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AN EXPLORATORY ANALYSIS INTO MEASURING BUSINESS CONTRIBUTIONS TO SUSTAINABLE DEVELOPMENT IN AUSTRALIA.

A Dissertation Submitted by
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by
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ABSTRACT

The aim of the research in this dissertation is twofold. First, from a wide ranging survey of the themes, principles and approaches to sustainable development, the objective is to establish a method of measuring whether or not business and industry are contributing to sustainable development. The second objective is to then use this method of measurement (called the Business Sustainable Development Index [BSDI]) to evaluate the contribution to sustainable development of selected Australian firms.

The three pillars approach to sustainable development and the capitals theory approach to its measurement are the theoretical bases for the measurement framework developed in this research (Elkington 1999; Figge and Hahn 2002; Faucheux and Muir 1997). The framework departs from previous methods employed for the measurement of business contribution to sustainable development in that it:

- is a synthesis of an index method of measuring contribution to sustainable development, used at the macro level, and a conventional ratio analysis approach to measuring business performance. Current methods predominantly apply only ratio analysis (Gil and Sleszynski 2003; Streeten 1995; Atkinson 2000; Figge and Hahn 2002; Wagner 2001).
- focuses on the movements in assets on a company's balance sheet and not, as current methods do, on making 'green' adjustments to profit figures from the company's profit and loss accounts (Atkinson 2000; Figge and Hahn 2002)

- deals only with a firm's contribution to sustainable development whereas current methods seek to measure both contributions to sustainable development and profitability in the one synthesised measure.

The study is grounded on the proposition that in a business setting 'what you don't measure you can't manage'. However, there are difficulties at both the conceptual level and the practical level which make the measurement of business actions in relation to sustainable development problematic (Burritt 2002; Deegan 1999a; Elkington 1999; Reinhardt 1999).

One of the major difficulties is that the concept of sustainable development applies to a broad, macro scale whilst individual business entities operate within boundaries defined by corporations law and the contemporary governance framework of business (Daly 1992; Deegan 1999a). In this regard, the approach in this dissertation draws on the work of Atkinson (2000) in only seeking to measure business 'contribution' to sustainable development. The concept of 'contribution' provides the bridge between the scale of the firm, as an economic entity, and the application of the principles and approaches to sustainable development which operate, most easily, at various natural scales (for example – the catchment scale or the continental scale). However, there are also practical difficulties, which arise because of the legal and financial limits (including increased costs) arising from current corporate governance expectations of business (Burritt 2002; Reinhardt 1999).

In view of these difficulties and to ensure that the meaning of sustainable development is not lost or reshaped when being translated from the broad scale to the business scale, this research establishes both 'scope' and 'functionality' tests for reviewing methods of measuring business contribution to sustainable development. This has been done to avoid important omissions which have been identified in applying the principles and themes of sustainable development to business settings (Dyllick and Hockerts 2002; Veleva and Ellenbecker 2000). The 'scope' test deals with the nine key themes and concepts which underlie the overarching concept of sustainable development. The 'function' test introduces a preliminary formalisation of emerging thinking that seeks to connect existing notions of organisational performance measurement (for example efficiency and effectiveness measures related to organisational goals, inputs, outputs and outcomes) with the contribution of

business to sustainable development (Higgins 2001). The functions of 'matching' and 'linking' are introduced as a bridge between principles of sustainable development, such as generational equity, and the organisational performance framework based on measurement against stated goals (Higgins 2001).

Based on these foundations and emerging from a review of current methods of measuring business contribution to sustainable development, a Business Sustainable Development Index (BSDI) and an Industry Sustainable Development Index (ISDI) are developed as more comprehensive responses to the application of sustainable development in business. Both indexes provide a consolidated indicator as well as providing a sub indicator of contribution in relation to each of the three pillars of sustainable development. Analysis is then undertaken to discern differences in contribution to sustainable development between firms which have been recognised for contribution to sustainable development and other firms which have not been recognised. To do this the study compares the financial performance of two groups of firms over 10 years and seeks to discern differences in contribution to the economic pillar of sustainable development.

In addition, the study reviews the performance of a pair of firms (one recognised for contribution to sustainable development and the other not recognised) for 6 years and reviews financial, environmental and social performance (the three pillars of sustainable development) in an endeavour to discern differences in performance overall and for each pillar. Additionally, the performance of relevant industry groupings is reviewed to provide a context and benchmark for considering firms' relative performances.

The results of the analysis in this research indicate that there are shortcomings in the methods currently employed to measure business contribution to sustainable development. These shortcomings include (1) incompleteness, when compared to broad principles and themes of sustainable development (2) confusion, in that current methods seek to measure both conventional business performance and contribution to sustainable development in one, synthesised measure and (3) inaccessibility, in that the cost of some popular business methods excludes many small to medium businesses from participating in the measurement process.

Abstract

The BSDI and ISDI developed in this research are contributions to the development of methods to measure business contribution to sustainable development by (1) seeking to develop a more complete tool that links existing organisational efficiency and effectiveness performance measures with the broad concept of sustainable development (2) focusing on the development of a single purpose measure designed to give a perspective on the contribution of the firm or industry to sustainable development only and (3) adopting a 'tiered' index approach that allows small to medium firms (SMEs) to participate in measurement of contribution to sustainable development.

The results indicate that this new method is able to be applied to different business settings (specifically industry, case study and model portfolio settings). This is a distinct improvement because of the patchy data which is available to research in this area. Preliminary results indicate that the apparent application of sustainable development techniques within a business setting is not having a significant impact on business performance to date. That is, there is no confirmation that those firms which have been recognised for making a superior contribution to sustainable development are making any significantly different contribution than other firms. The research suggests that it may be the ability of firms to report and market their efforts in regard to sustainable development, more than the actual contribution of these firms to sustainable development, which results in the perceived difference in business performance.

Key words: sustainability, sustainable development, functions of sustainable development, business contribution to sustainable development, measurement of sustainable development.

CERTIFICATION OF THE DISSERTATION

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

Neil Peach
21 March 2005.

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LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
AGO	Australian Greenhouse Office
ATO	Australian Taxation Office
BSDI	Business Sustainable Development Index
CBA	Cost Benefit Analysis
CBA_{-sd}	Cost Benefit Analysis for Sustainable Development
COD/BOD	Chemical/Biochemical Oxygen Demand
CO_2	Carbon Dioxide
DFE	Design for the Environment
EBITA	Earnings before Interest Tax and Abnormals
ESD	Ecologically Sustainable Development
GAAP	Generally Accepted Accounting Practice
GDP	Gross Domestic Product
GNP	Gross National Product
GRI	Global Reporting Initiative
IGAE	Intergovernmental Agreement on the Environment
ISDI	Industry Sustainable Development Index
ISEW	Index of Sustainable Economic Welfare
ISO	International Standards Organisation
MEPI Project	Measuring Environmental Performance of Industry Project
MNC	Multi National Corporation
NO_2	Nitrogen Dioxide
NSESD	National Strategy for Ecologically Sustainable Development
SD or sd	Sustainable Development
SME	Small to Medium Enterprise
SNA	System of National Accounts
SO_2	Sulphur Dioxide
SVA	Sustainable Value Added
TBL	Triple Bottom Line
VOC	Volatile Organic Compound
WBCSD	World Business Council on Sustainable Development
WCED	World Commission on Environment and Development
WSSD	World Summit on Sustainable Development

GLOSSARY OF TERMS

This research includes a survey of sustainable development. In so doing, a large number of words and terms are used in an endeavour to establish a framework for dealing with the ramifications of sustainable development for business. This research builds on the work of Bennett (2001) and Higgins and Venning (2001) to establish such a framework, but to do so specifically with business in mind. The following words and terms are applied as consistently as possible throughout this dissertation in order to enhance the clarity of expression and meaning.

WORD OR TERM	MEANING IN THIS DISSERTATION
Sustainability	A relatively steady state society with population in broad balance with resources and the environment. See Chapter One.
Sustainable Development	Development that seeks equitable distribution of resources between and within current and future generations of people. Such development would also maintain social and biophysical diversity on earth. See Chapter One.
Scales of Sustainable Development	Sustainable development is applicable to different scales. The scale of sustainable development may be related to (1) a nation state (2) a business (3) a catchment or region (4) an institution (5) an anthropocentric or a bio centric perspective. See Chapter One and Chapter Four.
Longevity	Length or duration of life. Used here in relation to institutions of sustainable development. Note: The longevity of an institution is not necessarily linked to sustainable development. An institution may have longevity but in fact may be making a negative contribution to sustainable development. See Chapter Four.
Institutions of Sustainable Development	Groupings of human activity with shared characteristics. Examples are (1) Civil Society (2) Business (3) Non Government Organisations. See Chapter Two.
Contribution to Sustainable Development	Whether or not an institution is making a positive contribution to sustainable development will depend on whether it has left the world better off at the end of period compared to the beginning of the period. See Chapter Three.

Stimuli of Sustainable Development	Factors or issues that have shaped the contemporary perspective of sustainable development so that it has moved from a local to a global concern. See Chapter One.
Building Blocks of Sustainable Development	These key concepts and themes underpin the contemporary perspective of sustainable development. See Chapter One.
Approaches to Sustainable Development	These are groupings of different perspectives of sustainable development that share a common goal orientation. This research considers that there are three key approaches to sustainable development. They are: • Systems • Definitions • Charters See Chapter Two.
Systems Approach to Sustainable Development	The goal orientation of this approach is focused on the relationships between various institutions and/or phases of sustainable development. The approach is characterised by the use of diagrams, flow charts and equations.
Definitions Approach to Sustainable Development	The goal orientation of this approach is focused on the behaviours and actions required by those in an institution of sustainable development to contribute to sustainable development. This approach is characterised by verbal descriptions and lists of issues.
Charters Approach to Sustainable Development	The goal orientation of this approach is on the transitional issues of sustainable development and focuses on providing an action plan for a specific institution to contribute to sustainable development. As such, it is charactered by project plans and 'to do' lists for particular institutions to improve capability for contributing to sustainable development.
Perspectives of Sustainable Development	A specific instance of an approach to sustainable development attributable to an individual or group. The Holling Four Box Model is a perspective on sustainable development within the systems approach. See Chapter Two.
Tools of Sustainable Development	In order to implement sustainable development, practitioners use tools. These tools may be used in planning, managing, reviewing, reporting or measuring sustainable development. See Chapter Three.

Functions of Sustainable Development	In order to implement and measure sustainable development, it is helpful to know the specific functions or operations which distinguish sustainable development from other ideas. This research considers that sustainable development involves specialist 'matching' and 'linking' functions. See Chapter Four.
'Matching' Functions of Sustainable Development	Sustainable Development requires the matching of different physical and temporal scales.
'Linking' Functions of Sustainable Development	Sustainable Development requires the linking of different areas of knowledge and institutions.
Three Pillars of Sustainable Development	The three pillars are (1) Social (2) Environmental and (3) Economic. These are convenient headings for amalgamating a range of knowledge, information and measures associated with sustainable development. See Chapter One and Chapter Two.
Business Sustainable Development Index	A comprehensive tool for measuring an individual business's contribution to sustainable development. See Chapter Four and Chapter Five.
Industry Sustainable Development Index	A comprehensive tool for measuring an industry grouping's contribution to sustainable development. See Chapter Four and Chapter Five.
Economic, Social and Environmental Sub Indexes	The BSDI or ISDI contain three sub indexes which amalgamate numerous issues under the three pillars of sustainable development. Each sub index contains a ratio component and an absolute component.
Ratio Component	The ratio component of a sub index comprises one or more ratios which seek to measure the efficiency component of an institution's contribution to sustainable development. See Chapter Four and Chapter Five
Absolute Component	The absolute component of a sub index comprises one or more measurable items which seek to measure the effectiveness component of an institution's contribution to sustainable development. See Chapter Four and Chapter Five.
Organisational Performance Framework	This framework comprises goals, inputs, outputs, outcomes and performance measures. Two key measures of performance are efficiency and effectiveness.
Organisational Goals	What the organisation seeks to achieve.
Organisational Inputs	The programmes the organisation has in place and the resources committed to them.

Organisational Outputs	The goods and services that the organisation produces directly.
Organisational Outcomes	The effects that the organisation's outputs have.
Efficiency Performance Measures	The ratio of inputs to outputs.
Effectiveness Performance Measures	The extent to which outcomes achieve goals.

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1. BACKGROUND TO SUSTAINABLE DEVELOPMENT FOR BUSINESS

1.1 Introduction

This chapter provides a background to this research and a review of the emergence of the concepts of sustainability and sustainable development. It then sets out the objectives of this research, as well as an outline of this report's structure.

1.2 Background

The type and scale of industrial growth in the world since World War Two has highlighted the tensions between conventional economic growth and the conservation of social and environmental diversity (Spangenberg 2001). These tensions are apparent in international, national and local politics and in the rise of environmentalism as a political idea. There are divergent views about how to respond, and the degree of response, to these tensions (Beder 1997; DeSimone and Popoff 1997; Dryzek 1997; Lovins 1997 and Spangenberg 2001). There is a multiplicity of specific tensions, such as:

- The extent to which economic markets need to be modified compared to the extent to which social organisation needs to be modified. An example of this is provided by the debate in relation to the privatisation of services which were conventionally provided by governments, such as health and education services.

- The level of gradual or incremental improvement required to existing production systems compared to the extent which comprehensively different methods of production are required. An example of this is the current debate regarding the continued use of fossil fuels compared to the application of new sources of power such as wind generators.

- The scale of improvements in resource productivity which is required versus the required scale of changes in consumption levels and patterns. This is well illustrated by the increases in the fuel efficiency of motor vehicles being negated

by the increased fuel consumption arising from the provision of larger vehicles, air conditioning and the like.)

These tensions and the trade offs in this debate are encapsulated in the emerging contemporary views of sustainability and sustainable development. Sustainable development is an adaption of conventional economic development but involves much more than just consideration of economic issues. It involves social and environmental issues covering complex areas such inter generational equity, biodiversity and well being (Diesendorf 1997).

Since World War Two and the growing importance of this 'growth versus conservation' debate, the expansion of the application of market systems as the basis for economies has meant that firms are heavily involved in the debate. Business, especially big business, has been subjected to closer scrutiny and business people have been keen to preserve the rights and privileges afforded under modern approaches to corporate governance (Dunlop 2000; Stigson 1999). These rights and privileges are components of a 'licence to operate' and go to the heart of how firms operate and the rules applied to their operations.

'Licence to operate' is the term used to describe the opportunity afforded to businesses to use the economic, social and environmental resources of societies at the same time as having specific, limited obligations to direct shareholders (Kiel and Nicholson 2000; Reinhardt 1999). Firms have therefore sought to highlight the value and benefits accruing to societies through their continued operation, with minimal restraints (Vogel 1983). This is well illustrated by the publication of extensive business reports on how individual or industry groupings of firms have contributed, not only to the economic outcomes of society but also to the social and environmental outcomes (Sustainability Ltd. and UNEP 2000; WMC Limited 2001;). The link between business and the emerging concept of sustainable development has been popularised, to varying degrees, in concepts such corporate social responsibility, the triple bottom line and natural capitalism (Deegan 1999a; Elkington 1999; Hawken and Lovins *et al.* 1999).

Firms have endeavoured to convey their positive contribution to the changed expectations regarding economic progress. This is not only to preserve 'licence to

operate' but because of the investment and value benefits accruing to those firms which are considered to be making wider social and environmental contributions. Substantial investment pools are becoming available to those firms that are rated or ranked as operating in a socially responsible manner (Donovan 2002). This is having the effect of changing the methods and approaches being applied to report on the performance of business. An important example of this is the Dow Jones Sustainability Index (Dow Jones Group and Sustainable Asset Management 2001). Firms are only regarded as being suitable for listing on this index following the completion of an extensive survey that evaluates business approaches in relation to economic, social, environmental and governance dimensions. There are, in addition, claims of superior financial returns accruing to those who invest in these enlightened businesses coming from firms themselves (WMC 2001) business advisers (Lagan 2001) and investment managers (Manning and Wade 2001).

Because the activity of business is now having such a substantial impact on people's lives in all parts of the world and because it is important to better understand what constitutes enlightened business performance in contributing to enhanced social, environmental and economic outcomes, this research considers the ways which are being used to measure business performance in relation to these outcomes. It is not anticipated that governments will act to substantially increase regulation and limit the operation of business. On balance it would appear that firms are winning the battle to retain their 'licence to operate' and the reasons for this are covered later in this chapter, when reviewing the progress of sustainable development in Australia. In view of this, it will be important to understand and measure business performance, but not just using conventional measures and not just against narrow economic expectations. This research focuses on enhancing methods of corporate performance measurement in relation to the expanded expectations arising from the 'conservation versus growth' debate.

One of the reasons for improving performance assessment is that there is some doubt as to whether or not some firms are actually making improved contributions (beyond their financial performance). There is also contention that some firms are seeking to reshape and limit the impact of these modified notions of progress (such as sustainable development) so that access to resources and markets and the opportunity

for achieving financial profits is not impeded (Beder 1997; Springett 2003; Welford 1997). Methods for measuring business performance against the wider issues covered by concepts such as the triple bottom line, natural capitalism and even corporate social responsibility are not fully developed (Deegan 1999a; Elkington 1999). Further, whilst there is considerable research into organisational environmental reporting and performance (Burritt 2002; Wagner 2001) to date, the emphasis of research in relation to the broader notions of corporate responsibility, such as triple bottom line, have tended to focus primarily on reporting (and its completeness) and not on empirical business performance (SustainAbility Ltd. and UNEP 2000) .

This research focuses on methods of measurement of business contribution to sustainable development and whether firms that have been recognised for contributing more to sustainable development are in fact doing so. The focus on sustainable development is warranted for several reasons. First, sustainable development reflects many of the issues included within the broader 'conservation versus growth' debate. Second, whilst not precisely defined, sustainable development is sufficiently articulated to provide a starting point for use in an empirical comparative analysis of business performance. Third, sustainable development has been the starting point for many of the corporate approaches in responding to the broader expectations of business within the 'growth versus conservation' debate. Perspectives such as the natural step (International Institute of Sustainable Development 2002), triple bottom line (Elkington 1999) and natural capitalism (Hawken, Lovins and Lovins 1999) are perspectives on organisational responses to the principles and themes within the overarching conceptualisation of sustainable development. It is important therefore, to consider more fully the emergence of contemporary concerns regarding sustainability and sustainable development.

1.3 Emergence of Sustainability and Sustainable Development

The contemporary concern regarding sustainability is different to the more localised concerns of earlier societies (Cocks 1999; Bennett 2001). This shift has seen contemporary sustainability concerns connect the initial local concerns of people (in relation to the sustainability of their local habitats and communities) to larger concerns about regions and the whole planet. This metamorphosis is reflected in the 'think global, act local' entreaty of the 1983 World Conservation Council strategy

(Warburton 1998). There would appear to be several significant stimuli for this change. First, there is the notion of having moved from an 'empty' to a 'full' planet. The increase in human population across the earth has resulted in recognition that the scale of human endeavours to actually affect the planet is very different from the previous low level impacts resulting from traditional hunter gatherer societies (Costanza, Daly *et al.* 2000).

Second, there is the impact of industrial processes and the resource consumption associated with industrial cultures across the earth. These are increasingly being recognised as capable of influencing significant global biophysical systems and processes (Lovins, Weizshcker *et al.* 1997). Third, modern methods of communication mean that information regarding events and issues from across the planet are quickly disseminated to the world's populations. This especially brings to light information about the living conditions and events which effect people in places all around the world (Elkington 1999). In particular, environmental problems are more widely known.

Others have suggested more broadly based stimuli, such as social changes that predispose people to question established values, fear over nuclear weapons testing and improved scientific understanding of the impact of human processes (Venning and Higgins 2001). There is a multiplicity of broadly based contributory factors to the emergence of sustainability thinking. However, the three stimuli noted above have reinforced each other's impact and provide an explanation of why sustainable development has changed from an issue with local and individual focus and emerged as a globally relevant question in the second half of the twentieth century. Within this context, the stimuli of business interest and response to sustainable development have been coloured by the specific circumstance of business as an institution within the general setting for sustainable development. The following issues are considered to be highly relevant to the business response to sustainable development.

First, there is the growth of markets through which humans obtain the goods and services that they require in their lives. It has been estimated that the areas of human activity covered by markets has grown from under 20% to over 90% during the twentieth century (James 2000). The ubiquity of markets has resulted in a

considerable diminution in the power of governments to control economic outcomes. It follows therefore, if there is to be positive progress towards sustainability, that business must play a critical part, given the resources that are produced, consumed and distributed by business through the market system. It also presages the unwillingness of governments in developed nations to increase regulations on business and to infringe on their licence to operate.

Second, and consequent on the first point above, there is growth in (a) the level of international trade and (b) the impact of the multinational corporations (MNC). These developments, in concert with the general stimuli provided by enhanced communications noted earlier, have meant that the operations of firms in different parts of the world are open to wider scrutiny (Stigson 1999). What a firm does in one part of the world may be reflected in market reactions in another part of the world. This has been referred to as consumers and or markets having 'x-ray vision' into MNC supply chains (Elkington 1999). An example of this is provided by the impact of unethical employment practices of an MNC in developing nations, on the buying behaviour of that corporation's customers in developed nations.

Third, there is the growth in intangible assets as a major component of business value. It has been estimated that over 70% of the capitalisation of firms on the stock markets of the developed world is made up of intangible assets such as copyrights, brand names, licences and associated intellectual property rights (Czechowicz 2000). The increase in prices for particular brands and licences has, at times, been associated with lower prices for primary products, suggestions of commercial 'exploitation' of undeveloped nations and significant legal battles involving multinational corporations (Beder 1997). As a result, the emergence of intellectual property rights may be accentuating the imbalance (inequality) between developed and undeveloped nations. This is impacting on the operation of trans-national companies that have to strenuously defend their role in potentially contributing to the widening gulf between 'haves' and 'have-nots'.

Fourth, there is the specific impact of industrial processes noted at the beginning of this chapter. It is considered that this has been reinforced by the involvement of MNCs in several widely reported industrial accidents/incidents. It has been suggested

that these incidents have had a significant impact on corporate behaviour through heightened recognition of the financial, legal, market and reputation impacts of such incidents (Worutch 1990).

These stimuli have operated to shape business perspectives on corporate social responsibility and licence to operate. From there, some MNCs have moved to more comprehensively understand and apply the thinking associated with sustainable development as an enhanced business response to these issues. Further, it is contended that this has prompted some firms to seek to reshape notions of sustainable development so as to minimise the impact that the application of sustainable development may have on the capacity for these corporations to fully exploit market opportunities (Welford 1997). These efforts at reshaping are indicated by (1) complexity of reporting and/or (2) omission of key issues and these two points are considered more fully below.

