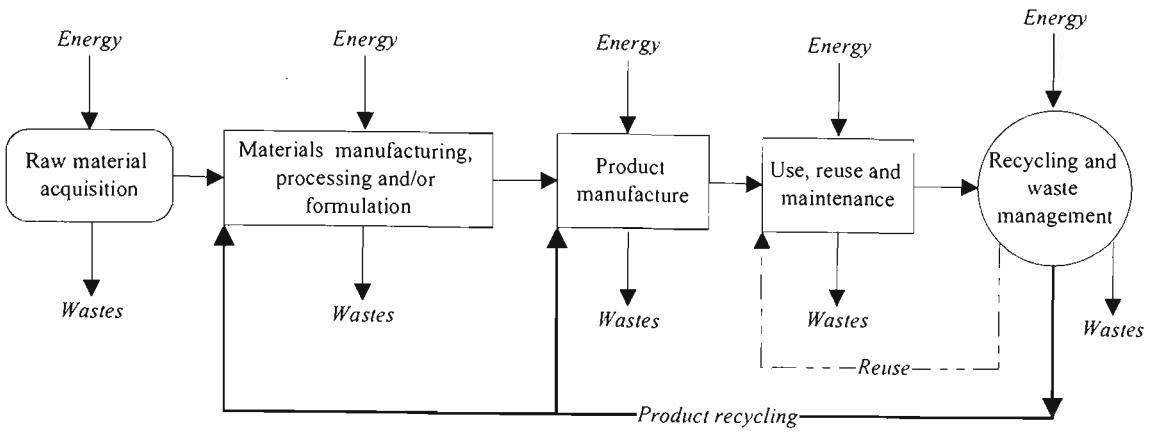
Figure D.1 Life cycle system concept



Source: (Boguski *et al.* 1996)

Life cycle assessment includes the entire life cycle encompassing extraction and processing of raw materials, manufacturing, transportation and distribution, use/reuse/maintenance, recycling and final disposal (Fava *et al.* 1991). Figure D.2 presents a general materials flow diagram for a product life cycle identifying the life cycle stages.

Figure D.2 General materials flow diagram for a product life cycle

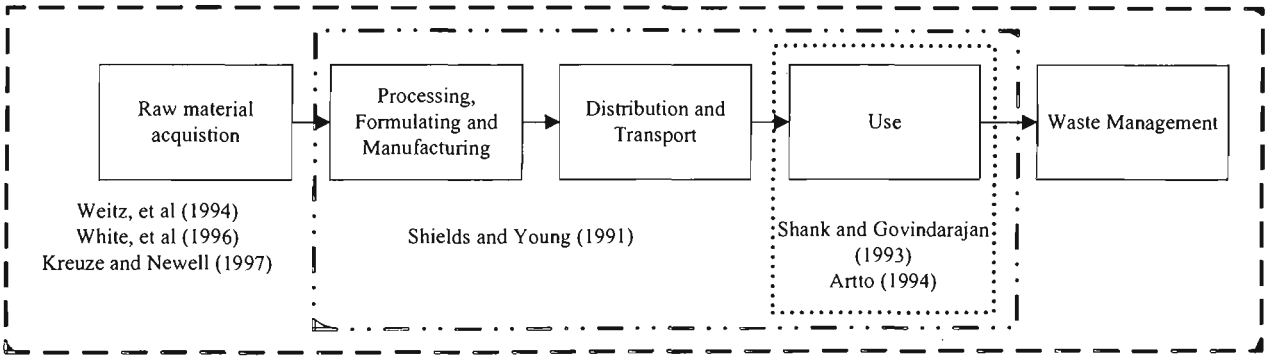


Source: (Boguski *et al.* 1996; Allen *et al.* 1997)

Life Cycle Costing

Examples of definitions to describe LCC are illustrated in Figure D.3. As illustrated the definitions vary considerably. The boundaries for each definition are indicated by the different dotted lines showing the system boundaries (range) of the definition and what life cycle stage is included. In respect of Shank and Govindarajan (1993) and Artto (1994) their definitions relate to the relationship between the cost the consumer pays for the product and the costs incurred over the useful life.

Figure D.3 Life cycle costing system boundaries



The basis for the definition of life cycle costing is taken from (White *et al.* 1996) and (Weitz *et al.* 1994):

> "Life-cycle costs include all internal costs plus external costs incurred throughout the entire life cycle of a product, process, or activity" (White *et al.* 1996).
>
> "Life cycle cost is defined as all internal and external costs associated with a product, process, project or activity throughout its entire life cycle - from raw materials acquisition to recycling/final disposal of waste materials. Internal costs are those directly incurred by an organisation (e.g., capital, labor, energy and regulatory compliance costs). External costs are those not directly incurred by the organisation (e.g., resource depletion, water contamination, and human health effects)" (Weitz *et al.* 1994).