Sustainability reports by some companies, putatively committed to sustainable development principles, are so large and so complex it is very difficult to discern whether there has been any real change or improvement in performance in relation to sustainable development. The 'People, Planet and Profits' reports prepared by Royal Dutch Shell Group of Companies (2001) are an example of this. There is an array of business indicators, charts, graphs and case studies which convey a wide variety of perspectives on company actions and which cover many of the principles and themes of sustainable development. Other than that the company has provided extensive information, there is little clarity about whether what has been achieved is really contributing to sustainable development. This proliferation of data has been supported to some degree by institutions seeking to expand the purview of sustainable development and in the process may have unwittingly increased the barriers to more small and medium sized enterprises (SMEs) from seeking to apply the principles of sustainable development. This issue is particularly relevant to the Global Reporting Initiative (2001) considered in Chapter Three.

On the other hand, some business interests have worked hard to re-define or omit some of the building blocks of sustainable development, possibly with the aim of minimising any reduction in business freedom or opportunities. The omission of

employment (namely numbers employed) in many of the significant business 'versions' of sustainable development is an example of a major omission, which goes to the heart of the notion of sustainable development. Instead it is common practice for firms to highlight how much work has been done to protect and develop those people that work for them (Sustainability and UNEP 2000). At the same time, many of the MNCs, now recognised for their contributions to sustainable development, retrenched thousands of employees during the 1990's (Cocks 2003).

In addition, business is also seeking to maximise advantage by demonstrating commitment to key social and environmental issues so as to improve profitability and shareholder's interests. So, it is important that the key concepts of sustainable development are recognised and that methods of assessing business performance in relation to sustainable development are as comprehensive as possible. The next section provides preliminary definitions for both sustainability and sustainable development followed by a brief overview of progress regarding sustainable development in Australia.

1.4 Definitions: Sustainability and Sustainable Development

Bennett contends that the *'...meanings of sustainability are as much a function of historical evolution as interpretation'* (2001, p26) and provides the following brief statements as indicating the general scope of contemporary sustainability '*…A relatively steady state society with population in broad balance with resources and the environment….. Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and into the future, can be increased'* (2001, p46).

Sustainable development is a way of moving towards sustainability and as such, is a means to an end. Sustainable development is an adaptation of conventional economic development and is difficult to achieve because it involves much more than just consideration of economic issues (Faucheux and Muir 1997; Stern 1997). Development that meets the primary criteria of being sustainable not only ensures efficient production of resources but also involves the equitable distribution of resources between and within current and future generations of people at the same

time as maintaining social and biophysical diversity on the earth (Diesendorf 1997; Bennett 2001).

Sustainable development began to be articulated, although not specifically named, at the United Nations Conference on Human Environment in 1972 as a result of the growing evidence of environmental pressures that humanity was placing on the earth (Bennett 2001). In the early 1980's the World Conservation Strategy gave currency to the term 'sustainable development' and emphasised that humanity had no future unless nature and natural resources were preserved (Warburton 1998). The Brundtland Report "Our Common Future' introduced the need to balance current development and consumption with the needs of future generations but still contended that growth in the international economy needed to speed up (World Conference on Environment and Development 1987). The basic definition by the WCED is well known and set out in full below:

'...Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts-

- *The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *The idea of limitations imposed by the state of technology and social organisation on the environments ability to meet present and future needs'* (WCED 1987,p.43).

Since then international fora, such as the Earth Summits in 1992, 1997 and 2002, have served as catalysts for continued policy developments and institutional interest in sustainable development (World Summit on Sustainable Development (WSSD) 2002).

In broad terms, by employing a sustainable development approach, the objective is to moderate growth (unlike the prescription of the earlier Brundtland conception which saw the need to speed up growth) and the consumption of resources in line with the physical scale of the earth and to distribute this consumption more evenly across the peoples and places on the planet, both now and into the future (Daly 1991). Whilst such an objective is simple, achieving it is difficult. The enormity (and almost impossibility) of the task is reflected not only in the wide ranging plan of

implementation arising from the latest Earth Summit in 2002 but in the acknowledged lack of progress since the previous summit (WSSD 2002). The lack of progress is at least in part attributable to the lack of specific, measurable targets. This may be because identifying and agreeing such targets is difficult but it may also be the sign of reluctance to come to grips with the issue.

The dialogue in Australia regarding sustainable development has proceeded in parallel with international developments and a brief background of general and business progress in Australia regarding sustainable development is outlined below.

1.5 Background: Sustainable Development in Australia

The Australian economy and its industry structure have developed in response to a wide range of cultural, social, environmental and economic issues. These issues include its large landmass, high mineral wealth, widely distributed centres of population and the relatively small overall population, compared to other developed nations. Australia has had a strong dependence on primary production and its mineral wealth has increased the importance of mining exports of raw materials and a domestic dependence on a carbon economy. Recent impacts of globalisation and the highly competitive international markets for commodities have further shaped the business demographics and means that Australia depends heavily on a large number of very small businesses for its well being and development (Fagan and Webber 1999; Hamilton, Schlegelmilch, *et al.* 2000; Krockenberger, Kinnade, *et al.* 2000). A large percentage of employment in Australia is provided by firms of less than 200 people (Australian Bureau of Statistics 2001d).

Unfortunately, small to medium enterprises (SMEs) are not well placed to research and develop responses to concepts such as sustainable development because there focus is necessarily on business survival and the bottom line. In view of this it is important that tools to measure contributions to sustainable development are made available to all companies, especially SMEs, in order to provide visibility of progress towards sustainable development. It seems unlikely to be beneficial to the progress of sustainable development if the very nature of the tools required for its introduction further increased the market advantage of MNCs and further disadvantaged SMEs. This provides a particular reason in an Australian setting as to why accessibility to

tools for measuring enterprise performance in sustainable development is important. This is in addition to the global need for such a tool arising from the increased marketisation of the world population referenced earlier in this chapter.

Over time, the approach being adapted by the Commonwealth Government in Australia to sustainable development appears to be markedly different to other jurisdictions and the differences between Australia, Canada and the United Kingdom are briefly reviewed. The Australian approach has a strong emphasis on diffusion to community-based groups and almost no specific administrative or institutional support (Dovers 2001). In particular there is a concern, given the importance of SMEs to the Australian economy, about regulating business activity to any greater extent. Recent Australian governments have generally been concerned to maintain the business licence to operate due to concerns that any greater regulation may affect employment levels (Dovers 2000; Hamilton, Schlegelmilch *et al.* 2000; Hockey (MP) 2001).

This difference has become accentuated since the original National Strategy for Ecologically Sustainable Development (NSESD) was brought together in 1992. This strategy was the product of extensive consultation through a number of high level coordinating mechanisms involving Commonwealth and State governments and incorporated input from groups with diverse knowledge and skills (Environment Australia 1992). Over time, the Commonwealth's general emphasis on conventional economic growth and the characteristics of the Australian continent and its approach to business have compounded to create a specific implementation style on the Australian continent (Dovers 2001). Whilst the literature contains no formal typologies for characterising national sustainable development strategies, the comparison with other like jurisdictions is marked.

In Canada there has been a specific move to establish legislative obligations in relation to the operation and performance reporting of sustainable development for public sector organisations, as well as the establishment of a specific administrative body to oversight this task (Bouder 2001). In the United Kingdom, there is a stronger emphasis on a national integrated strategy for sustainable development with specific targets and preferred outcomes established for key aspects of sustainable development

(Medhurst 2001). Both of these indications are absent at the commonwealth level in Australia.

There is however, recent evidence that some Australian state governments are moving towards a more formal recognition of sustainable development within the institutions of government and in the manner of community engagement and participation (State Government of Tasmania 2001; State Government of Victoria 2001). Of course it is too early in the development of sustainable development in a public policy setting to determine what approaches will prove most effective in the long run; however, the difficulties being encountered in Australia to resolve long term social and environmental issues and the reluctance to implement some of the more conventional recommendations regarding the recognition of environmental goods are strong indicators that all types of Australian governments will be reluctant to constrain the licence to operate for business (Dovers 2000; Hamilton, Schlegelmilch *et al*. 2000).

Within this context, sustainable development is referenced in over 140 pieces of Australian legislation and is clearly supported by key industry groups and corporate leaders (Burritt 2002; Dovers 2001;Krockenberger, Kinrade *et al.* 2000;). Most importantly however, whilst implementation of sustainable development is problematic, it would appear that the implications of sustainable development across business are not well understood. According to a report (cited in Arbouw 2001) from the Corporate Citizenship Research Unit at Deakin University, there is still some way to go to get corporate Australia to fully appreciate the implications of the licence to operate. The survey of corporate Australia, partially sponsored by Australian Institute of Company Directors, points to a considerable level of confusion in the business community as to what corporate citizenship means. The report contends that often corporate citizenship is equated to corporate philanthropy and that a company earns its licence to operate in the community through its good deeds. According to Birch (cited in Arbouw 2001, p15) who headed up the survey, the results suggest that *'...there was little understanding of how to make a triple bottom line approach work'*. Also, as set out below, it does not appear as though aspects of a sustainable development approach are being applied widely.

This is reflected in the fact that of some 989,000 private businesses and government trading entities in Australia, up to mid 2001, only -

- 432 of these had joined the Greenhouse Challenge, which is heavily subsidized by the Australian Government (Australian Greenhouse Office 2001)
- 80 companies had prepared public environmental reports (Environment Australia 2001)
- 12 Australian companies had been included in the Dow Jones Group Sustainability Index (Dow Jones Group and Sustainable Asset Management 2001)
- 2 companies had received international recognition for their 'reporting' performance in regard to the triple bottom line (SustainAbility Ltd. and UNEP 2000)

Overall, the information highlights the very limited application and reporting of sustainable development in the vast majority of Australian businesses. This, together with the confusion about the implications of corporate citizenship, is further insight into the Australian setting. This is contrasted against the background of the global factors reviewed above, which highlighted the importance of business making a positive contribution to sustainable development. With this in view, it is proposed to consider in more detail, the research problem covered by this dissertation.

1.6 Research Problem

It is an overarching goal of sustainable development that the key components operate in concert, so that the impact of one does not preclude the achievement of another. For example, economic development must not preclude the conservation of biodiversity and ecosystems. There is a matching process, implicit in sustainable development that requires, in this example, the size of the economy in a particular region or nation to match the size of the natural resources and eco system services available to this area. This is more fully explained by Daly (1991) who, along with others (Trainer 1998), has serious reservations as to whether the approach to sustainable development envisaged in the 1987 report by the WCED would meet this precondition.

Daly (1991) suggests that the 'trickle down' nature of development proposed by the WCED would require a world with substantially more natural resources and would inevitably result in a mis-match between economic activity and the environment. The trickle down approach to economic development posits that more economic development (not less) is actually needed so that benefits trickle down to the poor. To achieve the desired result, Daly (1991) contends that the scale of development would be beyond the carrying capacity of the world's resources and Trainer (1998) contends that it would result in reduced opportunities for future generations.

This matching of both physical and temporal scales is an important distinguishing feature of contemporary sustainable development thinking. So, for example, if the size of the economy is not matched in the present to the size of available resources and if the size of the opportunities available to those in the present is not matched to the opportunities for those in future generations, then sustainable development is not achieved.

Also, because sustainable development applies to multiple institutions (for example - government, business and civil society) and the associated planning draws on multiple areas of knowledge (for example - economics, social engagement, environmental science and governance) another distinguishing feature of sustainable development thinking, is the notion of linking. Sustainable development thinking must link multiple areas of knowledge and multiple institutions if it is to be ultimately successful. The application of the multiple functions of matching (physical and temporal scales) and linking (areas of knowledge and institutions) through a single concept such as sustainable development requires considerable re-shaping of modern approaches to human development processes (Spangenberg 2001).

Sustainable development is an emerging concept that has not yet been fully articulated. Concepts, especially complex ones such as this, develop through complex, iterative and dynamic processes (Foucault 1970; Deleuze and Guattari 1994). This work is a contribution to that part of this process associated with the improved understanding of how to most effectively report and measure business contribution to sustainable development. The application of sustainable development to business management is problematic because sustainable development is more easily applied

within geographical boundaries compared to institutional boundaries, such as a business. The expectations of a business, within current corporate governance arrangements, to maximise financial outcomes for shareholders also adds difficulties for the business manager in considering sustainable development (Dunlop 2000).

The relationship between sustainable development and a single business entity is not fully understood, either in practice or theory (Atkinson 2000; Deegan 1999a; Elkington 1999). This is because sustainable development is a broad ranging concept, which operates in relation to natural or physical scales; whereas a firm is an entity which operates only within institutional boundaries and whose operations are not limited to one physical location. Even if a firm has only one office or factory, by the very nature of business activity, its operations extend beyond that one location.

This has prompted recent efforts to shift to describing (and measuring) company efforts in relation to sustainable development as being 'contributions' to sustainable development. This is different to the measurement task at the national level where the measurement task is to decide whether the aggregation of all activity within the nation constitutes sustainable development or not. Because one company's 'sustainable development' cannot be measured in isolation to all other participants in the national economy, the emphasis for measuring business activity in this area has moved to determining whether the company's contribution (the effect of its social environmental and economic activities) has been a plus or a minus on the nation's tally sheet (Atkinson 2000; Deegan 1999a; Tyteca, Carlens *et al.* 2002). This requires the measurement of business contributions to the economic, social and environmental dimensions (known as the three pillars) of sustainable development and this in turn, requires expanded measures of company performance to be developed (Deegan 1999a; Figge, Hahn *et al.* 2002).

As noted above, the push for improving measurement of contribution to sustainable development is arising, at least in part, from stakeholder awareness and criticism of business in relation to the use of economic, social and environmental resources (Stigson 1999). Business people see the potential for their operations to be more highly regulated by increased governance arrangements unless they are able to demonstrate some contributions to sustainable development (Reinhardt 1999).

1.7 Objectives and Approach of the Study

There are claims about superior company performance being associated with the application of sustainable development techniques to business operations (Lagan 2001; Manning and Wade 2001; Donovan 2002). This is against the background of conventional economic theory that suggests that taking account of externalities always increases costs (Fiksel 1996; Wagner 2001). However, in Australia, there have been only limited efforts to measure 'contribution' of Australian industries and business to sustainable development (Environment Australia 2001). The primary objectives of this research are to establish a comprehensive method of measuring business contribution to sustainable development and to assess (using that new method) whether firms that have been recognised for making a contribution to sustainable development are in fact doing so.

These broad objectives will be achieved by:

1. Developing a more complete method of measurement of business contributions to sustainable development from an analysis of recent developments in the theoretical basis for measuring contributions to sustainable development

2. Assessing the economic performance of two groups (portfolios) of selected Australian companies with a view to discerning differences in performance between the two groups. Portfolio A comprises companies that form part of a portfolio of Australian companies recognised (by inclusion in an existing investment portfolio) for superior performance in relation to sustainability. Portfolio B comprises other Australian companies that have not been included in the selected investment portfolio. Each portfolio contains companies from a range of industries and the period of review is from 1992 to 2001.

   In summary this latter objective is to be achieved through model portfolio analysis and the question and hypothesis that relate to this objective are as follows:

   Question One: "Are there material differences in the economic performance of firms that have been recognised for contribution to sustainable development and those firms that have not been so recognised?"

Hypothesis One: There will be no difference in the performance of the two portfolios.

3. Assessing the performance of a pair of selected Australian companies from one sector, in this case, the mining industry, with a view to discerning differences in performance between each company in relation to contribution to sustainable development. One of the pair has been recognised for superior sustainability performance and is part of Portfolio A mentioned above. The other company in the pair is from Portfolio B. Each of the three pillars of sustainable development for each company is compared, as well as the overall contribution to sustainable development.

   The mining sector has been selected because it represents a good example of the tensions in the growth versus conservation debate as well as highlighting the focus of companies to retain their licence to operate. This is an industry that involves removing materials from the earth at the same time as causing some damage to the natural environment. Companies in this industry have been keen to demonstrate their commitment to sustainable development as evidenced by the relatively high number of companies in this sector which have prepared public environment reports (Environment Australia 2001). The period of review, in this case, is from 1995 to 2001.

   In summary this objective is to be achieved through case study analysis and the question and hypothesis that relate to this objective are as follows:

   Question Two: "Are there material differences in the contribution to sustainable development of a firm that has been recognised for contribution to sustainable development and a firm, in a similar industry, which has not been so recognised?"

   Hypothesis Two: There will be no difference in the performance of the two firms.

4. Applying the preferred method of measuring contribution to sustainable development to five industry groupings to provide a context and benchmark for reviewing the performance of firms within these industry groupings. This industry

level data provides additional information for comparison with the individual businesses studied in 2 above and provides an early indication of comparative industry performance (in relation to sustainable development) in an Australian setting. The three dimensions of sustainable development are reviewed and this industry information is available for the period from 1994 to 1998.

In summary this objective is to be achieved through industry analysis and the question and hypothesis related to this objective are as follows:

Question Three: "Are selected Australian industries making an increasing contribution to sustainable development?"

Hypothesis Three: Selected Australian industries are not making an increasing contribution to sustainable development.

The approach, questions and hypotheses are designed to achieve the research objectives within the known limitations. The limitations and overall scope of the research are outlined in the next section.

1.8 Scope and Limitations

As noted above, knowledge and articulation of the whole notion of sustainable development in relation to business is far from complete and agreement on definitions and approaches is limited (Veleva and Ellenbecker 2000). This research seeks to contribute in the area of business management but draws from other bodies of knowledge in relation to economics, environmental economics, business accounting, statistics and the social sciences. Business administration is necessarily eclectic in its approach, given the diversity of business circumstances, the multiplicity of operations in any one business and the changing social and political settings in which it is applied.

The complex, early nature of the research problem, together with the nature of business administration, has had a strong influence on the specific structure employed for this report. This structure is explained further in the next section. Also, because work in the area of business contribution to sustainable development is preliminary, a glossary of terms covering sustainable development and business performance measurement is included at page XV of this dissertation.

The research is limited in scope because of the difficulty in obtaining empirical information regarding the operation of individual businesses and industry groupings in relation to specific items that are required to comprehensively measure business contribution to sustainable development. The information required for this study involves economic, social and environmental data. However, information in the social and environmental pillars is not easily obtained. For example, few firms in Australia measure their greenhouse gas emissions and it is one of the easier impacts to estimate. Even information on the numbers of employees working for individual businesses is not readily available for companies listed on the Australian Stock Exchange during the 1990s. To reduce the impact of this limitation this research reviews three different business settings, as outlined above. By doing this and aligning the type and extent of data with the relevant pillar of sustainable development, this research is able to establish a broad, preliminary perspective on business contribution to sustainable development in Australia.

Further, the limitation of constructing a method designed to measure business contribution to sustainable development based only on those items of measure which are publicly available from existing reporting mechanisms is at risk, at least in part to questions of validity. In fact it has already been noted that there are reservations about the extent to which firms which are putatively making increased contributions to sustainable are in fact doing so. As well, it is contended that some of the existing methods are not sufficiently complete so as to reflect a reasonable measure of contribution to sustainable development.

This research takes three specific actions to mitigate concerns regarding validity. First, the method proposed in this research, the BSDI, is subjected to simple tests of ‘scope’ and ‘function’ against the established building blocks and core functions ascribed to sustainable development at the broader level. In this way, this research seeks to limit the risk of key aspects of the broader implications of sustainable development being omitted in translation to the business setting.

Second, the BSDI is constructed to provide for additional data items if and when they become readily available. This approach borrows from the method employed by the Human Development Index (HDI) (Streeten 1995) that allows for both data rich and

data poor nations to be compared at the primary level of the index. However, for those countries which have additional data, this can be incorporated into secondary and tertiary sub indexes which comprise the overall HDI. In the case of the BSDI the sub indexes provide for the incorporation of additional data at secondary and tertiary levels once firms or industries are able to readily provide the additional data.

As an example, the BSDI currently uses greenhouse gas emissions as the primary level environmental data. This in and of itself is not the only factor which gives a full picture of a firm's contribution to the environmental pillar of sustainable development. It happens to be however, the only data more widely available across firms and industries at present. In future, it may be possible to also obtain additional information on other key emissions, waste and also in relation to energy usage and resource consumption. All these items would enrich the picture and enhance the assessment of the firm's performance in relation to the environmental pillar of sustainable development and can be accommodated by the tiered approach in the BSDI.

Third, this research reviews the specific data items used in other like research projects to assess the most appropriate available data proxies for each particular pillar of sustainable development (Atkinson 2000;Tyteca, Carlens *et al.* 2002;Wagner 2001). In this way the experience from other research projects is used to inform the data proxies specifically selected when populating the BSDI in an Australian setting.

1.9 Outline of the report

This report comprises six Chapters. Chapter Two provides a context for better understanding the implications of sustainable development in a business setting by considering the 'scope', 'functions' and 'approaches' to sustainable development from both general and business perspectives. Chapter Three focuses on the issues and problems of implementing sustainable development. In so doing, it surveys current general and business approaches to the measurement of sustainable development and identifies initiatives which are most likely to inform a more complete method of measurement for business. As well a more complete approach for viewing the business application of sustainable development and on improving the method for

measuring business contributions to sustainable development is developed. This method is called the Business Sustainable Development Index (BSDI) and it aims to more completely reflect broad notions of sustainable development and to perform the 'matching' and 'linking' functions required of a comprehensive SD measurement tool for business.

The first part of Chapter Four comprises a review of techniques used by others in related research and important information about the most appropriate data items for populating the BSDI is identified. The final section of this chapter sets out how the BSDI is to be applied in three Australian business settings. The three types of analysis to be employed are portfolio analysis, case study analysis and industry analysis and the statistical techniques, sampling and population, variables and limitations of the methodology are discussed.

Chapter Five covers the analysis of collected data using appropriate statistical methods and the presentation of key findings in charts and tables. As noted above three types of analysis are undertaken. The portfolio analysis comprises fifty six companies from the Top 500 (by capitalisation) of the Australian Stock Exchange. Half of these companies have been selected for inclusion in an Australian portfolio called the 'Sustainability Leaders Australia Fund' (Manning and Wade 2001). The other half were from the Top 500 but not included in this sustainability portfolio. The 'economic' dimension of Business Sustainable Development Index (BSDI) of the two groups is compared over 10 years in an endeavour to discern any trends and any differences.

The case study analysis explores the Business Sustainable Development Index (BSDI) performance of a pair of companies over six years. Both companies are from the mining industry and one of the companies has been recognised in the international Dow Jones Sustainability Index,(Dow Jones Group and Sustainable Asset Management 2001) with the other firm in the pair not being included in this index. Each of the economic, social, environmental and overall dimensions of sustainable development are reviewed year by year and compared for trends and differences. The industry analysis comprises five industries for which it has been possible to obtain sufficient data to construct an Industry Sustainable Development Index (ISDI) for a

period of four years. One of the industry groups is mining and this allows some cross analysis of results from the preceding setting.

Chapter Six sets out the conclusions from this analysis and also crystallises the key contributions of this research, in both method and application, to measuring business contribution to sustainable development. In addition, conclusions are also drawn about the relevance of the research to policy, practice and future research into measuring business contribution to sustainable development.

1.10 Conclusion

The contemporary tensions in the growth versus conservation debate, arising from concerns about the level of industrial progress during the second half of the twentieth century, are evident in the underlying themes and concepts of sustainable development. The notion of sustainable development has been emerging for some two decades at the broad scale. At least some aspects of this concept are now influencing the management of business; however, business techniques for measuring contributions to sustainable development are emerging but are not yet complete. There is the potential that some key concepts from the broader notions of sustainable development are not being countenanced by applied methods in business. Therefore, this research initially seeks to establish a framework for understanding sustainable development at the business level, with the objective of being able to make comparative assessments of individual business contributions to sustainable development.

To do this a Business Sustainable Development Index (BSDI) will be developed so as to analyse the comparative performance of portfolios of multiple businesses, individual businesses and industry groupings. From a business manager's perspective, the challenge in dealing with broader issues such as sustainable development lies in balancing the tensions between the current expectations of business, from a corporate governance perspective, and the potentially competing demands of making a contribution to sustainable development. Part of the benefit of the preferred index approach lies in being able to use it in situations where there are different levels of data. This would allow businesses of all sizes to participate and compare results in relation to sustainable development. This would lead to greater understandings across

business and industry as to how business is able to most effectively contribute to sustainable development. Given the importance and scale of business activity in contemporary life, such an outcome is likely to increase the likelihood of overall, global sustainability.

2 SCOPE, FUNCTIONS AND APPROACHES TO SUSTAINABLE DEVELOPMENT

2.1 Introduction

The focus of this chapter is to review sustainable development in relation to its scope and functions, as well as approaches to its implementation. The first section considers the scope of sustainable development by reviewing the themes and concepts which underpin the contemporary view of sustainable development. It is not possible to apply sustainable development thinking by simply using the broad statements included in Chapter One (Bennett 2001). Consequently the first section of this chapter goes 'behind' the general statements reviewed earlier and considers in some detail the building blocks of contemporary sustainability and sustainable development. This is important if the method to be developed in this research is it to meet the test of completeness.

The second section considers the functions of sustainable development in an endeavour to better understand what makes it different to other broad ranging concepts. It was noted in Chapter One that sustainable development involves the functions of 'matching' and 'linking'. A better understanding of these functions is needed if company reporting and measurement of sustainable development is to support empirical comparative analysis, which is an objective of this dissertation.

The third section of this chapter then reviews key approaches to sustainable development to determine which of these will be most suitable in informing an improved method for measuring and comparing business contribution to sustainable development. As noted in Chapter One, sustainable development is difficult to implement and there have been a range of developments that endeavour to make it easier to implement. A review of these major approaches is undertaken in this last section as a precursor to determining the most appropriate approach for improving the measurement of business contribution to sustainable development.

2.2 The General Scope of Sustainable Development

The descriptive statements on sustainability and sustainable development outlined in Chapter One are inadequate for the full purposes of this research. Confronted with a similar issue when considering the translation of sustainability into policy, Bennett (2001) contended that these statements needed to be converted into 'operating principles' and he proposed that the operating principles for sustainable development are:

- intergenerational and intragenerational equity
- precautionary principle
- conservation of biological diversity
- internationalisation of environmental costs.

There are many different views on what constitutes the core operating principles of sustainable development and some of these views will be considered further in the last section of this chapter. However, given that an objective of this research is to translate general views of sustainability into a comparative measurement methodology it is considered necessary to undertake a more detailed breakdown of sustainable development, below the level of operating principles.

There are a number of underlying themes and concepts which are considered to be the building blocks of contemporary versions of sustainable development and its operating principles. These themes and concepts are drawn from the sustainable development literature (Costanza *et al.* 2000; Costanza and Wainger 1991; Costanza and Wainger 1993; Daly 1991; Faucheux and Muir 1997; OECD 2001; Pearce 2002; Spangenberg 2001; Stern 1997) and are set out in Table 2-1 below. A description of the manner in which they have evolved and at the same time shaped, the contemporary emergence of sustainable development, follows. These building blocks will be used later in this research to assess the completeness of different approaches to sustainable development.

Table 2-1: Themes and Concepts Underlying Sustainable Development

1. Resource Management	2. Growth
3. Consumption	4. Biodiversity
5. Pollution	6. Equity
7. Property Rights	8. Risk
9. Community Participation	

Some of these themes and concepts are readily identifiable in descriptions of sustainable development e.g. biodiversity, whilst are others are less obvious e.g. property rights and risk. The review that follows seeks to explain and link these building blocks to the general sustainable development debate.

1. Resource management: The focus of some governments and some businesses has moved from efficiency of use and the continuity of supply of raw materials to a broader cost benefit approach incorporating expanded forms of valuation and impact analysis (Pearce 2002). An expanded approach now encompasses the three pillars that support sustainable development (namely, social, environmental and economic issues). To enable this broader analysis to be undertaken, it has been necessary to expand methods of valuation to go beyond the value of specific resources, such as coal or iron ore, and to incorporate non market items which may be affected by the removal of the raw material. These items may be non market goods such as air and water, or may include losses of amenity attributable to individuals or communities (Mourato 1998).

   These non market goods have prompted new methods of valuation to incorporate assessments of willingness to pay and the new valuation methods have been used in the settlement of major environmental accidents (Duffield 1997; Mourato 1998). However, there is criticism of the appropriateness of these methods in that they reflect an anthropocentric perspective of many natural assets and overestimate the rate at which those natural assets may be consumed (Costanza 2001). In so doing, such monetisation of non market goods may in fact lead to the entrenchment of higher risk and unsustainable practices if the prices are not appropriate (Stern 1997). This issue of setting prices for environmental assets is considered further in Chapter Three, when the capital theory perspective is

analysed. However, contemporary resource management involving expanded impact analysis and the application of new methods of valuation are at the core of efforts to measure sustainable development (Pearce 2002).

2. Growth: Constraints to economic activity were not generally considered at the beginning of the twentieth century. Each period or season was seen as a continuation of the past and efforts to increase production and consumption were recognised as adding to man's progress. Economic growth models were only concerned with a single non depletable resource base; consequently limits to ongoing increases in such growth were not linked to the capacity of the earth (Stern 1997). Whilst there are still arguments about the nature and extent of such constraints and the earth's capacity, there is a large body of thinking now associated with concepts such as 'space ship earth' and 'limits to growth'(Lovins, von Weizshcker and Lovins 1997; Pearce 2002).

   These perspectives assume there are limits to how much man is able to take from the earth and to use these takings as part of man's economic development. Conventional economic growth models did not initially include natural resources as a constraint. During the 1970's economic models were developed which incorporated single depletable resource bases (representing the aggregate wealth of the earth's resources) and in the 1990's economic modelling showed that an unconstrained market system, with no externalities, will inevitably result in declining levels of economic welfare (Faucheux and Muir 1997). The new approach to growth incorporating social and quality of life issues (and the replacement of growth with development in sustainable development) is strongly linked to the need for matching the type and level of human activity with the available resources (Costanza 2001;Daly 1991; Trainer 1998).

3. Consumption: In a world when resources were considered to be non depletable, there were few reasons for limiting consumption. According to conventional economic analysis, in a similar way to thinking about growth, all consumption was considered to be beneficial. Now there is much debate about appropriate consumption levels, building on a notion that consumption levels should not deplete capital stocks (Faucheux and Muir 1997; Pearce 2002). As well, there is

concern that levels of consumption associated with the developed world are not achievable for all of the world's population and that current levels of consumption may in fact limit the choices of future generations through the depletion of natural resources and eco systems services (Beder 2000).

4. Biodiversity: Human concern for maintaining some balance between man's needs and preserving 'natural places' was apparent over many centuries. The current thinking is now exploring the extent to which anthropocentric concerns for biodiversity are sufficient to provide the basis for sustainability (Daly 1995). Further, it is also likely that biodiversity builds resilience against severe events and that this capacity is linked to the relative scale of human and natural systems. The larger the economy becomes relative to the natural resources and eco system services, the less capable these assets are of buffeting shocks such as natural disasters or man made failure (Costanza and Wainger 1993).

5. Pollution: The by-products of production were not considered to be sufficiently important in the early part of the twentieth century to warrant active consideration in the economic and production processes. These by-products were often externalities; being costs to society or a person arising from the actions of another (Mourato 1998). The recognition of the detrimental impact of modern industrial processes has resulted in the application of thinking about 'externalities' to a wide number of policy settings including the introduction of allowable limits, polluter pays and trading permits to control the level of pollution Pearce 2002).

   The thrust of these initiatives has essentially been to internalise an externality and this has prompted action, by companies especially, to reduce waste at all points in the life cycle of products. This has in turn prompted thinking in industrial ecology to explore 'closed loop' manufacturing, the aim of which would be to reduce waste to zero ((Ayres, Ferrer and Van Leynseele 1997; DeSimone and Popoff 1997; Fussler and James 1996; Hawken, Lovins *et al.* 1999).

6. Equity: In sustainable development, issues regarding gender and race have been amplified but as well, the notions of intragenerational and intergenerational equity have expanded the ramifications of equity (Weiss 1992). Intragenerational equity

is concerned with not only equality within nations and peoples but also across national boundaries (Beder 2000). Intergenerational equity is closely linked to the recognition that the habits of the present generation have the potential to pass a debt onto the next generation. This debt may be in the form of depleted natural resources, conventional economic debt or inadequate social structures to support well being (O'Riordan 1998). This is being highlighted through trans national employment by MNCs and the different employment conditions pertaining between countries (Deegan 1999b; Dow Chemicals 2000, Global Reporting Initiative 2000)

7. Property rights: When the scale of human activity was smaller, there appeared to be no reason to consider the need to control the use of non market goods such as air and water and property rights operated as the basis of managing individuals' goods. There is now growing competition for non market goods and the nature of market goods has moved dramatically from physical to intangible and intellectual (Czechowicz 2000). The vital and very large contribution of biophysical (non market) services to human well being has been clearly recognised (Hamilton, Schlegelmilch *et al.* 2000) and at the same time the potential threat through overuse of such non market services has been identified (Hardin 1996).

   A response preferred by some authorities is to expand the application of individual property rights to cover non market resources. On the other hand the use of property rights, by multi-national corporations (MNCs) especially, over intangible assets has the potential to limit the availability of resources to poor people and undeveloped nations. There is pressure for increased government regulation on one hand whilst business is seeking to retain the benefits of its licence to operate, as well as increasing the use of intellectual property rights to increase returns (Reinhardt 1999). Trainer (1998) has noted the reduction in prices for primary products (from developing nations) at the same time as the prices for those products are rising (in developed nations) through the application of marketing, branding and licensing techniques.

8. Risk: Risk was previously a much simpler issue with the scale of both the action and the risk being of the same order. For example, local action used only to create

the potential for local risk. The potency of industrial processes and technology now means that, unchecked, some local processes can lead to impacts on a larger scale and at considerable distance (Aplin *et al.* 1999; Duffield 1997). In response, notions such as the precautionary principle are seeking to ensure that the costs and the benefits, at different scales, are recognised (Diesendorf 1999). The precautionary principle is an approach that commends decision-makers to err on the side of environmental preservation when the extent of expected damage to the environment is uncertain (Burritt and Welch 1997). Improved scientific capacity to identify and monitor physical impacts has also heightened interest and awareness in the risks associated with many putatively innocuous actions (Higgins and Venning 2001). The implications of the precautionary principle and the capacity for firms to introduce new technologies that create both social and environmental issues has then influenced business approaches to both risk assessment and community engagement (Elkington 1999; Stigson 1999).

9. Community Participation: Whilst western democracies have long held that broad community participation was desirable, this often did not extend to specific decisions or projects. The current dialogue has been prompted in the context of questioning the capacity of regional, national and international institutions (including big business) to deal with issues at a local level (Beder 1997). Dryzek (1997) refers to this as the crisis of 'administrative rationalism' and sees that there are five dimensions of 'democratic pragmatism' which constitute efforts at enhanced community participation. They are:
    a. public consultation
    b. alternative dispute resolution
    c. policy dialogue
    d. public inquiries
    e. right to know legislation.

These dimension of participation are in response to the backlash against the consequences of actions taken at higher institutional levels or scales and a questioning of who actually benefits from actions initiated at these higher levels. This is particularly so for development programs that have occurred in poor nations but is also a significant issue in governance within developed nations. In summary, current thinking in community participation is seeking to expand the mechanisms through

which local communities can specifically influence and shape development by government and business (Salvaris 2000).

In summary, these themes and concepts have evolved considerably during the second half of the twentieth century and the evolution of thinking in each of these areas has underpinned the contemporary notions of sustainable development and its impact on business. In addition to these nine general building blocks of sustainable development there are certain themes and concepts specific to business which have emerged in the latter part of the twentieth century which have significantly influenced and shaped the implications of sustainable development for business. These are considered in the next section.

2.3 The Business Scope of Sustainable Development

There are a further three important issues, in addition to the general ones reviewed in the preceding section, which have been identified from the business literature on sustainable development which are specifically relevant to this research (Atkinson 2000; Burritt 2002; Deega 1999b; Dyllick and Hockerts 2002; Elkington 1999; Figge and Hahn 2002; Gray 1992; Gray and Stone 1994; Reinhardt and Vietor 1996 Welford 1997; Zadek 1999). These three themes and concepts are:

- corporate governance
- supply chain analysis
- accounting

These specific themes and concepts highlight the business specific implications of seeking to implement sustainable development.

Regarding *corporate governance*, the firm in general had somewhat privileged beginnings, having been established by royal charter. From there it extended to guilds and other organisations to allow individuals to pool their resources for the common good (Estes 1997). The privilege was eventually extended to a select group of trading companies, generally accompanied by national monopoly trading powers such as the East India Company and Hudson Bay Company. Liability for high-risk ventures acted as a brake on the willingness of investors to take part in lucrative trading undertakings. Britain was the first country to recognise this impediment to future development and so, by inventing the ability of merchants to limit their liability for

high-risk ventures such as trade, it encouraged the continued expansion of this unpredictable yet profitable area (Kiel and Nicholson 2000). Consequently business represents a specific type of institution when considering sustainable development and as such it operates in particular ways which are markedly different from civil society, governments and other institutions (International Institute of Sustainable Development 2002).

In his elucidation of the role of the firm as economic entity, Coase (1937, p.235) quoted Robertson who described firms as *'...islands of conscious power in this ocean of unconscious co-operation like lumps of butter coagulating in a pail of buttermilk'*. The contemporary interplay between the overall governance buttermilk and the corporate governance islands is well illustrated by the recent notion of 'licence to operate' (Elkington 1999;Lagan 2001; Reinhardt 1999). It is clear that MNC interest in sustainable development has been directly prompted by concerns in relation to potential limitations of this licence to operate (Dow Chemicals 2000: WMC Limited 2001). This is illustrated by an example, used by Reinhardt and Vietor (1996, p.219) in quoting the CEO of an MNC as having said- '*…we have realized that our property rights are contingent on social acceptance of our exercise of them. Our destiny is being argued at the polls, in legislatures, in the regulatory arena'*.

This interplay between business, government and society has been linked to legitimacy theory and the firm's desire to operate within the frameworks of society (Deegan 1999b). In essence, it is argued there is a contract between business and civil society and each individual business entity is expected to comply with the terms of the contract. In the context of the sustainability debate, others contend that the best governance environment for business and commerce is one that is based on people's needs, rather than those of business (Hawken, Lovins *et al.* 1999). This is a simple way of describing how to consider the issue of modifying the rules within which business operates.

On the other hand Dunlop (2000) suggests the dilemma is the extent to which corporations should even try to take a larger role in solving social or political problems. He questions whether societies would be willing to give corporations the license to accomplish those tasks and if so, how the limits of such a role would be

defined. Resolution of these issues has the potential to fundamentally alter the framework of corporate governance, with wide ranging impact on the law, accounting standards and taxation.

In practice however, existing governance obligations simply require firms to operate within the law of the relevant jurisdiction in which they operate and corporate governance obligations require company directors to operate only in the best interests of the firm's direct shareholders (Estes 1997; Kiel and Nicholson 2000). Disclosing information and taking action which is not specifically directed to shareholders is problematic (Foster 2000). Hence, there is a strong incentive for firms to adopt a narrow view of sustainable development. At the same time, given the hegemony of markets, governments, especially in the developed world, have been reluctant to substantially expand the obligations of companies for fear of 'capital flight' (Leveson-Gower 1997).

As a result, Leveson-Gower (1997) considers that governments and business are involved in a 'race to the bottom'. This race includes avoiding the early adoption of laws and regulations to moderate resource consumption, not requiring greater improvements in the treatment of wastes and emissions, as well as providing taxation and other financial incentives (to MNCs) which are not necessarily available to SMEs (Hamilton, Schlegelmilch *et al.* 2000; Beder 1997). It is for these reasons that it does not seem likely that significant formal changes to corporate governance, to better support sustainable development, will occur. Progressive, incremental approaches seem more likely in response to specific problems or issues. This is especially apparent in the slow expansion of environmental markets and management obligations in some developed nations (Bagshaw 1999; Gibson 2000; Hamilton, Schlegelmilch *et al.* 2000).

Regarding *supply chain analysis*; this is a business sequel to the key concept of resource management identified in the nine general themes and concepts reviewed above. Just as the original intent of resource management was related to continuity and availability of suitable raw materials, supply chain analysis and management for business was originally aimed at ensuring that business had access to smooth, continuous supplies of inputs at good prices (Beamon 1999; Elkington 1999; Pearce

2000). This was further refined to incorporate outsourcing of non core functions, moving some functions to developing countries, as well as further improving supplier relationships by 'just in time' methods and the deployment of shared business systems for enhanced inventory and tracking management (Beaumont 1993; Kinlaw 1993). As a result of the implications of increased community scrutiny of the actions of companies (especially MNCs) along their supply chains, companies are increasingly being held accountable for the quality of their management of sub contractors, of their approach to sourcing raw materials and of their treatment of workers in both developed and undeveloped countries when they are a part of the production process (Beamon 1999; Elkington 1999; Fiksel 1996). In many cases these workers are not employed directly by the MNC but it is expected that the MNC will ensure suitable working conditions are provided, as part of the company's 'licence to operate'.

This expansion of obligations beyond the factory gate runs in parallel with the expansion of intangible assets through licences and patents held by companies in developed nations (as noted above under the stimuli for business interest in sustainable development) (Beder 1997; Czechowicz 2000;). This has seen the outsourcing of many factors of production to lower wage environments in an endeavour to increase competitiveness and expand profits (Beamon 1999). These issues are synthesising to expand notions of corporate social responsibility and leading business to more fully understand the need to manage many issues beyond the factory gate (Nestor 2001). These impacts are not however, restricted to businesses that manufacture physical products but also apply to service businesses. As well the issues are not restricted to just the supply side of business administration.

There is a concomitant expansion of responsibilities on the consumer side of the supply chain. The implications for business are expanded responsibilities for what happens to their products, not only in the hands of the consumer but also, when it comes to the end of its economic life. Reinhardt and Vietor (1996) give the example of Monsanto's life cycle analysis that has two components-

- Inventory of materials and energy flows

- Improved understanding of the products value in use and of the externalities, positive and negative, which arise from the products manufacture, use and ultimate disposal.

Reinhardt and Vietor (1996) note that firms are cautious about taking life cycle analysis to its logical extension; namely, to expand it to full social cost accounting. The barriers to going this far include significant costs as well as increased liability in any later litigation, as a result of firms identifying their own responsibility. In addition it is suggested that current methods of life cycle analysis and private cost assessment already deliver most of the firm's benefits. To go further would increase the tension between business management and its shareholders.

In essence, without changes to the corporate governance obligations discussed above, firms will only go so far in seeking to deal with the social and environmental obligations (along the full length of the supply chain) necessary to give effect to sustainable development. One of the drivers of the cost barrier for business arises from how firms account for their activities. Accounting is a major function and obligation for business. So, to complete this analysis of the key themes and concepts of sustainable development for business, the issue of accounting is considered further.

Traditional *accounting* practice for business involves numerous issues and conventions that have evolved over years. These go to the heart of the transaction recording process and underpin the preparation of financial accounts for businesses. Generally Accepted Accounting Principles (GAAP) cover all these issues and they are designed to match current approaches to corporate governance and conventional supply chain analysis. Namely, they are overwhelmingly concerned with what happens inside the factory gate and are not well suited to deal with obligations that go beyond that (Australian Society of CPAs 1999; Burritt 2002; Deegan 1999a; Gray 2001). The principles focus on the firm as an 'entity' and the cost, revenues, assets and liabilities are predominantly focused on the entity – not its customers, stakeholders, neighbours etc. Consequently, those firms interested in the application of sustainable development are encountering limitations at the source of enterprise data, because of the combined constraints of current corporate governance obligations and the accounting concepts and principles designed to give effect to such obligations.

These limitations are then making it very difficult to expand the application of supply chain analysis as noted above (Reinhardt 1999).

There are considerable endeavours to expand accounting conventions so as to better equip companies as governance and supply chain obligations develop (Australian Society of CPAs 1999; Kite 1995; Rivett and Jones 2000). Social accounting and full cost accounting are tools that are being developed to provide the where-withal to allow greater visibility and management of costs associated with business activity (Bagshaw 1994; Gray and Stone 1999; Gray 2001; Zadek 1999). The weight of effort in this regard appears to be directed towards MNCs which are considered to have the capacity to take advantage of these initiatives, to the potential detriment of SMEs. The complexity and cost of implementing these tools is a significant limitation when considered at the individual business level and makes it infeasible for the vast majority of SMEs.

There are other accounting initiatives which do not require the implementation of full cost accounting but can be used to measure particular aspects of business performance. Conventional 'ratio analysis' has long been used to measure key performance issues prices compared to earnings, debt compared to cash, profits compared to costs and so on (Ratnatunga and Ramano *et al.* 1993). As well, this approach has been extensively used in eco efficiency initiatives where the ratio involves both physical measures (of production, pollution or energy consumption) and monetary measures (of costs, earnings and profits) (Burritt 2002; Fussler and James 1996; DeSimone and Popoff 1997). These measures have generally been focused on some aspects of efficiency and improving marginal optimality (Day 1991).

However, in some public sectors there have been, for some time, efforts in organisations to measure and account for issues in addition to efficiency (Higgins (2001). The efficiency measures in the public sector are similar to ratio analysis in the private sector whilst the effectiveness measures seek to link the effect of organisational outcomes with the goals of an organisation (Higgins 2001). To some extent this reflects the different obligations pertaining to public sector organisations and the expectation that they are accountable for issues beyond the operation of the organisation as an entity. This is not dissimilar in general terms with the broadening

expectations of business in response to issues that come under the umbrella of corporate social responsibility, such as sustainable development.