Value chain analysis

Value chain analysis (VCA) is the:

> 'systematic way of examining all the activities a firm performs and how they interact' (Porter 1985) with the supply chain.

Shank and Govindarajan (1993) defined VCA as the:

> 'linked set of value-creating activities' from basic raw material sources for component suppliers to the ultimate end-use product delivered into the final consumer's hand.

Activity based costing

Activity based costing (ABC):

> 'identifies activities, the resources used by the activities, the cause and effect relationships of resource consumption (resource drivers), products that consume the activities, and the cause and effect relationships for activity consumption (activity drivers)' (Quarles and Stratton 1998).

An activity based costing (ABC) system:

> 'identifies and then classifies the major activities of a facility's production process into one of the following four categories: unit-level; batch-level; product-level and facility-level activities' (Cooper 1990).

APPENDIX E - JOB TITLES OF INTERVIEWEES

Director

Managing Director

Operations Director

Plant Managers

Supply Managers

Purchasing Controller

Environmental Manager

Health, Safety and Environment Advisor

Commercial Manager

Occupational Health, Safety, Environment & Quality Manager

General Manager

Marketing/Technology Manager

Business Development Manager

Packaging Development Manager

APPENDIX F - PAPERS WRITTEN BY AUTHOR

Papers written by Karli James on topics from this thesis are:

James, K. (2002a), 'The National Packaging Covenant', *Journal of the Asia Pacific Centre for Environmental Accountability*, Vol. 8, No. 3, pp. 16-22.

James, K. L. (2002b), *Making Environmental Costs More Visible and Relevant - How Can it Be Done?*, Paper presentation at Paper presented at the Australian Institute of Packaging National Conference - Packaging Clean and Green 2002, Carlton Crest Hotel, Melbourne, 21-22 March.

James, K. L. (2002c), *The National Packaging Covenant, Life Cycle Assessment and Costing Approaches: An Australian food and packaging case study*, Paper presentation at the Third Australian Conference on Life Cycle Assessment - Life Cycle Decision Making for Sustainability, Grand Mercure Hotel, Broadbeach Gold Coast, 17-19 July.

James, K. L., O'Donovan, G., Kloot, L. and Sonneveld, K. (2002a), *Environmental issues and accounting approaches: An Australian food and packaging industry case study*, Paper presentation at Paper presented at the Accounting Association of Australia and New Zealand Annual Conference, Sheraton Hotel Perth, 7-9 July.

James, K. L., O'Donovan, G., Kloot, L. and Sonneveld, K. (2002b), *Environmental Issues and the Australian Food and packaging Supply Chain*, Paper presentation at Referred Proceedings of the 33rd Annual Meeting of the Decision Sciences Institute (DSI 2002), San Diego, California, November 23-26.

APPENDIX G - ENVIRONMENTAL ISSUES

Issue	Number of companies
LEGISLATION ISSUES	
National Packaging Covenant	9
National Pollutant Inventory	1
Prospect of container deposits	1
Obtaining Trade Waste License	1
Regulation changes	1
Conformance with Code of Practice for VOC	1
WASTE ISSUES	
Recycling	2
Recycling and litter	1
Waste Management	3
Waste minimization	1
Reduction of volume to landfill	1
Waste to Landfill	1
Waste disposal	1
Disposal of wastes	1
Disposal of hazardous waste	1
Landfill of packaging from raw materials	1
ENERGY ISSUES	
Energy Use	1
Greenhouse Challenge Program	1
Greenhouse (arm twisting to join program)	1
Greenhouse	2
Emissions trading	1
Different transport modes	1
EMISSIONS RELATED ISSUES	
General	
Emission reduction (internal)	1
Overall emissions and compliance	1
Air	
Reduction of transport emissions	1
Air Quality	1
Discharge to atmosphere	1
CO_2 emissions	1
Air pollution	2
Noise	
Noise pollution	1
Noise management	1