In summary, the conventional notions of *corporate governance*, *supply chain analysis* and *accounting* are key business issues that are undergoing some considerable evolution as a result, in part, of the implications of sustainable development. To a large extent however, whilst the developments in approaches to supply chain analysis and accounting are allowing some firms to respond more effectively to changing business circumstances, the full ramification of these initiatives will not be deployed until policy initiatives expand the relatively narrow view of corporate governance currently in place in most jurisdictions in the developed world. This narrow view legally limits the obligations of business managers to the specific interests of direct shareholders and thereby limits the extent to which firms are held accountable for the flow on effect of their actions beyond the factory gate. There are progressive incremental changes in areas such as product liability, occupational health and safety and environmental responsibility; however, these do not presage any significant social or environmental responsibilities for business that would be more in keeping with notions of sustainable development.

This governance setting, in conjunction with the corporate efforts to reshape the application and meaning of sustainable development for business (as noted in Chapter One) accentuates the problematic nature of applying sustainable development to business activity. As well there is also still a gap in understanding (what this research refers to as) the 'functions' of sustainable development. These functions of sustainable development are reviewed and explained in the next section.

2.4 The Functions of Sustainable Development

It is considered that there are common inter-related functions or operations which are associated with sustainable development. To some extent these functions assist in practically distinguishing sustainable development from other concepts. These functions have been previously, briefly referred to as 'linking' and 'matching'. The specific relevance of each of these functions to sustainable development is explored below. These functions are implied in much of the literature (Costanza *et al.* 2000; Costanza and Wainger 1993; Costanza and Wainger 1991; Daly 1991; Faucheux and

Muir 1997; Stern 1997). The functions described below are the preliminary result of extensive analysis of the mostly implied, and only partially articulated, functional implications of sustainable development.

To some degree, the literature has only gone behind the requirements of sustainable development in a limited manner. There is limited articulation of the functions that are necessary to give effect to its various prescriptions. For example, it is not overly difficult to grasp the general notion of inter generational equity – it could be regarded as making sure that our children have a bright future. But what precisely would you need to do to make sure that this was the case? It is contended that it is necessary to undertake certain functions in order to give effect to this and the other components of the sustainable development challenge. These proposed 'functions' are therefore preliminary and are proposed as one of the means by which this research endeavours to establish a method for improved empirical, comparative analysis in regard to business performance of sustainable development. These functions are:

- linking the three pillars
- linking different institutions
- matching physical scales
- matching temporal scales.

Regarding the first function of *linking the three pillars*, unless multiple knowledge systems are connected the extent of sustainable development is limited (Costanza and Wainger 1993; Cocks 2003; Lowe 2001; Stern 1997). For example, if only one area of human knowledge is utilised in relation to a particular problem or a particular area, then whilst such an analysis may be very worthwhile it will not be contributing to sustainable development until it is linked with other areas of knowledge. There are many instances of scientific advancement not being connected with the social and or environmental implications of such advancement. Improvement in food production techniques is an example of a scientific advance which has not solved food shortages and hunger in the world. The consequences are that advancement in one area can sometimes have a detrimental effect on other areas when different knowledge systems are not connected. In many aspects of life in the developed world today it is the

hegemony of economics (at the expense of other knowledge systems) that is causing and stimulating much debate (Heal 1998; Pearce 2002; Stern 1997).

Regarding the second function, unless an institution's actions are designed to enhance interaction with other institutions, then the scope of sustainable development is limited (Bishop 2002; Cuthill 2002; Gleeson and Low 2000; Gray and Lawrence 2001; Salvaris 2000). If for example, a government or corporation proposes to undertake a large development project and does not fully consult with the local people affected by such a project, it is possible that the project, whilst providing certain benefits, may in fact have a highly detrimental impact on those intended to benefit from the development. There is considered to be a need for contemporary businesses to more effectively link with multiple institutions (Stigson 1999) and this may be achieved in part through the application by businesses of, and measurement of contribution towards, sustainable development.

The third function relates to matching physical scales. If the scale of one element of sustainable development (for example – the economy) in a particular locale, is not consistent with the scale of each other element (for example – the environment) in that locale, then the system within that locale is not likely to be sustainable through time (Costanza and Wainger 1993;Daly 1991;Pearce 2002). The example of the potential mis-match between global economic activity and global natural resources to support the economy has been mentioned earlier in this chapter as well as in Chapter One. The Murray Darling River System in Australia is a further, significant example. This is a major socio political problem arising from the use of the water supply from this river system caused by the economic opportunities afforded those who extract water from the system (Environment Australia 2000). As a result of this use, the continued viability of the environment is at great risk. This then influences the long-term economic viability of farming operations, established on the basis of the availability of large amounts of water from the river system. Efforts in industrial ecology (Huber 2000) aimed at zero waste and closed loop manufacturing (Hawken Lovins and Lovins 1999; Lowe 2001) are examples of business endeavours to match the physical resources used in industrial processes with the supply of the natural resources used in those processes.

Also, there is a further type of matching in relation to physical scales, which is more subtle but still important. This matching of physical scales relates to sub components within a larger system (Cocks 1999; Costanza and Wainger 1993; Lowe 2001). For example, there may be several regions within one state or territory. If there are significant variations between the levels of development in one region compared to another, then there is likely to be some level of intragenerational inequity. The South East Queensland region in the State of Queensland provides a good example (SEQ 2021). Growth in the region is very high and there are considerable employment opportunities as well as access to public services afforded to those who live in this region compared to less populous areas of the state. Consequently, constituents in the less populous areas complain of less employment opportunities through less investment and so on (Gray and Lawrence 2001; Rocky Mountain Institute 2002). A sustainable State, in this case Queensland, would most likely ensure that the development in one region did not imbalance and disadvantage other regions.

The fourth function of sustainable development relates to matching temporal scales. Some actions are measured in milliseconds and others take hundreds and thousands of years. Sustainable development in its fullest sense requires us to make the connection and understand the impacts between these widely divergent temporal scales within a specific physical area (Commonwealth of Australia 2002; Faucheux and Muir 1997; O'Riordan 1998; Spangenberg 2001; Weiss 1992). This is particularly problematic when there is a big difference between say, natural cycles which may take many years and day-to-day human activities. Stocking levels of pastoral properties in Australia, subject to major climatic variations through time, are an example of the need to match temporal scales within a particular locale. If a property is consistently stocked at the peak carrying capacity of the land it is likely that the land will degrade during less fertile times (Environment Australia 2000; Gray and Lawrence 2001). Also, there is a further level of temporal matching and that is between present and future times. A simple example is provided by over consumption by one generation (in the present) that leaves the next generation (in the future) without access to particular assets. The recent intergenerational report by the Commonwealth Government of Australia (2002) put forward the view that unless current generations paid a more accurate price for some commodities the future tax burden (and government debt levels) would be too great for future generations.

In the same way that these four actions distinguish sustainable development from other types of development, these functions can also be used to distinguish the methods and procedures used to implement sustainable development from those used for other purposes. For example, cost benefit analysis (CBA) was developed prior to contemporary notions of sustainable development (Gilpin 1996; Pearce 2002). Initially, therefore, there was only one dimension of analysis, namely - economic. A sustainable development oriented cost benefit analysis (CBA_{-sd}) would incorporate social and environmental dimensions as well. In so doing the sustainable development version of cost benefit analysis would seek to perform a wider or broader range of functions. Using the nomenclature of linking and matching, the functions of a sustainable development oriented, cost benefit analysis would include:

1. *linking different disciplines:* this requires the three pillars of sustainable development knowledge, covering the social, environmental and economic aspects, to be utilised
2. *linking different institutions:* this requires widely based engagement and input from various relevant institutions and authorities
3. *matching different physical scales:* this requires impact assessments to be made in an endeavour to ensure that the scale of the benefits is commensurate with the scale of the costs for each of the three pillars.
4. *matching different temporal scales:* this requires accounting for past and future needs and costs. It may require different approaches to discounting future values and using advanced methods of valuation to give due regard to current and future generations.

This example highlights how particular methods can be analysed to discern the extent to which they may be appropriately called methods of sustainable development. An analysis of the literature reveals the application of a number of key methods in the deployment of sustainable development (Atkinson and Hamilton 1996; Ayres Ferrer and Van Leynseele 1997; Fiksel 1996; Fussler and James 1996; Gilpin 1996; Gray 1992; Mourato 1998; Zadek 1999). These methods, which are either new, or which have been refined from earlier versions, perform varying parts of the 'linking' and 'matching' functions described above. They include life cycle analysis, extended cost

benefit analysis, impact analysis, valuation and accounting. A novel typology for analysing these methods of sustainable development would be to classify them according to their linking and or matching functionality and to further assess the extent to which these particular functions are achieved. An objective of this research is to develop an improved method for measuring business contribution to sustainable development and this new method will be reviewed to determine the extent to which it performs these key functions of sustainable development for business.

The next section of this chapter considers the approaches which are being employed by those seeking to implement sustainable development. These approaches incorporate, to varying levels, the themes, concepts and functions reviewed above. In so doing they operate as one means of converting the general descriptions and operating principles of sustainable development into action

2.5 Approaches to Sustainable Development

Recent approaches to sustainable development have built on some initiatives which have sought to simplify the notion of sustainable development, make it more applicable, and at the same time enhance the potential for the concept to be monitored and measured. These initiatives include the:

- three pillars concept which groups all aspects of sustainable development under one of three headings viz economic, social and environmental (Figge and Hahn 2002)
- capital theory approach which works from the assumption that sustainable development requires the maintenance of capital (asset) stocks and that to be sustainable generations should live on the 'interest' from their assets (Faucheux and Muir 1997; Stern 1997)
- economic approach focusing on the allocation, distribution and scale of resources which has led to the development of widely based indexes for monitoring national sustainability (Daly 1991)

These overarching approaches have served to inform many emerging and more detailed perspectives of sustainable development and it is this body of current and emerging approaches that will be reviewed further in this section.

There are also different typologies, which could be used to classify these different approaches to sustainable development. One could apply a discipline-based typology (economic, environmental and social), an institutional typology (business, government and civic) or a geographical typology (national, regional and local). However, such approaches are too limited for this dissertation, as they do not allow a broad ranging review of relevant developments in the literature. From a review of the literature (Briassoulis 2001; Costanza and Wainger 1993; Higgins and Venning 2001; International Institute of Sustainable Development 2002; Lowe 2001; O'Riordan 1998; Veleva and Ellenbecker 2000) there are considered to be three very broadly based groupings of approaches to sustainable development that best suit the purposes of this research. These groupings are:

- definitions
- charters
- systems

The three groupings proposed are not exclusive or independent of one another. For example there are perspectives found in the systems grouping which are very close to perspectives in the definitions grouping and on first review may intuitively appear to belong there. Similar circumstances apply to the boundary between definitions and charters.

The groupings are like three adjacent areas that overlap with each other. The benefit of considering these groupings is that this provides the opportunity to understand the emphasis and particular explanatory power of the different approaches, as well as better understanding their scope to assist in measuring business contribution to sustainable development. Within each of these groupings there are numerous perspectives that reflect individual interpretations of sustainable development. Within the systems approach for example there are numerous individual perspectives such as (1) triple markets perspective developed by Figge and Hahn (2002) (2) business savings perspective developed by Atkinson (2000). These and other perspectives are considered in more detailed later in this chapter. Initially however and set out below in Table 2-2 is a summary of the primary approaches considered in this research.

Table 2-2: Summary of Approaches to Sustainable Development

Definitions Approach to Sustainable Development	This approach is focused on principles, behaviours and actions required by those in any institution of sustainable development to contribute to sustainable development. This approach is more diverse and subjective than the systems approach and is characterised by verbal descriptions, operating principles and lists of issues. An example of a specific perspective, which falls into this approach, is the Brundtland definition. (See Section 2.5.1).
Charters Approach to Sustainable Development	This approach is focused on transitional issues associated with the action plan for a specific institution to develop the capability of contributing to sustainable development. As such, it is characterised by project plans and 'to do' lists for particular institutions to improve capability for contributing to sustainable development. An example of a specific perspective, which falls into this approach, is the Bellagio Principles (See Section 2.5.2).
Systems Approach to Sustainable Development	This approach is focused on the relationships between various institutions or phases of sustainable development. The approach is strongly analytical and is characterised by the use of diagrams, flow charts and equations. An example of a specific perspective, which falls into this approach, is the Hollings Four Box Model. (See Section 2.5.3)

As noted above, within each of these groupings there are numerous perspectives that reflect individual interpretations of sustainable development. The next section explores several perspectives within each of the key approaches.

2.5.1 Definitions Approach to Sustainable Development

The definitions grouping seeks to describe verbally what constitutes sustainability and sustainable development. It is concerned with issues, principles, behaviours and outcomes and is not linked to any specific scale or institution of sustainable development. This approach seems to have been the most influential to date in the development and diffusion of information in relation to sustainable development. This is evidenced by the definition provided the WCED, which is probably, the most

widely quoted description of sustainable development in the literature. For this reason it is set out in full below.

'...Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts-

- *The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *The idea of limitations imposed by the state of technology and social organisation on the environments ability to meet present and future needs'* (WCED 1987,p.43).

Subsequent developments have sought to clarify, expand and make more explicit what is implicit in this definition. This is well illustrated by Diesendorf (1997) in his synthesis of sustainable development that is set out below:

- economic development and well being
- equity between and within generations
- conservation of biodiversity and ecosystems
- dealing cautiously with risk and uncertainty
- community participation (Diesendorf 1997)

In setting out such a synthesis, Diesendorf notes that it contains a mixture of processes, principles and preferred states. This highlights one difficulty in dealing with sustainable development. The issue of biological diversity is a preferred state of affairs whilst the precautionary principle is not a preferred end state but an expression of a preferred method for reviewing and understanding the risk and associated impacts of specific actions. Generational equity is the requirement for a particular moral or at least ethical dimension, which requires consideration for people in different countries and in part, who have not yet been born.

The definitional approach provides the scope for incorporating diverse meanings and implications of sustainable development. As such it is capable of providing a potentially more complete description of sustainable development than is currently achievable through other approaches. Put another way, definitional approaches allow us to say what we cannot build and are potentially less constrained in seeking to elucidate some of the less tangible aspects of sustainable development. On the other

hand it is important to note that there are hundreds of definitional approaches being applied to sustainable development as governments, communities, non government organisations and businesses strive to demonstrate their understanding, and in some instances, adoption of sustainable development through their actions.

This is evidenced by the various definitional approaches used in closely related documents covering sustainable development policy in Australia. The National Strategy for Ecologically Sustainable Development (NSESD) contains seven components, the Intergovernmental Agreement on the Environment (IGAE) contains four components and ESD Working Group approach covered six key components (Bennett 2001). The subtle differences in emphasis as well as the strong similarities of these definitional approaches are highlighted in the Table 2.3 below.

Table 2-3: Comparison of Different Definitional Approaches. Based on Bennett (2001).

Diesendorf	NSESD	IGAE	ESD Working Party
Economic development/well being	Long/short term decision making	Equity between generations	Economic development/well being
Equity between and within generations	Precaution	Precaution	Equity between generations
Biodiversity	Internationalisation of environmental issues	Biodiversity	Equity within generations
Precaution	Economic development/well being	Improved valuation	Biodiversity
Community participation	International competitiveness		Precaution
	Improved valuation		Internationalisation of environmental issues
	Community participation		

The order of the components used by each authority has been retained; however, for simplicity, where the component is similar, but different words were used, the table above has used an abbreviated description in the interests of simplicity and ease of comparison. The table illustrates the similarities and differences through the use of the same colour for components which arise in more than one column. It is considered that whilst the WCED definition of sustainable development has operated as a key marker and focal point for subsequent expanded conceptions of sustainable

development, it is apparent that there is no specific methodological framework for reviewing and refining the components which make up any one definitional approach.

The definitional approaches developed for and applied by the business level are similar in approach to the general approaches outlined in Table 2.3. That is, they provide lists that are intended to circumscribe the relevant issues of sustainable development for business. In this way they provide prescriptions of what business needs to consider and work towards to contribute to sustainable development. There are two key business definitions perspectives which have emerged over the past decade and which serve to highlight the breadth of perspectives in the business arena. One has become popular with many businesses and is commonly referred to as the triple bottom line approach (Buchanan 2000; Deegan 1999a; Elkington 1999; Topfer 2000; Yencken 2001;). The key components of this approach are summarised in Table 2.4 below. The other business definitions approach is not so well recognised or applied and is best reflected in what is referred to in this research as the expansive approach. This expansive approach is illustrated in this research with examples from Welford (1997) and Dyllick and Hockerts (2002). Welford's approach is summarised in Table 2.4 below and Dyllick and Hockerts' approach is summarised in Table 2.5.

The lineage of these business, definitional perspectives is strongly linked to the general definitions approaches reviewed above, in that they reflect a mixture of principles, themes and concepts that seek to provide a basis for informing behaviours and actions of those seeking to implement sustainable development. Table 2-4 below summarises the approaches of Elkington (triple bottom line) and Welford (expansive) and uses the building blocks of sustainable development covered earlier in this chapter as the basis for comparing and testing the coverage of these approaches. It is apparent that there are considerable differences in these business perspectives - areas where there are clearly differing emphases and others where there is little or no coverage of a sustainable development theme or concept.

Table 2-4: Key Business, Definitional Perspectives Compared to Macro Principles and Themes of SD (Based on Welford (1997) and Elkington (1999))

Expansive Approach	Principles/Themes of Sustainable Development	Triple Bottom Line Approach
• Accountability • Transparency • Education • Equity • Trading practices • Futurity • Human rights • Employment policies • Equal opportunity • Quality of working life • Women • Minority groups • Indigenous populations	**1. Equity** **2. Property Rights**	• Business ethics • Social impacts of investment • Environmental justice • Human and minority rights • Environmental refugees • Intergenerational equity
• Use of non-renewable resources • Life cycle impacts • Product stewardship • Life cycle analysis • Design of product durability • Biodiversity and animal protection • Habitat and species protection • Animal testing	**3. Biodiversity** **4. Resource Management** **5. Pollution**	• Environmental literacy and training • Carrying capacities for tourism • Environmental liabilities and shareholder value • Eco- efficiency
• Precaution	**6. Risk**	
• Product justifiability	**7. Growth** **8. Consumption**	• Ecological tax reform • Environmental economics and accounting • Shadow pricing
• Local action and scale • Community linkage • Appropriate scale • Partnership and cooperation strategies • Appropriate location • Empowerment of stakeholders	**9. Community participation**	

The eco efficiency approach (De Simone and Popoff 1997; Fiksel 1996; Fussler and James 1996), which has been widely employed by business, is not mapped separately in Table 2.4 because it is recognised and absorbed by both of the other approaches. Most authorities now consider that the eco efficiency approach is inadequate in relation to its response to sustainable development and that it now constitutes one component of other more complete, business approaches (Deegan 1999a; Elkington 1999; Hawken, Lovins *et al.* 1999). Eco efficiency countenances a wide range of environmental performance improvements and its inadequacy, as a model for sustainable development does not diminish the value of eco efficient activity in its own right.

The following further points are noted in relation to the above table:

- The triple bottom line perspective has a strong economic/environmental focus
- The expansive perspective has limited focus on the economic development aspect and this could be a significant weakness of this particular perspective.
- The expansive approach has a strong emphasis in relation to equity and participation
- The triple bottom line approach shows potential gaps in relation to the risk and community participation.

In considering the scope of these two approaches it is not difficult to understand why some businesses (especially SMEs) would find it almost impossible to countenance them within their day to day operations (Simpson 2000) and why the issue of sustainable development is strongly linked to big business (World Business Council for Sustainable Development (2002).

Because the expansive approach represents such a diverse range of issues for business to consider, there have been recent efforts to simplify this definitions perspective. An example of this is provided by Dyllick and Hockerts (2002). Their perspective borrows from the three pillars concept noted earlier and they propose three dimensions for business decision-making for sustainable development which are:
set out in Table 2.5 below. Under the three headings in the table, Dyllick and Hockerts' have proposed six key elements as a means of crystallising the multiple implications of the expansive approach.

Table 2-5: Key Aspects of Expansive Approach by Dyllick and Hockerts (2002)

Business Dimension	Natural Dimension	Social Dimension
Eco efficiency	Eco effectiveness	Ecological equity
Socio efficiency	Sufficiency	Socio effectiveness

The table above shows that the Dyllick and Hockerts perspective introduces new notions such as 'effectiveness', 'equity' and 'sufficiency' and these will be further reviewed below. These are new issues for business to consider and they go well beyond the conventional concern for increased efficiency. Deegan (1999b) has noted the limitations of current accounting measures to adequately accommodate both conventional business thinking and sustainable development. He also notes the potential future use of the term 'significancy' as an indication of the need to overcome the current limited notion of 'materiality' in business accounting disclosures and reporting. The current application of materiality in business accounting only bears on whether the issue is sufficiently large to influence the future operation and profitability of the business. It does not consider the materiality of the issue from an environmental perspective. As noted earlier, the public sector in Australia has been using a general performance framework which includes both efficiency and effectiveness performance measures. The efficiency measure involves the ratio of inputs to outputs and is similar to the ratios used widely in business including eco efficiency ratios. As noted by Burritt (2002) these ratios generally involve both physical and monetary units of measure (for example, tonnes of emissions per dollar of earnings). The effectiveness measure seeks to measure the alignment of business outcomes with the goals of the organisation (Higgins 2001).

Business is not currently interested in these latter measures and terms such as 'equity' 'effectiveness' and 'sufficiency' are considered to be efforts by the authors to link sustainable development outcomes with the goals of a business striving to make a contribution to sustainable development. It is noted that the wide spread implementation of these factors in business performance assessment across the business community would require increased clarity about how to apply these new constructs, as well as extensive changes in institutional arrangements and corporate governance. These issues will be pursued later in Chapter Three and Chapter Four of

this research. Prior to considering other approaches to sustainable development it is proposed to review the six factors introduced by Dyllick and Hockerts (2002) and set out in Table 2.5 above.

The business dimension is consistent with the conventional model of the firm in that it seeks efficiency, in reducing costs and damage, with a view to maximising value. This pillar includes environmental as well as social efficiency. Environmental efficiency would result in improved ratios such as emissions (tonnes) per sales (dollars). Improved social efficiency would involve improved ratios such as staff time (hours) per injury costs (dollars) and so on. The natural dimension recognises that increasing efficiency does not automatically improve contribution to sustainable development and the terms 'eco effectiveness' and 'sufficiency' are introduced. They cover the two ways in which sustainability can be compromised in the face of increased efficiency of production and these are explained below.

First, increased efficiency resulting in reduced costs to customers may result in increased use of the product or service. This may in fact increase overall resource consumption and pollution and thereby impede any progress towards sustainability. This is referred to as the 'rebound effect'(Dyllick and Hockerts 2002) and requires recognition of eco effectiveness as well as eco efficiency. Second, in the face of increased efficiency, consumers may choose to purchase higher resource consuming products. This is referred to as 'sufficiency' and can be illustrated by the trend of consumers to increase demand for higher fuel consuming sports utility vehicles (SUV) in response to fuel efficiency gains in automobiles. These examples make it very apparent that applying efficiency measures to business will, on its own, not automatically increase contribution to sustainable development, if the results of the efficiency lead simply to more consumption of resources.

The third, social dimension in the Dyllick and Hockerts perspective (2002) covers the issues of social effectiveness and ecological equity. Social effectiveness seeks to place some accountability on firms for the accessibility and availability of what they produce to more than just a select, privileged few. It could be seen as an attempt to bring a business perspective on intragenerational equity. Ecological equity brings to light the potential responsibility of business to play a role in contributing to

intergenerational equity; namely, equity between current and future generations. This is consistent with the view introduced by Fussler and James in suggesting that firms analyse their products and ask a set of sustainability-oriented questions. One of these questions is - 'Would this product be available in an equitable world of 8-10 billion people?'(Fussler and James 1996). There are several issues implicit in this question. Importantly, it requires that the firm has knowledge of its resource consumption in making a product and this would certainly require the comprehensive application of life cycle analysis in production.

It follows also, that it would require a firm to have access to information regarding the aggregate consumption of the resources used in production and for there to be knowledge about the limits of the sustainable supply of these resources. This links individual business analysis and performance with industry level analysis and performance (Sustainable Asset Management 2001; Australian Greenhouse Office 2001; Australian Bureau of Statistics 2001c). As well, it implies that the firm has the flexibility to transfer its productivity and profit making capacity to potentially lower margin and less resource intensive products. There is evidence in the statements made by the World Business Council for Sustainable Development (2002), that there are at least a small number of the world's largest and most prestigious businesses beginning to recognise that there may be limits to business profitability in only continuing to pursue high margin, high value added products (WBCSD 2002). This is because of the relatively small proportion of the world's population which can afford such goods.

There is of course, the potential for firms within existing governance arrangements to voluntarily undertake some of these approaches; however, as discussed earlier, company directors would need to keep in mind the existing legal obligations which they have to their current shareholders (Foster 2000). Existing governance obligations limit the extent to which company directors are able to take account of other stakeholders interests and reflect the obligations implicit in the application of 'effectiveness', 'equity' and 'sufficiency' at the same time as fulfilling and retaining their jobs as directors of a company. In effect, Dyllick and Hockerts (2002) are seeking to retain the scope of the expansive, definitions approach and to define it more clearly for company directors; however, the difficulty lies in seeking to construct a working model that encompasses the emerging notions contained in their

project. This goes to the heart of the objective of this research and will be considered further again in Chapter Four

This review of the definitions approach to sustainable development highlights that one of the strengths of such an approach is its flexibility and at the same time it is one of its weaknesses. It enables proponents to shape sustainable development to meet particular needs and provide particular emphases (as illustrated by the summary of Dyllick and Hockerts perspective (2002) summarised in Table 2.5). This means however, that significant elements of sustainable development may be excluded or avoided in the process and this has been illustrated by the triple bottom line approach summarised in Table 2.4. There is certainly a view by several authorities that the business lobby, as represented by industry associations and related bodies, have sought to consciously modify approaches to sustainable development (such as the triple bottom line) so as to minimise impacts on conventional business growth (Beder 1997; Mayhew 1998; Topfer 2000;Welford 1997; Springett 2003). The expansive approach reflected in the perspectives of Welford (1997) and Dyllick and Hockerts (2002) would require much more deep-seated change and have serious ramifications for current business operations.

In summary, some of the definitions approaches (such as the general one put forward by the WCED (1987) and the triple bottom line for business (Elkington 1999)) have been influential at both general and business levels. Whilst there are noted reservations about the completeness of triple bottom line approach (compared to the building blocks of sustainable development set out earlier in this chapter), the expansive versions put forward by Welford (1997) and Dyllick and Hockerts (2002) represent comprehensive reflections of the general perspectives of sustainable development. As such, these latter, expansive, definitions approaches could be built upon to support a comprehensive approach to measuring business contribution to sustainable development later in this research.

2.5.2 Charters Approach to Sustainable Development

Whilst charters originally had a formal legal connotation involving the granting of certain rights and privileges, they are commonly used today by industry groups and other bodies to describe a commitment to a common purpose and usually a

commitment to apply key principles or approaches. Within a sustainable development setting there are many such undertakings by a wide variety of bodies. Some of these are set out in Table 2.6 below. The charter approach to sustainable development represents an explanation of the actions required by individuals, communities, governments and businesses to make progress towards sustainability.

The significance of the charters grouping to sustainable development is that it represents a 'call to arms' approach, which identifies the actions necessary by target groups to achieve sustainable development. What the charter approach endeavours to add to the definitions approach is that it focuses on the institutional and transitional requirements of sustainable development. It focuses on the institutional dimensions of change and seeks to identify those actions which are necessary in order to bring about sustainable development (Environment Australia 2000; IISD 2002; WBCSD 2002). Its value arises because sustainable development is as much about how you achieve particular results (for example, community participation) compared to what results you achieve (for example, intergenerational equity) (Stern 1997).

Stern (1997) notes that some authorities consider that sustainability is an exercise in 'conflict management' and the other approaches to sustainable development do not elucidate how institutional structures will change in order for sustainable development to be achieved. Current systems and definitional approaches are limited in the extent to which they countenance the institutional change agenda required to achieve sustainable development and this is why the charters approach is an important grouping for consideration.

It is not surprising that the charter approach, in practice, is strongly influenced by a particular institutional setting (for example, community, government or business). Charters offer the opportunity for institutions to learn more quickly and establish like-minded approaches to important issues. The following table outlines the key charters and uses the typology adopted by The International Institute of Sustainable Development (IISD) in relation to the institutions of sustainable development (IISD 2002).

Table 2-6: Institutions of Sustainable Development and Related Charters (Based on IISD 2002)

Institutions of Sustainable Development	Key Charters
Civil Society	• Earth Charter (International NGO Forum Rio de Janeiro) • Bellagio Principles: Guidelines for Practical Assessment of Progress towards Sustainable Development.
Multi Stakeholder	• Tokyo Declaration (WCED) • Principles of a Sustainable Society (UNEP and WWF)
Business Sector	• Coalition for Environmentally Responsible Economics (CERES) • Principles for Business (Caux Round Table)
Government - International	• Rio Declaration on Environment and Development
Government - National	• Goal, core objectives and guiding principles for ecologically sustainable development strategy - Australia • Principles of sustainable development -United Kingdom
Government – State and Local	• Municipal Management by Eco System Principles (ICLEI)

Most importantly the charter approaches reflected in the instruments set out in Table 2.6 above, indicate the specific actions or positions necessary to move specific institutions towards sustainability. As such, each charter gives an indication of the transitional actions and measures required for implementing sustainable development. The business principles of the Caux Round Table (2003) are an excellent example of this. The principles in this charter make very explicit the transitional considerations necessary for the institution of business to move closer to sustainability. The areas covered by the Caux Round Table charter include shareholders, suppliers, customers, staff, trade, innovation, law and trust.

In addition to these major charters, there are also many industry charters or covenants which set out how like minded organisations seek to achieve shared goals (Australian Chamber of Commerce and Industry 2001; Cement Industry Federation 2000; Minerals Council of Australia 2000; [National Packaging Covenant] Environment Australia 1999). It is then in the hands of member organisations to the charter or covenant to progress towards the stated objectives.

The underlying value of the charter approach is its focus on institutional action necessary to give effect to sustainable development. This approach fills an important

gap left by the other two groupings and whilst the charters approach borrows heavily from the definitions approach in theoretical content, it provides a strong emphasis in relation to linking institutional actions for sustainable development.

There are specific business charter approaches to sustainable development, which are not included in the general perspectives considered above. These business perspectives focus on what individual businesses need to do so as to become a business which contributes substantially to sustainable development. The three distinctive business charter approaches (1) value chain (Beaumont 1993 (2) TQM (Kinlaw 1993) and (3) HR (Dunphy and Griffiths 1998). Each of these approaches is like a project plan that has been prepared by a project manager to achieve a specific outcome. As such, the measurement and monitoring associated with such approaches does not focus on the actual measurement of business contribution to sustainable development. It in fact focuses on whether the business is developing and implementing the capability and capacity to contribute to sustainable development.

Further, it is also clear that the three business charter approaches under review adopt quite different pathways or enabling mechanisms, within an organisation, to effect the changes necessary to move towards sustainable development. This is reflected clearly in the name given to each of these charter approaches and the specific differences in their pathways are summarised in Table 2-7 below.

Table 2-7: Summary of Business Charter Perspectives on Sustainable Development

Value Chain Perspective	TQM Perspective	HR Perspective
Primary Activities Inbound logistics Operations Outbound logistics Marketing and sales Service Design Product disposal Risk management **Support Activities** Firm infrastructure HR management Technology development Procurement External relations Premises	Pressures Life cycle analysis Benchmarks Audits Strategies Response level Principles and characteristics	Corporate capabilities Stewardship of resources Valuing and promoting diversity Defining leadership Raising awareness of sustainability Creating circles of research and diffusion of practice in sustainability.

The value chain perspective focuses on ensuring that each organisational unit in the firm is operating towards understanding the firm's actual impacts in these areas and assessing those impacts in relation to compatibility with sustainable development. The TQM perspective adopts a set of enterprise wide milestones to drive organisational change and the HR perspective establishes a set of prerequisites for leaders in the organisation to pursue sustainability goals.

Finally, in relation to these charter approaches, each employs a method for plotting progress in moving towards sustainability. There is evidence of firms, participating in these charters, applying techniques consistent with general project management theory, to achieve targets (Dow Chemicals 2000; WMC Limited 2001). In these cases not only project outcomes are identified and measured but project milestones and inputs are measured as surrogates for progress, until sufficient progress has been made for some or all project outcomes to become visible. This is indicative of general project management techniques (Krajewski and Ritzman 1993). These stages in the journey provide both internal and external organisational visibility of company activity associated with a transition to sustainable development.

A risk of this approach is that too much emphasis may be given to the actual transition process as an end in itself, without understanding and monitoring the extent to which it is actually making an identifiable difference to some of the imperatives of sustainable development. This risk is indicated by the overwhelming emphasis of international awards for sustainable development in business being assessed, to a large degree, on the basis of the scope of reporting completeness, as opposed to actual outcomes (SustainAbility Ltd. and UNEP 2000). This goes to the heart of the aim in this research to better understand how to reflect business results in contributing to sustainable development. It also highlights the difference between outputs and outcomes in an organisational performance framework.

Earlier in this chapter, when considering the definitions approach, reference was made to the organisational performance framework used in some public services. Higgins (2001) sets out the following definitions (in Table 2.8 below) for the elements within such a performance framework.

Table 2-8: Elements of an Organisational Performance Framework (Based on Higgins (2001)).

Performance Element	Definition
Organisational Goals	What the organisation seeks to achieve.
Organisational Inputs	The programmes the organisation has in place and the resources committed to them.
Organisational Outputs	The goods and services that the organisation produces directly.
Organisational Outcomes	The effects that the organisation's outputs have.
Efficiency Performance Measures	The ratio of inputs to outputs.
Effectiveness Performance Measures	The extent to which outcomes achieve goals.

Using this framework outlined by Higgins (2001) and used within the Australian government's public service, it is noted that the charters approach (at both the general and business levels) is primarily concerned with the organisational *outputs* associated with sustainable development as opposed to the organisation's *outcomes* in relation to sustainable development. This is an important distinction which will be considered more fully at the end of this chapter.

The next section reviews the systems approach to sustainable development.

2.5.3 Systems Approach to Sustainable Development

In a sustainable development context, a 'system' would equate to the scale of the entity under review. In this way the system may be a river catchment or a region, city or nation state. Costanza and Wainger (1993) have suggested a sub typology that can be applied to systems approaches. This sub typology uses three criteria for describing these approaches. The criteria are (1) realism (2) precision and (3) generality. 'Realism' relates to the capacity of the approach to simulate system conditions in a qualitatively understandable manner. 'Precision' involves precise, quantitative results and 'generality' indicates that the approach can be applied to a broad range of situations (Costanza and Wainger 1993).

Costanza and Wainger (1993) note that no single systems approach is able to maximise all three criteria simultaneously and consequently there is a trade-off in regard to the explanatory and predictive capacities of any one perspective. Of particular relevance to this research are two of the sub types proposed by Costanza and Wainger. They are:

- high generality conceptual approaches

- moderate generality and moderate precision indicator approaches

It is proposed to analyse the characteristics of these approaches with a view to identifying if any one or more would be applicable in a business setting.

The *high generality conceptual* approach seeks to provide comprehensive generality, but in doing so must necessarily forego realism and precision. Costanza and Wainger (1993) cite the Holling four box model as an example of this type. It comprises four elements which are exploitation, conservation, release and reorganisation with a cyclical pathway of evolution which connects them. These elements represent phases that are used to describe changes and behaviours in a system, such as a catchment area or a forest.

For example, release represents the breakdown of existing structures through events such as fire or political upheaval. After the release, there is exploitation, which is the regeneration phase, as a new order (reorganisation) takes hold. A release for a forest may be a bush fire, for a company, a release may be a major industrial accident or a substantial financial loss. The conservation phase allows consolidation and the development of increased levels of order. In some cases, through allowing some level of 'creative destruction' during the conservation phase, the level of destruction arising from the next release phase may be reduced. For a forest this may take the form of controlled burning to reduce fuel levels. For a business, this could take the form of disaster simulation training or internal audits to test the veracity of procedures and processes. As such, the Holling four box model provides the opportunity for exploring and understanding the characteristics of a sustainable system.

There is a high level of generality in the Holling perspective. Other perspectives of high generality include extended metabolism (Hawken, Lovins e*t al.* 1999) and the natural step (Light 2000). Whilst each of these perspectives has particular features, their primary benefit lies in their illustration of the dynamic, changeable nature of sustainability. The end state of sustainability is forever moving in response to multiple, compounding and interrelated changes. These perspectives also highlight the interconnectedness of sustainability systems thinking. The flows and processes implicit in them portend the need for the matching and/or linking functions of sustainable development mentioned earlier.

Costanza and Wainger (1993) also suggests that it is appropriate to include in this highly general category, conventional macroeconomic models and economic models of growth. Economists have grappled since the late 1930s with the issues of sustainable income, growth and consumption. Hicks (cited in Pearce 2002) proposed that desirable consumption levels would reflect no depletion in capital stocks as a result of consumption during a period. This simple notion has been the basis for subsequent developments in capital theory approach to sustainability with economists expanding the dimensions of and conditions for understanding sustainability. These capital theory models are based on the general contention that a necessary condition of sustainability is adequate stocks of capital, of all types, in order to be able to survive and rebound from shocks and failures in the system at various times (Faucheux and Muir 1997; Stern 1997).

Whilst analysts of civilisations and societies which have collapsed have expounded a number of reasons for their failure and whilst depletion of capital stocks of various kinds has played a part, it is not clear to what extent this has been the compelling reason for these failures (Cocks 1999; Diamond 2002). High stocks of human, social, natural and economic capital are certainly good insurance in the event of a significant system 'release', to use the terminology of the Holling model. Within capital theory, the definition of capital that satisfies these conditions must include all of the productive assets available to the economy. For this research, the terms capital and assets are interchangeable and there are numerous types of capital/assets, including –

1. Natural
2. Human
3. Manufactured
4. Social
5. Economic
6. Moral and ethical

It is also noted that business gives considerable attention to defining and valuing different types of capital/assets.

In the earlier discussion of property rights (being one of the key themes and concepts underlying sustainable development covered under 'scope' earlier in this chapter), reference was made to the growing importance of intangible asses/capital, such as licences, patents and copyrights. These intangible assets are distinguished by business from physical assets which may in fact be any one of items 1, 3 and 5 above. The

issue of measuring and monitoring the different types of assets/capital in business is taken up further in Chapter Four, when the Business Sustainable Development Index is constructed. In applying capital theory some aggregation of assets using monetary valuations is proposed as an indicator of sustainability. This brings to light the extent to which the various forms of capital are substitutable.

This in turn bears on the issue of whether the primary concern of sustainable development is to ensure that the total amount of capital does not decline or whether there a need to maintain stocks of each type of capital. There is considerable debate about this and Stern (1997) outlines a number of key schools of thought on this issue. These are:

- strong form sustainability: this requires that separate stocks of each form of capital must be maintained.
- weak form sustainability: this assumes that the elasticity of substitution between natural capital and aggregate artificial capitals is one for one. That is, weak form sustainability is only concerned with the stock of total capital, not particular types of capital within that total.
- London school: suggests that there are critical levels of some stocks of natural capital below which it is not possible to substitute (Stern 1997). This follows from the idea of thresholds in natural systems.

If the issue is taken as depending on one or the other of these positions, the question of what constitutes the appropriate or optimum scale of development (bearing in mind the requirement of sustainable development that the scale of development is matched with the available capital resources) needs to be considered.

Daly (1991) suggests that this optimum scale may be an anthropocentric one or a bio-centric one. If it was anthropocentric then the scale of development would expand to the point where the marginal benefit to human beings of additional man made physical capital (assets) is just equal to the marginal cost to human beings of sacrificed natural capital. If it was a bio-centric optimum, it would mean that the scale of human development would be smaller in recognition of the fact that other species have intrinsic value beyond their instrumental value to human beings (Daly 1991).

The second scale – the bio-centric scale - also brings to light that, in order to maintain the resilience of our environment there may be a need to maintain stocks of capital which would otherwise be consumed in pursuit of the anthropocentric optimum. This recognises the non-linearity, threshold and irreversibility effects which are known to operate in eco systems. These characteristics are well illustrated by species extinction due to changed circumstances (Cocks 1999; Diamond 2002) and by Dyllick and Hockerts (2002) in the story of the aircraft mechanic who removes one rivet from the body of the plane prior to each flight. The absence of one rivet does not affect the performance of the plane up to the threshold point; however, after that, the removal of one further rivet leads to the destruction of the plane.

It is therefore clear that the capital theory approach to sustainability depends not only on maintaining capital stocks but also on understanding the appropriate level of substitutability (sometimes referred to as the elasticity of substitution between natural and man made capital) and the optimum scale of development. It is important to recognise however, that whilst living on one's interest (and not eating into capital) appears to be a sensible approach, there is no certainty that it is a sufficient condition for the sustainability of our planet and human life (Cocks 1999; Diamond 2002). However, despite this reservation, capital theory appears to represent a sound basis for pursuing the objectives of this research. It offers the scope for valuing assets/capital within a business and for using this as a simple mechanism for determining whether the firm has made a positive or negative contribution to sustainable development by keeping track of the total, and component, capital values through time.

The second systems approach of interest to this research is *Moderate-generality and moderate precision indicator*. Due to the complexity of multiple human and ecological systems, there is considerable advantage in models that are able to simply indicate the general magnitude and direction of change. This gives rise to models which seek moderate levels of precision and generality, at the expense of realism (Costanza and Wainger 1993). The most important of these for this study are again, the economic models.

Pearce (2002) contends that the economic/accounting models were given impetus during the Earth Summit in 1992 through the adoption of Agenda 21. Agenda 21

explicitly called for the creation of integrated economic and environmental accounts to complement the United Nations System of National Accounts (SNA) (WSSD 2002). The latter approach is the basis for many countries' production of accounts showing Gross Domestic Product (GDP), which has become the surrogate measure for the standard of living (when expressed as GDP per capita), of not only the economy, but also the whole society. This does not however include the depletion of natural or social capital.

The move to a more integrated approach reflected the recognition that GDP is an inadequate indicator of sustainable development (Atkinson 1995). There are a range of tools, within the overall framework of national accounting that have and are being pursued to better understand the integration of the economy and the environment. These have been categorised by Atkinson and Hamilton (1996) and include measures and accounts of:-

- resources and pollutants flows
- natural resource balances
- environmental expenditure accounts
- green accounting aggregates

A brief review of each of these approaches follows.

Resources and pollutants flows record flows between eco systems and different sectors of the economy and include inputs such as energy and outputs such as solid wastes and greenhouse gases. The benefit of this approach is that it allows policy makers to link such flows to conventional economic input-output tables and to thereby review the impact of prospective regulations and taxes on production, profits or employment. The limitation of this approach is that it does not provide insight into the matching between the resources used in the flows with their continued availability.

Natural Resource Balances represent a balance sheet showing the opening and closing stocks of various natural resources and the flows, which determine the net changes. Physical quantities could be barrels of oil or cubic meters of timber and the flows reflect the quantity harvested less new discoveries or natural growth. The limitation of this approach is that at present it only deals with natural physical assets.

Environmental Expenditure Accounts comprise capital and operating expenditures by economic sector for protection and enhancement of the environment. Through the operation of these accounts it is possible to discern the distribution of costs associated with abatement by economic sector. Also, whilst it is a relatively simple approach it does not reflect any implications of matching so important in considering sustainable development. Knowing environmental expenditure does not contribute in any way to matching the scale of economic activity with the scale of the environment required to support such activity.

Green Accounting Aggregates focus on making an adjustment to conventional national accounts. The number and type of adjustments appears to be the basis for distinguishing between specific perspectives. There are two important tools of measurement that fall under this category - genuine savings (Atkinson and Hamilton 1996; Pearce 2002) and the index of sustainable economic welfare (ISEW) (Gil and Sleszynski 2003). Both draw heavily from capital theory with the first approach proposing a measure based on subtracting the loss of natural assets, for the period, from investment for the same period. The second seeks to capture a broader perspective of sustainability and involves constructing an index based on numerous indicators of social welfare goods and bads (Atkinson and Hamilton 1996).

It is considered that the Green Accounting Aggregates approaches are the most comprehensive approaches when considering the overall operation of a system and its performance in regard to sustainable development. They are especially useful in relation to tracking and measuring the interrelated impacts of the economy and the social and physical environments. In essence, and to again use the terminology of the performance framework outlined in Table 2.8 above, the green accounting aggregates are designed to measure at the outcome level whereas the other approaches are concerned with inputs and outputs of the system under review. As such the green accounting aggregates approach represents a very likely channel for improved measurement of business contribution to sustainable development. The way forward with this approach will be considered further after the next part of this section, which deals with systems approaches developed for business.