Issue	Number of companies
EMISSIONS RELATED ISSUES (continued...)	
Odour	
Odour	2
Odour management	1
WATER ISSUES	
Water quality	1
Ground water issue (contamination on site)	2
Waste water discharge	1
Waste water management issues	2
Storm water pollution management	1
LAND ISSUES	
Locality (near residential areas)	1
Planning and land use conflicts	1
Site contamination	1
Impact of Mining	1
Reducing footprint	1
Salinity	1
RESOURCE RELATED ISSUES	
Resource use (efficiency)	1
Forest resource use	1
OTHER	
Spills	1
Flare system	1
Integrity of product in delivery	1
Life cycle work	1
On-going existence concern with community	1
Sustainability of whole business	1
Sustainable development	1
Biodegradable plastics	1
Systems Implementation (environmental focus)	1
Asbestos removal in buildings	1
Refrigeration technology	1
Education of community	1
Education of employees (internal)	1

APPENDIX H - ENVIRONMENTAL COST ALLOCATIONS

Table H.1 Allocation type used by the packaging sector for direct conventional costs

Packaging sector			Allocation				
Direct conventional costs	Yes	% Yes	Unit	Batch	Product	Process	Facility
a) Capital	8	100				4	3
b) Buildings	7	88				3	3
c) Equipment	8	100				4	3
d) Utility connections	6	75				3	3
e) Equipment installation	7	88				4	3
f) Project engineering	8	100				4	3
g) Operation and Maintenance	7	88				4	3
h) Raw materials	8	100	1			6	1
i) Labour	8	100	1			6	
j) Waste disposal	6	75	1			3	3
k) Utilities	7	88				5	2
l) Revenue from recovered material	5	63	1			3	
m) Other	1	13					

Table H.2 Allocation type used by the food sector for direct conventional costs

Food sector			Allocation				
Direct conventional costs	Yes	% Yes	Unit	Batch	Product	Process	Facility
a) Capital	9	100	2		1	1	5
b) Buildings	9	100	2		1	1	5
c) Equipment	9	100	2		1	1	5
d) Utility connections	7	78	1		1		6
e) Equipment installation	8	89	2		1	1	5
f) Project engineering	9	100	1		1	2	5
g) Operation and Maintenance	8	89	1		2	3	3
h) Raw materials	9	100	2	2	3		1
i) Labour	9	100	2	1	3	2	1
j) Waste disposal	9	100	2	1		1	6
k) Utilities	9	100	1		2	2	4
l) Revenue from recovered material	7	78	1			3	4
m) Other	0	0					

Table H.3 Allocation type used by the 'other' sector for direct conventional costs

'Other' sector			Allocation				
Direct conventional costs	**Yes**	**% Yes**	**Unit**	**Batch**	**Product**	**Process**	**Facility**
a) Capital	9	90			1	6	2
b) Buildings	8	80			1	6	1
c) Equipment	9	90	1		1	6	1
d) Utility connections	8	80			1	4	2
e) Equipment installation	9	90	1		1	6	1
f) Project engineering	8	80			1	5	1
g) Operation and Maintenance	9	90			1	6	2
h) Raw materials	9	90	1	1	2	3	1
i) Labour	10	100			1	6	2
j) Waste disposal	9	90	1		1	6	1
k) Utilities	9	90	1		1	5	2
l) Revenue from recovered material	7	70			1	4	1
m) Other	1	10					1

Table H.4 Allocation type used by the packaging sector for indirect costs

Packaging sector			Allocation				
Indirect costs	Yes	% Yes	Unit	Batch	Product	Process	Facility
a) Compliance costs	3	38				3	
b) Permitting	2	25				1	1
c) Reporting	1	13				1	
d) Tracking	1	13				1	
e) Monitoring	3	38				1	1
f) Manifesting	1	13				1	
g) Training	7	88				1	3
h) Waste handling	4	50				1	1
i) Record-keeping	1	13				1	
j) Labelling	2	25				1	
k) Testing	5	63				2	2
l) Emergency preparedness	2	25				2	
m) Medical surveillance	6	75				2	2
n) Waste storage	3	38				2	
o) Waste disposal	6	75				2	3
p) Waste reuse	4	50				3	
q) Waste recycling	5	63				2	3
r) Waste treatment	4	50				2	1
s) Pollution control equipment	2	25				2	1
t) Raw materials linked to non-product output	4	50				2	2
u) Insurance	3	38				2	1
v) Value of lost inputs	5	63				4	1
w) Energy costs	6	75				4	1
x) Products reused	4	50				4	
y) Products recycled	4	50				2	1
z) Emission costs	4	50				3	
aa) Pollution control purchase	4	50				3	
bb) Pollution control maintenance	4	50				3	1