Two key business, systems perspectives are worthy of review in the context of the objectives of this research. Applying the typology employed by Costanza and Wainger (1993) and outlined earlier, they fall into the category of *moderate generality and moderate precision indicator* perspectives. They are (1) the business savings approach (Atkinson 2000) and (2) the triple markets approach (Figge and Hahn 2002). It is proposed to consider each of these perspectives separately. Atkinson (2000) developed the business savings approach for a firm based on the general thrust of the genuine savings approach mentioned immediately above, as part of the green accounting approaches. The business savings approach varies slightly from the simple, conventional economic model of the firm that requires a firm to focus on maximising value or wealth. This value is generally constructed as the present value of its expected future cash flows. It is possible however, to consider the firms value in different ways, including the book value (the depreciated value of its saleable assets) or liquidating value (the market value of its saleable assets) (Mansfield 1999).

It is considered that the relationship between the present value of future cash flows (profits) and the value of assets (book or liquidated value) depends on the extent to which the assets recorded in the balance sheet are complete and also, on the extent to which those assets contribute to future cash flows. Within this context, the scale of a firm, seeking to maximise its value, is determined by the profit maximising output. The profit maximising output is achieved when marginal cost equals marginal revenue (Mansfield 1999). Coase (1937) clarified that the limiting factor of this output and therefore, ultimately, the determinants of a firm's size were (1) marketing costs (namely, the costs of using the price mechanism) and (2) the costs of organising the product or service.

It can be deduced from the above economic approach to the firm, that there is no mechanism that would limit the aggregate production of all value maximising firms to a level, which may be consistent with the level and type of ecosystem services that may be available (Daly 1991). Recall that one of the preliminary tests identified in this chapter was, that for sustainable development to be achieved, it was necessary for the physical scale of each element to be matched. Put simply the conventional value-optimising model of the firm does not require the matching of aggregate firm activity (economic) with the available resources (environment).

Atkinson (2000) adjusts this conventional economic approach to the firm and takes into account environmental concerns. His approach for considering business contribution to sustainable development is based on the same fundamental assumptions of marginal optimality contained in the conventional economic theory of the firm However; Atkinson adds costs, which are not conventionally incorporated into managerial economic calculations, as a means of accounting for considerations of sustainable development. This adjustment to the conventional model of the firm operates, in very broad terms, in the same way that green adjustments to the national accounts at the national scale. That is, to the extent that costs for environmental bads are known, those costs are subtracted from the total calculation. In the case of the national scale, the GDP figure is adjusted for damages to the environment. In the case of the firm, the operating profit (instead of the GDP at the national scale) is adjusted for calculated damage to the environment. Such adjustment calculations are considered in more detail in Chapters Three and Four.

This perspective, called the business savings approach in this research (to identify its relationship to the genuine savings approach at the national level) seeks to perform one of the key functions of sustainable development in a business setting. It seeks to match the physical scale of business activity with that of the environment, through the use of an adjustment to the operating profit result of the business to take account of environmental costs. Such an adjustment does not however, in and of itself, cause the aggregate level of business consumption of resources to be consistent with sustainable levels of environmental assets. At best it is intended to at least, moderate the use of (or damage to) environmental resources.

Unlike the preceding approach, the triple markets approach (Figge and Hahn 2002) to business contribution to sustainable development would, if it were to be widely applied, require some adjustment to the current governance arrangements applying to business operations in nations such as Australia. In so doing it seeks to deal with the issue of matching physical scales to a greater extent than envisaged by Atkinson's perspective outlined above. It seeks to do so by introducing the notion of 'effectiveness' into the theory of the firm. The concept of effectiveness is designed to ameliorate the drive for 'efficiency' implicit in the impact of simply using marginal

optimality, (within the constraints already identified above and clarified by Coase) as the basis for determining the size and nature of a firm's production.

Figge and Hahn (2002) have proposed a concept called sustainable value added (within their triple markets approach) as a means of partially introducing the implications of effectiveness into the operation of the firm. In effect, a positive sustainable value added (*SusVA*) indicates that the firm has succeeded in creating extra value, compared to the best practice efficiency benchmark of other firms in the same industry, while keeping the overall resource consumption at the level of the preceding period for all resources which are used by the company (Figge and Hahn 2002). To be implemented widely this approach requires a tertiary trading market for increased production opportunities and proposes that firms use this as a way of settling which firm would be permitted to consume additional resources. This links with similar requirements from the expansive approach proposed by Dyllick and Hockerts (2002) and reviewed above.

Figge and Hahn (2002) propose that only those firms that operate above the eco and social efficiency benchmarks are entitled to increase input consumption. For this reason, this research refers to the Figge and Hahn approach as being the triple markets approach. The reason being is that it presages the need for three separate markets as follows:

- a market for the normal goods and services of the company
- a further market to determine the cost of environmental goods (for example a market for carbon trading)
- a third market which has information on the efficiency of production of firms so that any further production opportunities are afforded to those firms which are the most efficient producers.

In effect the triple markets approach is seeking to make sure that the costs of environmental resources are factored into firm performance (like the business savings approach employed by Atkinson (2000))

However, the triple markets approach goes further in seeking to minimise the impacts of increased production prompted by improved efficiency and considered by Dyllick

and Hockerts (2002). It does this by only allowing the most efficient producer to take on additional production opportunities. Again, this does not ensure the matching of the required resources from aggregate firm activity and sustainable resource levels but it does provide additional checks and balances to additional consumption. The approach is most likely to require higher levels of regulation by government to not only introduce secondary environmental markets but tertiary markets to allocate additional production opportunities to the most efficient producers. In the absence of such regulation it would seem to require a strong connection between individual business performance and industry level analysis to establish the additional markets and knowledge for business operations.

In summary, the systems approaches at the general level offer diverse perspectives on sustainability from highly generalised models (such as the Hollings Four Box Model) to complex economic perspectives (such as macroeconomic growth models based on capital theory). However, at the business level, the systems perspectives seem to be considerably narrower in approach and focus on adjustments to operating profits as the primary mechanism for recognising the implications of sustainable development.

The full implications of 'sufficiency', 'equity' and 'effectiveness' raised by Dyllick and Hockerts (2002) in their expansive definitions approach are not fully dealt with; however, the Figge and Hahn (2002) triple markets approach does seek to build a bridge to effectiveness measures implicit in business considerations of sustainable development. The Figge and Hahn (2002) approach implies much greater changes in corporate governance than appear likely based on the earlier assessment of business licence to operate. At a minimum, the Figge and Hahn perspective would require a high degree of information and knowledge sharing between individual business entities and their respective industry groupings. As such there is clear scope for the enhancement of systems approaches at the business level, to accommodate some of the wider implications of sustainable development.

2.6 Conclusion

This chapter has reviewed sustainable development in relation to its scope and functions as well as a variety of approaches to its implementation. It is possible to assess approaches to sustainable development by using both the scope and functions

tests. This assessment can be expanded to also incorporate the extent to which an approach is able to measure sustainable outcomes (as opposed to outputs or inputs) in the context of a comprehensive performance framework (Higgins 2001). Each of the approaches considered in this chapter has been reviewed progressively and a summary assessment of each approach is set out in Table 2.9 below. The table also indicates the page reference in this chapter for the earlier discussion on the named approach.

In considering each approach the following questions have been asked and the range of answers considered is also set out with each question:

- Scope: Does the approach cover the nine key concepts, themes and issues considered in Section 2.2 and, where appropriate, the three additional business issues identified in Section 2.3 of this chapter? The potential answers are shown as; (H) – to a great extent; (M) -to a reasonable but not great extent; (L) -to a limited extent
- Function: Does the approach contribute to the four functions of sustainable development set out in Section 2.4 of this chapter? The potential answers are shown as; (H) – to a great extent; (M) to a reasonable but not great extent; (L) to a limited extent.

In addition, two further assessments have been included in the summary table. Because this research is directed towards empirical comparative analysis, a preliminary assessment has been made, based on the information so far, in regard to the potential for the named approach to support such analysis. This assessment has been simply based on the extent to which the approach would support quantitative data collection and comparison on a broad scale.

The final question relates to consolidating the information drawn from the preceding questions and deciding whether further analysis of this approach is warranted in this research:

- Performance Framework: This is a preliminary assessment in regard to the question- Does the approach offer potential to inform an empirical comparative analysis of performance in relation to sustainable development? Such an approach would be consistent with the framework described by Higgins (2001) and

summarised in Table 2.8 in Section 2.5.2. The potential answers are shown as; (H) – to a great extent; (M) to a reasonable but not great extent; (L) to a limited extent

- Further review warranted: This question is an indicator of whether there is a need to review this approach further (by reviewing its method of measurement) in Chapter Three. The answers are either (Y) yes, or (N) no.

All of the results to each of these questions are set out in Table 2.9 below.

Table 2-9: Summary Analysis of Approaches to Sustainable Development

Perspective (Approach shown as: (D)=definitions (C)= charters (S)=systems)	Reference (Page No).	Scope(1)	Functions (2)	Performance framework(3)	Further review warranted (4)	Comments
WECD (D)	45	H	M	L	No	Too general for application in this research
Diesendorf (D)	45	H	H	M	No	As above
NSESD/IGAE/ ESD (D)	46	H	H	M	No	As above
Triple Bottom Line (D)	48	M	M	M	No	As above
Expansive (Welford) (D)	48	H	H	M	No	As above
Expansive (Dyllick and Hockerts (D)	49	H	H	H	Yes	Represents the most developed definitions approach for business.
Macro-level Charters (C)	55	H	H	L	No	None of the charter approaches meet the performance framework needs of this research
Value Chain (C)	56	M	M	L	No	See above
TQM (C)	56	M	M	L	No	See above
HR (C)	56	M	M	L	No	See above
Holling Four Box Method (S)	59	H	M	L	No	Too general for application in this research
Natural Step (S)	59	H	M	M	No	As above
Extended metabolism (S)	59	H	M	L	No	As above
Capital Theory (S)	60	L	M	H	Yes	Method warrants further review
Genuine Savings (S)	64	L	L	H	Yes	As above
ISEW (S)	64	M	M	H	Yes	As above
Business Savings (S)	65	L	L	H	Yes	As above
Triple Markets (S)	65	M	M	H	Yes	As above

The summary assessments consolidated in the above table are considered further below, using the headings adopted as the typology for this review. Approaches in the 'definitions' category are highly relevant for a full understanding of the implications of sustainable development. They generally rate well in relation to scope and functions but rate less highly in relation to their usefulness in an organisational performance framework. They are, for the most part, too general to support empirical comparative analysis. There is one very important exception to this. The expansive approach put forward by Dyllick and Hockerts (2002) shows development towards a more structured, but comprehensive, understanding of sustainable development for business and this approach warrants further analysis.

The major drawback of the charters approach in relation to this research is its focus on the institutional changes necessary to achieve sustainable development. As such, whilst it ranks in the mid range for both scope and function it is primarily directed towards measuring the inputs/outputs of an organisations move towards sustainable development and it provides little opportunity for the comparative assessment of outcomes. For this reason it is not intended to further consider the charter approaches for detailed analysis in this research.

Interestingly the systems approaches rank well for scope and function at the macro or broader scale but at the business level are more limited in their scope and function. This tends to confirm the views noted earlier regarding the fact that business perspectives on sustainable development may well not be comprehensive or complete. It also noted that the systems approaches are strong in regard to supporting an organisational performance framework.

In light of the above it may be possible to expand the scope and function of the business systems approaches, potentially through building on the developments commenced by Dyllick and Hockerts (2002). The latter approach offers the opportunity for establishing a link between the comprehensive scope of definitions approaches and the efficiency and effectiveness components of an organisational performance framework described by Higgins (2001). Consequently, Chapter Three will commence with a review of the measurement methods used in each of the

approaches marked for further analysis, with a view to identifying one or more pathways for improvement.

One final point prior to proceeding to the analysis in Chapter Three and this relates to the operation of the typology used to describe the different approaches to sustainable development in this chapter. This typology has provided a suitable mechanism for reviewing a very wide range of conceptions of sustainable development which are applied in a similarly wide variety of circumstances. However, in undertaking this review it is emerging that whilst the typology does work well at the broad level, in reflecting the differing goal orientations and perspectives of sustainable development, the typology may work somewhat differently at the business level. In other words and for example, at the macro scale the Hollings four box model represents a highly generalised conception of sustainability as does the definitions approach offered by the WCED. The same can also be said in relation to the macro level charters reviewed. That is, at the macro level, the typology reflected clearly different and almost 'stand alone' perspectives on the issue of sustainable development.

However, as the analysis moved to the business level, it appears that the typology becomes more a hierarchy of related approaches. That is, the definitions perspectives seem to operate as an organizing or goal setting framework for considering business conceptions of sustainable development. At the same time the charters approaches at the business level are more akin to management methods for organizational change towards sustainable development. At the same time the orientation of the systems perspectives at the business level is much narrower than at the macro level and seems more directed towards measurement and performance monitoring of sustainable development.

This does not diminish the validity of the review to date but it does offer a potential insight into the implementation of sustainable development in business. Consequently this will be reconsidered again towards the end of this research in regard to future developments and research in this area. It may well be that for business managers; applying sustainable development could involve the integrated application of a perspective from each approach to achieve a comprehensive result. Aligned with the performance framework mentioned earlier (Higgins 2001) this potential integrated

business approach to sustainable development could be summarised as set out in Table 2.10 below.

Table 2-10: Potential Integrated Business Model for Implementing Sustainable Development

Business Performance Framework	**Approaches to sustainable development**
Goals	Definition Approach
Outcomes	Definition Approach
Outputs	Charter Approach
Inputs	Charter Approach
Efficiency performance measures	Systems Approach
Effectiveness performance measures	Systems Approach

The implications of this assessment will be reconsidered in Chapter Six in dealing with the implications of this research for business managers.

3 TOWARDS AN IMPROVED METHOD FOR MEASURING BUSINESS CONTRIBUTIONS TO SUSTAINABLE DEVELOPMENT

3.1 Introduction

This chapter builds on the review of scope, functions and approaches to sustainable development in Chapter Two and establishes an improved method for measuring business contribution to sustainable development. This is achieved through two primary steps of analysis. The first step (spanning Sections 3.2 to 3.8) continues the review of those perspectives on sustainable development identified in Chapter Two as having potential to contribute to an improved method for measuring business contribution to sustainable development. The focus is on the measurement methods associated with these selected perspectives. The perspectives which will be further assessed are the:

- expansive perspective (Dyllick and Hockerts 2002) because it represents a comprehensive scope for business considerations of sustainable development
- capital theory perspective (Faucheux and Muir 1997; Stern 1997) because it provides an essential understanding of measuring sustainable development, if only at the broad scale at present
- green accounting aggregates perspectives covering the genuine savings perspective (Atkinson 1992; Pearce 2002) and the index of sustainable economic welfare (ISEW) perspective (Gil and Sleszynski 2003) because they represent an endeavour to expand the scope and function of the capital theory perspective (again however only at the broad scale at present)
- business savings perspective (Atkinson 2000) and the triple markets perspective (Figge and Hahn 2002) because these are important, current perspectives to measuring business contribution to sustainable development.

Prior to reviewing measurement methods associated with each of these specific perspectives, the first part of the chapter begins with a general overview of methods of measuring sustainable development.

The second step of analysis in this chapter (in Sections 3.9 and 3.10) will seek to build an improved method for measuring business contribution to sustainable development. Section 3.9 consolidates the earlier analysis of methods of measurement and seeks to construct an idealised environment for maximising business contribution to sustainable development. The objective is to clarify what the specific expectations of business may be and at the same time ensuring that none of the key prescriptions of sustainable development (from the macro level) are lost.

The macro conditions for sustainable development are used as the starting point for this analysis and then, building on the work of Dyllick and Hockerts (2002), it is proposed to build a picture of what 'ideal' firm behaviour would look like in order to maximise contribution to sustainable development. From there Section 3.10 builds a new, expansive, systems perspective to measuring business contributions to sustainable development. The new method, the Business Sustainable Development Index (BSDI) is developed from a synthesis of key knowledge from both macro and business levels. This includes consideration of efficiency and effectiveness measures and ratio analysis as well as the index method employed by both the ISEW (Gil and Sleszynski 2003) and the HDI (Streeten 1995). The new method effectively seeks to apply a systems approach to the definitions perspective of Dyllick and Hockerts (2002). It also builds on the systems perspectives of both Atkinson (2000) and Figge and Hahn (2002) in seeking to build a bridge between the macro and business levels of measurement.

3.2 Overview of SD Measurement Methods

The methods for measuring sustainable development have been extensively reviewed in the literature (see for example Australian Bureau of Statistics 2001b; Deegan 1999a; Hamblin 2001; O'Riordan 1998; Salvaris 2002; Stern 1997; Veleva and Ellenbecker 2000) and these methods can be simply classified under the following headings:

- suite of indicators
- transition indictors
- consolidated indicators

There are strong connections between the approaches to sustainable development covered in Chapter Two and these three methods of measurement. A description of these methods and related examples are set out below. In general, the *suite of indicators* method is favoured by those adopting the definitions approach (Elkington 1999; Global Reporting Initiative 2000; SustainAbility Ltd and UNEP (2000); the *transition indicators* method is favoured by those adopting a charters approach (Beaumont 1993; Dunphy and Griffiths 1998; Kinlaw 1993; WMC Limited 2001) and the *consolidated indicators* method is favoured by those adopting a systems approach to sustainable development (Atkinson 2000; Figge and Hahn 2002). It is proposed to briefly review and evaluate developments in each of these indicator methods prior to considering the specific methods used in the perspectives selected for further analysis from Chapter Two.

The *suite of indicators* method usually involves a list of measures, grouped according to the three pillars or a similar type of categorisation. This method is very popular in business because it helps to overcome the limitations of valuation methods and the resulting difficulties in reducing all measures into one unit of value (Global Reporting Initiative 2000; SustainAbility Ltd and UNEP 2000). There is a strong logic for this approach given the limited extent of knowledge about what constitutes sustainable development and that reducing results to one measurement is an over simplification. An excellent example of the application of this method is provided by the Australian Bureau of Statistics (ABS) (2001b) approach to providing a national perspective of Australia's progress in relation to sustainable development. This project scrutinised multiple methods and resolved an approach that grouped each item under one of the 'three pillars' of sustainable development (ABS 2001b).

The groupings and related measures were developed by the ABS to meet the needs of the particular circumstances of Australia at present and there was a clear decision not to reduce the measures to a single number (index). It was felt that a single measure approach would inhibit analysis. This could be better achieved by considering the implications of particular measures in the units of measure most appropriate for the issue being considered. This particularly relates to social issues such as education, violence/crime and health. The intention of the ABS is to chart or map progress against these individual measures over time and to provide sufficient commentary on

changes as a way of keeping track of progress towards or movement away from sustainability (ABS 2001b).

The Global Reporting Initiative (GRI) (2001) has developed a tool that is used by many firms which have adopted a definitions approach (such as the triple bottom line outlined in Chapter Two) to sustainable development. The tool comprises a very extensive suite of potential indicators, which are grouped under the headings of the three pillars. The GRI tool provides large companies with the scope to collect and publish significant amounts of information on a wide number of topics (extracted from the GRI list).

The general method employed by the GRI tool is very popular amongst businesses interested in sustainable development. This is probably based on the credentials afforded the tool by the GRI and also because businesses are free to choose from the list of topics, depending on which data they may have available. The GRI (2000) does suggest most appropriate units of measure for various items such as air pollution and solid waste; however, it does not suggest any particular targets. As well it does not seek to establish any causality between the items measured and sustainable development and it does not seek, through its method, to specifically deal with the difficult issues of 'sufficiency' 'equity' and 'effectiveness' raised by the expansive definitions perspective of Dyllick and Hockerts (2002).

The GRI potentially diminishes the particular characteristics of business as an institution through simply providing a suite of possible indicators. At least the GRI approach is a good list of issues that any business could keep in mind when considering sustainable development. Also, it allows individual businesses to keep a track of movements in key data items over time. At worst it is compounding the confusion and hiding poor results in relation to sustainable development. This goes to the heart of many concerns associated with corporate management of the sustainable development issue (Beder 1997; Mayhew 1998; Springett 2003; Welford 1997). The GRI (2000) could be contributing to a false sense of achievement and progress in relation to sustainable development by the lack of rigour in its method. Whilst the notion of a suite of indicators is attractive and simple it goes no way to resolving or elucidating the conceptual difficulty in resolving the link between business action and

broad scale sustainable development. As such, it is considered to be an unsuitable tool for giving effect to improved methods of measuring business contribution to sustainable development. In summary, it is considered that the suite of indicators works most effectively at the macro scale because it is able to deal with a wide range of indicators and provide an overview of performance at the regional or national scale. It is considered to be less appropriate for the business level because it potentially leads to the collection of large amounts of data and does not specifically deal with the particular implications (arising from the governance setting) of sustainable development for business.

The *transition indicators* method (which is predominantly associated with the charters approach to sustainable development) measures the progress of an institution in moving closer to being able to make a positive contribution to sustainable development. The transition is usually broken down into identified steps, as set out previously when considering the charters approach in Chapter Two. As a result, the methods of measurement for this approach are more focused on measuring that institution's progress, in relation to the institutional change agenda (as set by the institutions governing body). This is not suggesting that the purpose of these transitional indicators is not important, far from it. In fact, an important criticism of the capital theory method and other consolidated indicator methods is the absence of this institutional change component (Stern 1997).

This highlights the complexity of the whole notion of sustainable development and why Diesendorf's synthesis (1997) noted earlier in this chapter, is not a homogenous set but a combination of themes, principles and issues. Sustainable development is not achievable without institutional change. By default therefore it is important to know if these institutional changes are occurring. The focus of charter methods is this institutional change and not so much with the other factors associated with particular physical or temporal limits of sustainable development (Beaumont 1993; Dunphy and Griffiths 1998; Kinlaw 1993). In effect, using the nomenclature of linking and matching, the transitional indicators method is strong in relation to the linking functions and lacking in relation to the matching functions. As well, from an organisational performance perspective, the transition indicators method is very much directed towards inputs and outputs and not outcomes (Higgins 2001). For these

reason this research will not further investigate the charters approach and its related measurement methods.

Consolidated indicators involve all components of the measurement method being converted to a common unit of measure. This common unit could be dollars or it could be an index number. This is the method usually employed in the systems approach to sustainable development and examples of this are provided by capital theory (Faucheux and Muir 1997; Stern 1997) and the business savings method (Atkinson 2000). One of the overall objections to this method is that it is debateable as to whether it is possible to reduce the measurement of contribution to sustainable development to one number (Deegan 1999b; O'Riordan 1998; Stern 1997). This can be overcome to some degree by allowing contributory components to be quantified and so identified by those seeking to better understand what the single number answer means. This is well illustrated by the triple markets method (Figge and Hahn 2002) and the index of sustainable economic welfare (ISEW) method (Gil and Sleszynski 2003).

Because the objectives of this research are to measure and compare business contributions to sustainable development and based on the assessment carried out so far, the consolidated indicators methods are the most likely basis for future improvement. Whilst it would be possible to compare company performance using the other two methods, it would require that considerable additional data was available and it would also require substantial resources to collect and collate same. Consequently the primary focus in this research will be in reviewing and developing consolidated indicator method/s. However, the discussion in the next section, which is directed towards reviewing measurement methods of the selected perspectives from Chapter Two, begins with a review of the expansive definitions perspective for which there is not yet a clear measurement method available. This is the only non systems perspective to be reviewed further and this arises from the developments by Dyllick and Hockerts (2002) in seeking to more accurately describe the business problem of contributing to sustainable development.

3.3 Expansive Perspective: Method of Measurement

Developments in relation to measurement of sustainable development at the general level have already significantly influenced the approaches that have been developed at the business level. This is illustrated in Chapter Two by the work done by Atkinson in developing the business savings approach (2000) and this development has been based on the genuine savings approach (Pearce 2002) from the macro level. Whilst this is so, it is important to recognise that the conceptual problem at the business scale is a significantly different one compared to the macro scale. This has not been extensively considered; however, the work of Dyllick and Hockerts (20022) and Figge and Hahn (2002) is starting to more completely highlight this.

The measurement of sustainable development at the business scale is considered to be different for two key reasons:

- Business activity does not fit neatly into a natural hierarchy of 'scales'(e.g. catchment, region, eco system) and this makes some of the matching implicit in sustainable development very difficult to achieve (Deegan 1999a; Elkington 1999).
- The institutional features of business (circumscribed by corporate governance) mean that firms act differently to the overall market system (Coase 1937). This disparity between the 'part' and 'whole' of a system applies in many different situations and has been identified in both natural systems and economic systems (Costanza and Wainger 1993).

These issues are reviewed in more detail below.

In regard to the first point, it has been noted that one of the important functions of sustainable development is to match physical scales with economic social and environmental activity. The difficult issue in measuring business impact is that the business, by its very nature, is not constrained to a single, identifiable place. Consider for a moment a firm whose head office is in City X, its production facility is in City Y, its products and distribution network are in multiple countries and its shareholders include multinational pension funds. How is it possible to consider the impact of such an organisation and match it to a physical scale? This is a fundamental difficulty for measurement of business sustainable development.

In regard to the second point, it is commonly thought that the impact of all the parts (e.g. individual trees) must equal the impact of the whole (e.g. the forest). It has been observed that in natural systems, such as forests, this is not always the case (Costanza and Wainger 1993). In economics an analogous situation arises when we consider the operations of an individual firm within the whole economy. Coase (1937) highlighted that the operation of the firm, in regard to its internal processes, operates outside and differently to the normal market. Bosses of firms tell employees what to do, they don't ask them for a 'quote' before doing a job and then select between competing employees (Coase 1937).

So, the operation of the individual firm does not mirror that of the economy because of the particular institutional arrangements that apply to firms. When considering sustainable development, some of the tools of measurement have not seriously confronted this issue. This is reflected in the simplistic application of indicators from macro approaches without careful recognition that application of the same indicators at different scales does not result in measuring a scaled down version of sustainable development. As noted earlier, the suite of indicators method generally applied in business runs counter to some of the prescriptions of sustainable development.

In short, because of these issues, some authors have (1) suggested caution in regard to efforts of measurement (Elkington 1999) (2) suggested the need for new terms for describing the business performance framework (Deegan 1999b; Dyllick and Hockerts 2002) and (3) concluded that it is not feasible to measure business sustainable development (Deegan 1999b; Atkinson 2000). It is certainly clear from the analysis so far that the conceptual approaches to measurement at the macro and individual business scales must be different in construction. In the absence of specific solutions, a feasible approach is to focus attention on making an assessment of whether a firm has made a positive or negative 'contribution' to the overall sustainable development of the nation. This is the approach proposed by Atkinson (2000) and the direction adopted by this research. At present there are no other feasible or identified alternative theoretical solutions to this issue.

Therefore, at the individual business level, and taking a lead from the national level debate, the measurement objective is directed towards quantifying whether the firm has made a positive or negative contribution to sustainable development over the subject period. Although suggestions regarding the incorporation of external costs such as pollution into corporate accounts was made as early as 1976 (Atkinson 2000), key developments towards understanding the measurement issues for business in relation to sustainable development have only emerged since the early nineties.

Another way of describing the measurement problem is provided by the notion that the sustainable corporation would leave the environment (in the broadest sense of the word) no worse off at the end of an accounting period than it was at the beginning of the period (Gray 2001). The practical application of this approach, through the application of full cost accounting (as described in Chapter Two) has been extremely limited. As noted earlier, costs, as well as the limited added benefits to the company, have been impediments identified by Reinhardt (1999).

The impediments, even to this modified 'contribution' method for business are very substantial. Firstly, the determination of external costs for items such as pollution is difficult given that this problem has not been solved at the macro level. Secondly, efforts to track pollution impacts of an individual firm are difficult given the distribution of production even for small firms. Thirdly, the social costs are much less clearly identified. Fourthly, the corporate governance arrangements applying to firms in most parts of the world place limitations on the responsibilities of company directors and require them to act in the best interest of shareholders, not stakeholders. Fifthly, the accounting practices that have been established to support the governance regimes place very specific limits on the approach to be adopted in accounting for the companies' activities.

Against this background the expansive approach to sustainable development proposed by Dyllick and Hockerts (2002) is seeking to establish more clearly defined parameters for incorporating the broad intentions of sustainable development within a business setting; however, the method for actually measuring this approach is not yet clarified. To date Dyllick and Hockerts (2002) have identified the performance dimensions of business making a contribution to sustainable development but these

have not yet been defined sufficiently to measure. This is illustrated in Table 3.1 below which summarises the six dimensions of performance proposed by Dyllick and Hockerts. As well, the generic terms from an organisational performance framework are listed showing efficiency and effectiveness measures against each of the pillars of sustainable development.

Table 3-1: The Expansive Definitions Approach (of Dyllick and Hockerts 2002) Compared to an Organisational Performance Framework (Higgins 2001).

Dyllick and Hockerts (2002)	**Organisational Performance Framework (Higgins 2001)**
Economic	**Economic**
• Economic Efficiency	• Economic Efficiency
• Social Efficiency	• Economic Effectiveness
Social	**Social**
• Socio Effectiveness	• Social Efficiency
• Ecological Equity	• Social Effectiveness
Environment	**Environment**
• Sufficiency	• Environmental Efficiency
• Eco Effectiveness	• Environmental Effectiveness

At this stage in the development of the measurement methodologies for business in relation to sustainable development, the exact relationship between the items on each side of the above table have not be clarified or resolved. However, it is at least conceptually possible to propose that all of the efficiency measures covered by Dyllick and Hockerts (2002) under the economic pillar could be reasonably split between the three pillars as indicated on the right hand side above. As well it may be at least conceptually possible to relate the different terms used by Dyllick and Hockerts such as sufficiency, ecological equity socio effectiveness to the effectiveness elements in the generic framework. At present, in the absence of clarity around these issues, the measurement method employed by the expansive approach would necessarily be similar to the solution adopted for most other definitions approaches. That is, it would be a suite of indicators method listing particular measures using the relevant units of measure for each one. However, an example of the application of this methodology to Dyllick and Hockerts' perspective has not been identified in the literature to date. Consequently, the application of Dyllick and Hockerts' perspective to the measurement of business contribution to sustainable development remains unresolved.

It is now appropriate to consider in more detail the other relevant, systems approaches and the methods of measurement used in these approaches.

3.4 Capital Theory: Method of Measurement

As noted in Chapter Two, the systems approach is focused on the relationships between various institutions or phases of sustainable development. The approach is strongly analytical and is characterised by the use of diagrams, flow charts and equations. Some of the initial contributions to measurement methods for systems approaches arose from welfare economics and the developments of Hicks and Kaldor have been considered significant in this regard (Pearce 2002). In welfare economics the definition of income for the nation is the amount that can be consumed during a specified period whilst ensuring that wealth at the end of the period was no less than wealth at the outset. In this early work there was no consideration of depletable resources (Stern 1997). From these early general perspectives, development of measurement tools has followed two identifiable pathways. One pathway will be referred to as capital theory and the other pathway as full cost accounting. These pathways flow directly from the perspectives covered in Chapter Two under capital theory and green accounting aggregates. They are not mutually exclusive but they have sufficiently different focus to warrant separate explanations. The capital theory method is dealt with firstly.

During the 1970s significant work was undertaken in relation to economic growth models, which incorporated consideration of exhaustible resources. This work expanded on the initial work in welfare economics and included a single non-renewable resource and a stock of manufactured capital. A production function produced a single output using these two inputs and it was assumed that sustainability was technically feasible (Stern 1997). This was based on the unitary (one for one) substitutability of natural resources and manufactured inputs and based on the assumption of continuing technical progress (Faucheux and Muir 1997).

An example of the links between sustainable development and these growth theories is provided by the Ramsey rule. This is set out in the following equation-

Equation 3-1:

$$\frac{\dot{C}}{C} = \frac{\alpha R^{\beta} / K_M^{1-\alpha} - d_M - \rho}{\mu}$$

where C is consumption and the left hand side of equation represents the percentage growth rate of consumption. The first expression on the right hand side represents the marginal productivity of human- made capital. A Cobb-Douglas production function is assumed incorporating human made capital (K_M) and natural resources (R) (Pearce 2002). Pearce suggests that under these conditions (which ignores technical change and population growth) the growth rate of consumptions depends on –

- Utility discount rate (ρ)
- Marginal productivity of human made capital
- Elasticity of the marginal utility of consumption (μ)
- Rate of depreciation of human made capital (d_m)

Further, if natural resources or human made capital move towards zero then so do income and consumption and this is not compatible with a sustainable development pathway (Pearce 2002).

Whilst the position outlined above is an aggregate at the national level, the implications flow through to the operation of business in general terms at least. Put another way, it is not considered feasible that the national economy could achieve sustainable development if none of the businesses in that economy are operating to contribute to sustainable development. What has not been resolved to date is how these aggregated equations are translated to inform the actions by each firm. There is no conceptual relationship between aggregate notions such as the marginal utility of consumption or the elasticity of the marginal utility of consumption and the marginal optimality sought by individual businesses (Daly 1991).

Even if there were such a correlation, the issue is more problematic than that. The operation of specific institutional arrangements dictated by corporate governance mean that there is further translation that needs to be made between the aggregate and firm level. Consequently, to make the connection between the aggregate and firm levels there would need to be a ‘conversion’ or ‘translation’ to account for the fact that activity within a firm is not mirrored in the market. This point was noted earlier and has been described by Coase (1937) in his seminal work on the theory of the firm.

This issue remains unresolved and will be considered further when seeking to develop the improved measure of business contribution to sustainable development later in this chapter.

Returning to the macro scale, Faucheux and Muir (1997) note that to avoid a reduction in per capita consumption (under the same conditions as above regarding population and technical progress) the share of economic product that is saved needs to be at least as large as the natural capital factor share (The Hartwick rule). As noted earlier, the Cobb Douglas production function incorporated above assumes unitary substitutability between natural and human made capital and to avoid a reduction in per capita consumption the economy must also satisfy the following conditions:

- Manufactured capital is relatively more important than natural capital in production, meaning that the factor share received by economic capital is larger than that going to natural capital .
- Savings are sufficiently high, more particularly, that for each moment in time there is investment in manufactured capital stock formation (savings) of at least the equivalent of the value of the resource rents (Faucheux and Muir 1997).

These prescriptions become even more demanding if the condition for nil population growth is lifted. The need for technical progress to improve the elasticity of substitutability of natural and man made capital becomes critical.

The method so far has not dealt with the problem of intergenerational equity. In the terms of the capital theory method this involves an inter-temporal equilibrium between utility maximising consumers. This is technically dealt with by constructing an overlapping generations approach, incorporating a depletable natural resource, and assuming that each generation is operating to maximise the present value of utility (Faucheux and Muir 1997). This brings to light a further problem in achieving sustainable development. In the absence of complete knowledge of the economy's key technical and social parameters (including capital stock levels, output, substitution elasticities, and social discount rate) it is not possible to infer by how much the future prices for resources may be wrong. Put another way, if we do not know future generations' demand for goods, eco system services and resources, or future

production possibilities, we cannot be sure that they are necessarily revealed in the market prices for those goods today. Consequently, it is difficult to simply infer from the fact that an economy had savings for a period (i.e. the community lived on its interest) that the consumption during that period is actually consistent with the concept of intergenerational equity (Faucheux and Muir 1997; Stern 1997).

This highlights the significant difficulties associated with assuming that the capital theory approach will inevitably lead to sustainability. These issues are not, however, unique to capital theory and even in view of these limitations it still constitutes an important contribution towards the measurement of sustainable development. There is still much that needs to be understood however, and based on some authors' suggestions (Faucheux and Muir 1997; Stern 1997) it appears that capital theory would be enriched if it was able to:

- Provide clearer, simpler measures of success- as noted above, the factors used by the capital theory are technical ones and few players in a national economy would really know if they were contributing or not to these factors.
- Link with other systems approaches to support scenario modelling- this is very much about providing more information about the social and environmental issues which are 'assumed' by the capital theory. There is no recognition of possible threshold limits as noted earlier in Chapter Two in the discussion on strong and weak forms of sustainability.
- Link with expanded forms of historical analysis so as to expand the understanding of a wider set of factors that may impinge on sustainability- this is similar to the point above only with the past in view. By linking information on social and environmental issues in the past with past economic performance, it would be possible to enrich the knowledge of future possibilities.

In summary, the basis for these suggestions is to expand the scope and functions of capital theory.

This research has established two simple tests for assessing the completeness of approaches to sustainable development. Scope covers the key themes and concepts of sustainable development and functions covers the matching and linking operations

implicit in sustainable development? On this basis, the suggested improvements to capital theory would cover:

- expanded scope (Faucheux and Muir (1997) note that intragenerational equity is not covered in any of the extant models)
- improved linking function, in that it provides little understanding for institutions regarding the practical actions that need to be taken (Stern (1997) sees this as requiring more measures and simpler, clearer ones)
- improved linking function (so that it incorporates richer knowledge from other disciplines)

The implementation of these improvements for the individual business entity would result in a clarification of the relationship between aggregate indicators of sustainable development and the activities that occur within business.

To achieve this it would be necessary to also account for the corporate governance implications which sit between individual business activity and the aggregate operation of the economy. The problem therefore requires an understanding of the relationship at three distinct levels. This is illustrated in Table 3.2 below.

Table 3-2: The Three Levels Involved in Understanding Business Contribution to Sustainable Development

LEVEL	DESCRIPTION
LEVEL ONE	The national economy level has established indicators of sustainable development.
LEVEL TWO	The market in which individual businesses operate is regulated by the specifications of corporate governance.
LEVEL THREE	The operation of an individual firm is determined by its management/ownership.

At the moment, the specific relationship between indicators of sustainable development at level one in the table above and the other two levels is not fully understood. This is made more difficult by the fact that each level operates differently and that the whole system is not a homogenous blend. As noted earlier, it is common for both natural and man made systems to operate in a way such that the sum of the parts does not equal the whole (Costanza and Wainger 1993).

The next section outlines the developments in the green accounting methods for measuring sustainable development at the national level.

3.5 Green Accounting Aggregates: Method of Measurement

The second significant pathway of development in regard to consolidated indictors methods flow from the green accounting aggregates perspectives discussed briefly in Chapter Two. Pearce (2002) indicates that the first set of national accounts that incorporated provision for depreciation of environmental goods was undertaken in 1989 in relation to Indonesia. This work involved deductions for the extraction of forestry and petroleum products as well as output losses arising from soil erosion.

The thrust of this work was to modify the nation's GDP by the amount of the consolidated deductions. As noted earlier, the Earth Summit in 1992 gave impetus to institutional initiatives in relation to sustainable development. One of these included the proposal for nations to develop revised measures of gross national product (GNP) on the basis that it only reflected one form of capital –man made, reproducible items.

As noted in Chapter Two there were two approaches under this heading which are worthy of particular attention, given the objectives of this research. They are genuine savings and index of sustainable economic welfare (ISEW) and they each have a method which has been developed to measure sustainable development. These methods will be considered in turn below.

In the *genuine savings method*, an economy, which takes account of its capital stocks, could be represented by the following equation from Pearce:

Equation 3-2 $$NNP = C + I_{net} - d_M - d_N - d_H - d_S$$

where:

- NNP is net national product.
- C is national consumption.
- I_{net} is net investment.
- d_M is depreciation on man made capital.
- d_N is depreciation on natural capital, covering depletion of stocks plus growth and discovery.
- d_H is depreciation of human capital –likely to be negative as skills appreciate.
- d_S – depreciation of social capital which could be positive or negative depending on family breakdown, crime rates etc. (Pearce 2002).

The genuine savings measurement tool proposes that in line with the concept of putting money aside over time to replace an ageing asset, then a nation's savings less depreciation of its capital stocks equals its genuine savings. The Pearce equation above indicates the capital stocks which would be considered by the genuine savings tool and it follows that, in broad terms, if genuine savings are persistently negative, well being will necessarily decline. A further calculation would be needed to determine the impacts of population growth on the per capita consumption of the subject economy.

This approach reflects a simple methodology for determining if an economy meets the simple rule of whether it is living on its interest or using accumulated stocks of capital. Unfortunately it does not resolve any of the valuation and pricing issues nor the inter-temporal equilibrium issues also encountered by capital theory; however, it has been widely applied and its simple logic can be translated to the business level. The application of this method to individual businesses is taken up by Atkinson (2000) and is reviewed later in this chapter.

The *Index of Sustainable Economic Welfare (ISEW)* method of measurement of sustainable development is computed by adding values of items, which increase welfare and subtracting items of values that decrease welfare. There are twenty-one separate items incorporated in the index and these include personal consumption, expenditures on education and health, loss of farmlands, depletion of non-renewable resources and a welfare inequality index. A full list of the items included in the index is set out in Table 3.3 below. The plus (+) or minus (-) sign indicates whether the item makes a positive or negative contribution to the index. The last item, namely the welfare inequality index, is included to adjust for the impact of economic indicators that do not take into account the individual welfare of citizens. The ISEW was built with the intention of analysing the long-term trends in a stabilised economy. Experience has shown that the most important component is personal consumption – it primarily shapes the index (Gil and Sleszynski 2003).

Table 3-3: List of Items Comprising the Index of Sustainable Economic Welfare

(+) Personal consumption; (+) Household labour (+) Services: consumer durables; (+) Services: streets and highways; (+) Public expenditures on health and education; (-) Expenditures on consumer durables; (-) Defensive private expenditures on education and health; (-) Loss caused by commuting (-) Loss caused by road accidents;	(-) Loss caused by water pollution (-) Loss caused by air pollution; (-) Loss caused by noise pollution; (-) Loss of wetlands; (-) Loss of farmland; (-) Depletion of non-renewable resources; (-) Long-term environmental damage; (-) Ozone layer depletion (+/-) Change in net capital (+/-) Change in net international position and (+/-) Welfare inequality index.

The index is constructed by monetised entries for each item for each year under review and these time series are adjusted to give constant prices and a per capita result for the locale under review. In the case of the index for Poland, (Gil and Sleszynski 2003) which is one of the most recent indexes constructed, it was found that during the study period that growth in GDP per capita was accompanied by a decline in ISEW per capita and vice versa. This reflects the tension between growth and development strategies and also highlights the need for better understanding of the policy settings which may result in improved welfare without detriment to social and environmental indicators (Gil and Sleszynski 2003).

The limitations of the ISEW approach again, like capital theory, reflect limitations in knowledge systems covering (1) actual physical data about environmental limits (2) accurate pricing in relation to a wide range of eco systems services and (3) understanding of the specific importance and nature of relationships between the items in the index and (4) the value/importance of many other items which are not included in the index (Atkinson and Hamilton 1996).

One of the suggestions for improvement to the capital theory was the need for a wider range of disaggregated, simple indicators so that it was easier to identify what needed to change to improve results. It would seem that the ISEW is one effort to expand the scope, coverage and transparency of consolidated indicator methods. Not only does the ISEW create a single index measure, it also makes it possible to review each of the contributing sub indexes to discern a deeper level of causality between the single resulting measure and it component sub indexes. Again this was another suggested

improvement for the capital theory. Also, by being able to project results of sub indexes into the future and review past results by sub index, the index would cover most of the issues recommended for improvement to capital theory.

The ISEW is a pointer to what may be achievable at the business level in using a consolidated indicator for comparative analysis but improving the depth of the information by providing access to sub index information. As noted above, one of the major objections to the ISEW is its ability to demonstrate the specific links and relationships between the items which make up the index (Atkinson and Hamilton 1996). This is also likely to be a significant issue if it were possible to construct such an index for an individual business entity. From the earlier discussion on the capital theory it is apparent that the links between sustainable development at the aggregate level and individual businesses are not clear or quantified. Chapter Two clarified that the expansive approach to business sustainable development was relatively comprehensive in both scope and function; however, at this stage a method for measuring this approach is not yet available.

There is an associated development in the application of index methods at the macro level which is relevant to this enquiry. Chapter One noted that the Human Development Index (Streeten 1995) had become an important global measurement method in relation to the social pillar of sustainable development. The index incorporates information from hundreds of countries and in addition to the empirical information a wide range of qualitative information is obtained to enrich the understanding of social conditions in each participating country. The development of the index has meant that there has been a need to accommodate large variations in the amount and quality of information available between different countries.

Simply put, poor countries have very limited demographic and other data whilst developed countries are data rich. In response to this situation, the HDI has been constructed so as to accommodate these different levels of date. This has been achieved by way of using optional sub indexes within the overall index. By having sub indexes which are able to incorporate additional data and which sit within the structure of the consolidated index, the HDI is able to still compare country performance at the primary index level. At the same time, countries with additional

data can incorporate this and compare relevant sub indexes with other data rich countries. The business environment is one in which large companies have the resources to collect large amounts of data whilst small businesses are limited in this regard. It is possible that an improved method for measuring business contribution to sustainable development may be able to incorporate the flexibility achieved by the HDI. This will be taken further in Section 3. 10 of this chapter.

The next two sections review current progress in measuring business contribution to sustainable development.

3.6 Business Savings: Method of Measurement

In normal operating conditions, all firms have an impact on the environment. This may be caused through extraction of natural resources, consumption of fossil fuels, and emission of wastes during the production and distribution processes and so on. Assume that it is possible to value and account for the total amount of this damage through a dollar amount. If this were possible, then that amount could be subtracted from the firm's operating profit and in so doing, the remaining balance (namely, profit adjusted for damage) would indicate the extent to which the firm's normal operations depended on the avoidance of accepting the full cost of its operations.

Section 2.5.3 set out the basis for the conventional operation of an individual business. If this is adjusted to take account of environmental damage, then the adjusted equation for the value of the firm would be as follows:

Equation 3-3 Present value of expected future profits $$= \sum_{t=1}^{n} \frac{(TR_t - TC_t) - TD_t}{(1+i)t}$$

where TD_t is the total damage arising from the firm's operations in the year t.