Table H.5 Allocation type used by the food sector for indirect costs

Food sector			Allocation				
Indirect costs	**Yes**	**% Yes**	**Unit**	**Batch**	**Product**	**Process**	**Facility**
a) Compliance costs	6	67	1				5
b) Permitting	6	67	1				5
c) Reporting	4	44				1	3
d) Tracking	2	22	1				3
e) Monitoring	4	44	1				3
f) Manifesting	3	33	1				3
g) Training	8	89				1	6
h) Waste handling	7	78				1	5
i) Record-keeping	2	22	1				3
j) Labelling	2	22				1	2
k) Testing	7	78	1			1	5
l) Emergency preparedness	3	33					4
m) Medical surveillance	7	78					7
n) Waste storage	4	44	1				4
o) Waste disposal	9	100	1			1	6
p) Waste reuse	5	56		1			3
q) Waste recycling	7	78		1		1	4
r) Waste treatment	6	67				1	5
s) Pollution control equipment	4	44					3
t) Raw materials linked to non-product output	5	56			1	2	3
u) Insurance	2	22					3
v) Value of lost inputs	8	89		1	1	1	4
w) Energy costs	9	100	1		1	1	4
x) Products reused	4	44	1		1		2
y) Products recycled	2	22	1				1
z) Emission costs	5	56				1	3
aa) Pollution control purchase	4	44					3
bb) Pollution control maintenance	3	33					3

Table H.6 Allocation type used by the 'other' sector for indirect costs

'Other'			Allocation				
Indirect costs	**Yes**	**% Yes**	**Unit**	**Batch**	**Product**	**Process**	**Facility**
a) Compliance costs	7	70				5	2
b) Permitting	6	60				5	2
c) Reporting	3	30				3	1
d) Tracking	3	30				3	1
e) Monitoring	3	30				3	1
f) Manifesting	3	30				3	1
g) Training	9	90				5	3
h) Waste handling	9	90	1		1	4	2
i) Record-keeping	3	30				2	1
j) Labelling	5	50				3	2
k) Testing	7	70				4	2
l) Emergency preparedness	4	40				2	3
m) Medical surveillance	7	70				4	3
n) Waste storage	4	40				3	1
o) Waste disposal	9	90	1		1	5	2
p) Waste reuse	5	50	1			3	1
q) Waste recycling	5	50				3	2
r) Waste treatment	6	60				5	1
s) Pollution control equipment	3	30				2	1
t) Raw materials linked to non-product output	7	70			1	5	0
u) Insurance	7	70				4	3
v) Value of lost inputs	6	60			2	4	0
w) Energy costs	9	90				7	2
x) Products reused	5	50				3	2
y) Products recycled	3	30				2	1
z) Emission costs	4	40				3	1
aa) Pollution control purchase	6	60				3	2
bb) Pollution control maintenance	6	60				3	2

Table H.7 Allocation type used by the packaging sector for less tangible costs

Packaging sector			Allocation				
Less tangible costs	Yes	% Yes	Unit	Batch	Product	Process	Facility
a) Penalties and fines	4	50	1				2
b) Personal injury/property	5	63	1			2	2
c) Increased revenue-quality	3	38				2	
d) Increased revenue "green products"	2	25				2	
e) Land pollution	3	38				1	2
f) Air pollution	1	13				1	1
g) Water pollution	3	38				1	2
h) Noise pollution	0	0					
i) Odour pollution	0	0					
j) Visual pollution	0	0					

Table H.8 Allocation type used by the food sector for less tangible costs

Food sector			Allocation				
Less tangible costs	Yes	% Yes	Unit	Batch	Product	Process	Facility
a) Penalties and fines	7	78					4
b) Personal injury/property	8	89	1				6
c) Increased revenue-quality	3	33		1	2		
d) Increased revenue "green products"	1	11					1
e) Land pollution	3	33				1	2
f) Air pollution	0	0					
g) Water pollution	2	22				1	1
h) Noise pollution	1	11				1	
i) Odour pollution	0	0					
j) Visual pollution	1	11					

Table H.9 Allocation type used by the 'other' sector for less tangible costs

'Other' sector			Allocation				
Less tangible costs	Yes	% Yes	Unit	Batch	Product	Process	Facility
a) Penalties and fines	6	60				4	2
b) Personal injury/property	8	80				5	3
c) Increased revenue-quality	2	20	1			1	0
d) Increased revenue "green products"	2	20	1			2	0
e) Land pollution	3	30				3	0
f) Air pollution	4	40				3	1
g) Water pollution	4	40				3	1
h) Noise pollution	3	30				3	0
i) Odour pollution	2	20				2	0
j) Visual pollution	2	20				2	0