These additional damage costs may cover a range of factors and of course the calculation of this amount is subject to the availability of prerequisite physical data, as well as the operation of advance valuation methods (referenced in Chapter Two (2)). This approach has been put forward by Atkinson and he refers to the differential between the value of profits ($TR_t - TC_t$) and the value of damage caused (TD_t) as the 'corporate genuine savings rate' (Atkinson 2000). Atkinson proposes that the greater

the costs associated with damages, the less resources are available to invest in new assets and consequently, the less 'sustainable' is the company (at least notionally).

In effect this approach to measuring business contribution to sustainable development does not seek to change any fundamental dynamics in the operation of the firm. It is based on the conventional precepts of marginal optimisation and it does not elucidate, any further, the relationship between individual businesses and aggregate indicators of sustainable development. However, it incorporates additional cost factors (which could be based on abatement costs or damage costs) which indicate whether the levels of profit are sufficient to make the business sustainable if the additional costs, associated with damage, were internalised. This approach is a direct derivation from the genuine savings approach at the national level (See Section 2.5.3). There are related approaches which utilise abatement costs instead of damage costs to adjust profit outcomes (Gray and Stone 1994). Either way, it is construed that the remaining profit may be used to invest in future assets. This is the same conceptual foundation applied by the genuine savings approach at the national level (Atkinson and Hamilton 1996; Pearce 2002).

There are several issues worthy of discussion in relation to the application of this tool to the measurement of business contributions to sustainable development. First, there is potential confusion regarding the actual intent of the tool. Is it intended to measure the sustainability (longevity) of the firm or is it directed to measuring business contribution to national sustainable development? That the result of applying the approach is intended to identify resources available for re investment suggests that the focus is more on longevity of the firm. Whilst it would be counterproductive if a firm's contribution to sustainable development led to its closure, it is not sufficiently clear, given the current level of knowledge about how to define and measure business contribution to sustainable development, whether one method is able to serve as both a measure of profitability (and longevity) and a measure of contribution to sustainable development at the same time. In practical terms there is no evidence of nations doing away with their systems of national accounting in favour of green accounting aggregates and the like. For the same reason, it is considered important at the firm level to solve the problem of what constitutes a positive contribution to sustainable

development before also seeking to amalgamate this with conventional measures associated with longevity and profitability.

The next issue is that the adjustment is directed to the profit and loss measures within the business and as such, it is most likely that over time this will be seen as a profit reducing mechanism and therefore builds resistance from shareholders and managers. This is also considered counter intuitive given that the primary objective is to determine contribution to well being. It has been noted previously that this is based on a prescription of maintaining capital stocks. It is somewhat circuitous therefore to propose that the resultant 'genuine savings', as reflected in the profit and loss accounts of the business, be applied to assets at some point into the future. It would be better, in the first instance to determine whether the firm's contribution to the nation's stock of capital assets has in fact been positive. It seems feasible that a firm could achieve a positive genuine savings result and at the same time for it to have made a negative contribution to well being (using the test of change in capital stocks as the basis for this calculation).

The final point relates to the continued primacy, in this tool, of marginal optimality (of cost and income) as the only basis for firm decision making to optimise the present value of future cash flows. There is no recognition of what might be described as 'effectiveness' measures to bring to the notice of the firm's managers and shareholders, the accumulative and or distributive effect of the firms actions. As such, there are no mechanisms to even suggest the need for a basic matching of physical scales of production with the available resources. This also applies to the matching of temporal scales and generational equity. This is not a conceptually easy task and remains a continuing challenge for all models of sustainable development at the business level. In summary, this business savings approach falls somewhat short in building a stronger connection between aggregate indicators and individual business indicators of sustainable development.

3.7 Triple Markets: Method of Measurement

Another consolidated indicator method is used by Figge and Hahn (2002) to measure sustainable value added (*SusVA*) within their triple markets perspective. Sustainable value added is represented by the following equation:

Equation 3-4 $$SusVA = EG - \sum_{i=1}^{n} EE_{i,b} x (EIA_{i,t1} - EIA_{i,t0}) - \sum_{j=1}^{m} SE_{j,b} x (SIA_{j,t1} - SIA_{j,t0})$$

where *EG* is economic growth of the firm reflected by changes in value added over the period from t_1 to t_0 ; *n* and *m* are the number of relevant environmental and social impacts; $EIA_{i,t0}$ and $EIA_{i,t1}$ representing the eco effectiveness for environmental impact *i* in t_0 and t_1; $SIA_{j,t0}$ and $SIA_{j,t1}$ representing the social effectiveness for social impact *j* in t_0 and t_1; with $EE_{i,b}$ and $SE_{j,b}$ as the eco and social efficiency of the benchmark for environmental resource *i* and social resource *j*, respectively.

As noted earlier, sustainable value added is calculated by deducting the sum of all cost and revenues from changes in corporate eco or social effectiveness from the economic growth of the firm. A positive sustainable value added (*SusVA*) indicates that the firm has succeeded in creating extra value, compared to the benchmark, while keeping the overall resource consumption at the level of the preceding period for all resources which are used by the company (Figge and Hahn 2002). The sustainable value added approach is directed towards finding a potential control mechanism for matching the aggregate resource use of firms to the aggregate physical resources available. As such it represents a unique contribution; however, it is difficult to envisage how such an intermediate trading mechanism would operate in practice. Such a mechanism would necessarily operate separately to the market for the firm's goods and separately to any extant market in environmental goods that may already be in operation.

So, it would be a market within a market within a market – hence the descriptor used to describe this model (in this research) as the triple markets approach. Despite the potential difficulties, in establishing a further market, the outcome still does not ensure that aggregate production is matched to physical scale. It does however, seek to ensure that wherever possible, the most efficient supplier satisfies any increased demand and this takes it one step further than the business savings model considered above.

Consequently, the difficulties associated with its application and the limited extent to which it resolves the primary issues confronting sustainable development in business,

diminish its potential for wide spread application. In summary, the triple markets approach seeks to build a bridge between the aggregate (national) implications of sustainable development by introducing an additional control over production (the third market where only the most efficient producer is permitted to undertake production). This is a particular stratagem to introduce the notion of effectiveness into the operation of business and as such is seeking to better accommodate the multiple ramifications of sustainable development at the national (aggregate) level to the individual business level.

In essence, for Figge and Hahn (2002), effectiveness is achieved when the efficiency of a particular firm is above the industry benchmark. This is a very different treatment of effectiveness compared to the perspective of Dyllick and Hockerts (2002) who regard effectiveness in terms of the neologisms of ecological equity and sufficiency. Also, given the earlier discussion in this dissertation about the issues around licence to operate (in Chapters One and Two) and the noted unwillingness of governments to intervene in markets, there seems little likelihood that governments would introduce a third market. This is especially so when some developed nations are not prepared to introduce a second market, such as for carbon trading (Hamilton and Schlegelmilch 2000)

Powerful industry groupings could well use the triple markets approach, in a voluntary compliance way, to further compliment industry strategies to demonstrate commitment to sustainable development. For example, a powerful industry group, such as the mining industry in Australia, could add such an approach to its charter regarding sustainable development (Minerals Council of Australia 2000). If social, as well as environmental and economic factors were included in such a process, then the outcome would most likely be a very positive one in regard to sustainable development. If the social issues were not considered in the ‘efficiency’ benchmarks then it may be used as an additional strategy by MNCs within an industry to boost market share.

Each of the methods of measurement, associated with the perspectives selected for further analysis, have now been reviewed and the next section is a discussion of what has been discerned from this analysis.

3.8 Review: Methods of Measurement

Based on the preceding analysis, all methods of measurement in relation to sustainable development are theoretically unresolved to the extent of incorporating all of the key themes and concepts (scope) as well as the core functions (of matching and linking) of sustainable development. All of the reviewed methods at the national scale are based on capital theory and draw on considerations of strong and weak sustainability. They also require valuation of all components so as to enable consolidation. As a result, they provide the simplest way in which to undertake comparative analysis in relation to contribution to sustainable development.

At the national level, considerable effort is being applied to expand the capital theory method so as to be more comprehensive. The ISEW is a major development from capital theory using accounting aggregates. It endeavours to enrich the understanding of sustainability through charting a large number of issues considered to be important to sustainability. The shortcomings of this method go to the heart of human knowledge systems, which are limited in the extent to which they are able to map causal relationships between the various issues included in the index. Current developments in methods to measure business contribution to sustainable development have drawn from the national scale methods. The business savings method (Atkinson 2000) seeks to achieve similar results to the genuine savings method at the national scale (Pearce 2002). The genuine savings method is seeking to add an environmental dimension to the measurement of national progress. The business savings method is similarly seeking to adjust profit for a business entity to reflect environmental costs.

The issue at the business level is that simple adjustments to operating profits do not adequately reflect the ‘effectiveness’ measures that bear on sustainable development at the single business level. Others are making efforts to reflect this perspective. For example, the triple markets perspective (Figge and Hahn 2002) requires an additional test on businesses seeking to produce more and in this way is seeking to build a bridge between the conventional drive (at the micro economic level) for efficiency and the national implications of sustainability in seeking to match the aggregate scale of the economy with the scale of the available resources.

It has been noted earlier that Dyllick and Hockerts (2002) have identified in their expansive definitions perspective, new terms to describe the effectiveness issues confronting business. However, there is no method for quantifying these terms and their implications. It has also been noted that some public sector organizations measure organizational performance using both efficiency and effectiveness measures (see Chapter Two) (Higgins 2001). As a means of improving methods of measurement for business contribution to sustainable development it would seem to be feasible to:

- build an index method following from this development at the national level (Gil and Sleszynski 2003)
- incorporate the efficiency and effectiveness measures countenanced by Dyllick and Hockerts (2002)
- apply the organizational performance framework of efficiency and effectiveness measures used in some public sector organizations (Higgins 2001).

With these possibilities in view, the next section will commence the process of clarifying the setting for establishing such a measurement method.

3.9 Defining a Business Environment for SD

This section builds on the work of Dyllick and Hockerts (2002) in endeavouring to describe the performance framework that would more appropriately link individual business action with aggregate indicators of sustainable development. In so doing, and as noted earlier, they have introduced new terms, including, 'sufficiency', 'effectiveness' and 'equity' to seek to describe a more complete response by business to sustainable development (Dyllick and Hockets 2002). Essentially, this and the other definitions perspectives (reviewed in Chapter Two) are seeking to change business 'behaviour'. This is one of the clear goal orientations of this type of approach. It has also been identified that those working on systems perspectives have emphasised the need for the change to markets. Specifically, the work of Atkinson (2000) is based on there being a market for environmental bads (for example carbon emissions) with the value of these environmental bads subtracted from the overall operating result of the firm. Effectively, there are two markets in place in this perspective. One is the market for the firm's goods and the other is the market for the environmental bads.

To the extent that the Atkinson model portends a 'market within a market' then the work of Figge and Hahn (2002) proposes a market within a market within a market. There are the two markets of the Atkinson model plus there is a further market in which it is determined whether the additional production of one firm is sufficiently efficient (that is, it produces the least environmental bads) for it to be allowed to increase production of its product. This sub market would see additional production being traded to the most efficient producers and/or existing inefficient production being moved from one (less efficient firm) to another (more efficient firm). These two perspectives are seeking to modify the system in which conventional businesses operate as a means of accommodating the notion of sustainable development.

So, on one hand the definitions approach (as represented by Dyllick and Hockerts (2002)) is seeking to describe different ways of doing business (within the existing market system) and on the other hand, the systems approach (as represented by Atkinson (2000) and Figge and Hahn (2002)) is seeking to modify the markets within which business operates. It is as though the definitions approach is building change from the 'inside' (namely behaviour within and by the business) whilst the systems approach is starting from the outside (namely the operation of the market place/s within which businesses operate). This is consistent with the levels outlined in Table 3.2 and reiterates the need to understand the business involvement in sustainable development with reference to these three levels. The definitions approach has sought to clarify the issues at level one (the individual business entity). The business systems approach has sought to clarify the issues at level two (the market in which businesses operate). Finally, the aggregate level indicator models such as capital theory have sought to clarify the issues at level three (the national economy).

It is intended to seek to build a perspective which takes into account these three levels of sustainable development for business. To do this it is necessary to consider the:

- relationship that would exist between the firm and the market place
- way in which performance is measured and monitored
- primary indicators of success and failure

In effect the aim is to clarify the meanings of the neologisms used by Dyllick and Hockerts (2002) in their expansive definitions perspective and in so doing building a

more transparent link between the national, aggregate level indicators of sustainable development.

By this it is not intended to presage any substantial changes in governance or market systems. It is clear from preceding analysis in this research that this is not a realistic expectation in developed nations in the foreseeable future. The objective in this section is build a clear understanding of the approach to the whole business system that would build a connection between micro (individual) activity and the macro (aggregate) implications of sustainable development. This is really a process of seeking to simplify the real world in order to develop a response (method) which is commensurate with human knowledge. This process, where simplified models are used so as to build understanding, is a common one in research (Zikmund 1997). The features of such a (simplified/idealised) system are explained below. The primary, distinguishing features are numbered in parenthesis (No.) so as to keep track of the emerging requirements.

The objective of all participants (institutions) within the system is to grow capital (One). This is based on the capital theory approach being applied to all institutions within the system, not just the system as a whole. So, no matter whether it was an individual, government or business, the primary objective is to increase capital. This is a change from current circumstances in which governance arrangements have meant that some institutions are very limited in their obligations.

In this regard, the operation of corporate governance (namely the governance of business as an institution) has served to limit the obligations of business and this was explored at some length in Chapter Two. To some extent the extensive growth of the non government sector in all parts of the world, could be seen as a counter to the limited obligations of business to perform a more complete role in the whole market system. It was noted earlier that Hawken, Lovins and Lovins (1999) countenanced the intent of this first prescription by suggesting that corporations should be accountable to the same extent as individuals. It is intended through this first prescription to place the same, equal obligation on all institutions within the whole system and to avoid any inter-institutional offsetting of negative and positive contributions to capital maintenance and growth (One).

There would also be a need to know and measure all forms of capital and to keep a track of balances at the individual or unit level within each institution as a whole (Two). In the case of business, this is consistent with the prescription put forward by Gray (and noted in Chapter Three) to the effect that the sustainable corporation would leave the environment no worse off a the end of the accounting period than it was at the beginning of the period. This prescription is intended to overcome the problem noted earlier in relation to the 'sum of the parts' within the whole system. This was recognised in the preceding analysis of capital theory where it was difficult to discern what the aggregate achievement of sustainable development would actually mean for individual economic entities such as firms.

Daly (1991) explains that there is no prescription in microeconomics that recognises the potential physical limits of overall production. Further, Dyllick and Hockerts (2002) have enunciated that increasing efficiency in a business does not necessarily contribute to sustainable development. The problem is that if the expectation at the individual business level is that firms can make negative contributions in relation to some aspects of capital, then the sum of all businesses may not achieve a positive contribution. The prescription of the intended overall system is to apply the same rule to each unit within each institutional grouping as is applied to the institution as a whole.

This point is worthy of some further analysis as, on the surface, it could be suggested that simply tracking assets would not achieve the multiple ramifications of sustainable development. Quite simply, if business continued to be able to offset negative contributions to social or environmental issues with positive economic contributions then little would be different to the current situation. Therefore there is a need for strong form sustainability (as discussed in Chapter Two) whereby all forms of capital are at least maintained and preferably increased by each individual economic entity (Three). This brings the efficiency/effectiveness issues raised by Dyllick and Hockerts (2002) into play. For example, it would not be sufficient for firms to increase eco efficiency (that is, reduce pollution per unit of production), it would also be necessary to reduce total pollution (even under conditions of increased output).

Currently business is only required to increase efficiency. In this regard, it is expected that increased efficiency is necessary to achieve eco efficiency. But it has been noted by Dyllick and Hockerts (2002) that increased efficiency can lead to increased production and consequently increased use of environmental goods and the increased creation of environmental bads. To counter this, all physical items of production would by necessity need to be valued at full cost and the objective of the business would be to increase efficiency on one hand but on the other hand reduce the production (in absolute terms) of environmental and social bads (Four). The same efficiency/effectiveness issue would also need to be applied to the economic and social capital of the business. Exactly what is included in the account keeping for each form of capital continues to be problematic in operational terms; however, this does not diminish the intent of the proposed system.

In summary this virtual (three level) system would have the following attributes:

- One: the same, equal obligation on all institutions within the whole system and to avoid any inter-institutional offsetting of negative and positive contributions to capital maintenance and growth
- Two: the need to know and measure all forms of capital and to keep a track of balances at the individual or unit level within each institution as a whole
- Three: all forms of capital are at least maintained and preferably increased by each individual economic entity
- Four: all physical items of production would by necessity need to be valued at full cost and the objective of the individual entity would be to increase efficiency on one hand but on the other hand reduce the production (in absolute terms) of environmental and social bads

This is a simple setting completely consistent with the prescriptions outlined in this research regarding the primary thinking on what constitutes sustainable development.

It covers the three requirements established earlier and enables an understanding of the:

- relationship between firm and market
- way in which performance is measured and monitored for the individual firm
- primary indicators of success and failure.

There are many more subtle and detailed aspects of this setting that could be explored. For example, Hawken, Lovins and Lovins (1999) have proposed the notion of markets dealing only in 'leasehold' assets and that at no stage would property rights confer 'freehold title' to the purchaser. The manufacturer would continue to be responsible for the item once the current lessee no longer had a need for it. In effect, the disposal implications for a depleted asset would be the responsibility of its manufacturer. Another example would be to incorporate 'closed loop' manufacturing such that the outputs or by-products of one company are used as the inputs of another (Huber 2000; Lowe 2001). For the purposes of this study, with its focus on the measurement aspect of business contribution to sustainable development however, these issues do not change the overall setting and the intent required for a sustainable system. There are many such technical enhancements which could be considered to better describe the three level system but the objective is to simply construct a simplified setting sufficient to better understand methods of measurement.

The operation of this simple system could be initially represented by the equation below.

Equation 3-5: Total Business Assets + Total Government Assets + Total Civil Society Assets + Total Non Government Assets = Total System Assets

This reflects the expectation that each institution as a whole is making a contribution to the total assets of the system. For this to represent a strong form sustainable system, it is further proposed that capital stocks of each type, and in each 'unit' within each institution, would be maintained or increased over the accounting period. This may be overly 'conservative' given that temporary negative balances for one of the pillars, or some level of inter institutional offsetting, may be sustainable over time.

However, given the degree of uncertainty regarding the overall prescriptions of sustainability, it is designed to build redundancy into the model and to maintain capacity within the overall system. For the institution of business it would mean that all individual businesses would have the same operating prescriptions as the business community as an institution. That is, all assets must be measured and there must be at least no decrease in any of the three forms of assets (social, environmental and economic) over the accounting period. In this way, it is proposed that the overall

business institution can only be expected to achieve a positive contribution to sustainable development if there is a prescription for each entity within the business institution system to operate on the same basis. Maybe companies could trade 'surpluses' with less asset rich firms, but again the limits to this would need to be considered, and it is not necessary, for the purposes of this research, to extend the system to incorporate such subtleties.

It is now intended to consider, on the basis of this simple system, the manner in which a consolidated indicator method would operate to provide comprehensive information on the contribution of a business to sustainable development.

3.10 Towards an Improved Measure of Business Contribution to SD

Prior to proceeding with the development of the preferred method, it is important to summarise the current progress of methods for measuring business contribution to sustainable development. As well it is intended to formulate the 'specifications' for an improved method, so as to overcome current shortcomings in extant methods. These two tasks are undertaken below and then the logic for the preferred tool is established. Finally, the developed tool is tested for both completeness and functionality using the previously adopted tests.

In regard to the current state of development of consolidated indicator methods, the following observations offer a brief summary of what has been learned to date. First, it has been found that the measurement of business sustainable development is constrained dramatically by the conceptual difficulties arising from the nature of the firm and how it operates. Second, current consolidated indicator methods are directed to adjusting firm profits when the primary objective of sustainable development is regarded as being directed towards maintaining capital or assets. On this basis, an appropriate measurement tool for business contribution to sustainable development is more likely to be concerned with the firm's balance sheet and not the firm's profit and loss account.

Third, as noted earlier in this chapter, the intent of current measurement tools is confused between firm sustainability (longevity) and firm contribution to sustainable development. This has resulted in the adjustments for sustainable development being

made to profit accounts rather than adjustments to the business balance sheet. Fourth, the current business measures suffer the same criticisms levelled at the capital theory approach at the macro level in that they offer a single number (namely, adjusted profit) that provides limited information about what exactly needs to change. Fifth, it has been noted that the more expansive approach offered by the macro index approach (ISEW) has not been applied to the problem of measurement at the single economic entity scale.

It is therefore likely that an improved measure for business contribution to sustainable development would have the following features. First, measurement of business contribution to sustainable development may be best placed focusing on the balance sheet rather than the profit and loss account. Capital and assets have a broad application to other institutions and as well, are more easily related to sustainability (through maintaining stocks of capital) compared to profit. At present it is difficult to know what relationship may exist between profit and sustainable development and consequently measures that depend on making adjustment to profit figures are far less likely to be making accurate assessments. This is not to say that the relationship between business assets and stocks of capital is straightforward. There is much that still needs to be done to establish the relationships between various forms of aggregate capital and the assets of a business and this was highlighted by the earlier review of capital theory. The measurement methodology proposed later in this research seeks to make a step towards building the necessary connections.

Second, there is a need for both efficiency and effectiveness measures. Without these it is not possible to monitor the competing demands outlined above in relation to environmental, economic and social goods and bads. The work of Dyllick and Hockerts (2002) has so far sought to describe the implications of this problem for business by using the terms ‘sufficiency’, ‘equity’ and ‘effectiveness’. By using both conventional ‘efficiency’ measures (such as emissions per unit of production) and ‘effectiveness’ measures (such as total pollution) it may be possible to accommodate these competing dimensions of contribution to sustainable development. The efficiency measures represent conventional ‘ratios’ which are used in all facets of business performance. The effectiveness measures could simply be the ‘absolute’ values of key items, such as total assets, total pollution or total staff.

Third, the measure needs to be capable of being disaggregated so that the performance in particular areas (of the three pillars) can be discerned. This is required in order to ensure 'strong form' sustainability is being achieved. Adjustments to profit and loss accounts can hide contributing factors just as adjustments to national accounts can do the same. However, at the macro level, endeavours such as the ISEW are seeking to open up the knowledge of contributory factors and their relative importance (Gil and Sleszynski 2003). The work of Figge and Hahn (2002) has started this process in a business setting, albeit by using adjustments to profit and loss. There appears to be limited progress in establishing a richer, index method that would assist in understanding business contribution to sustainable development.

Fourth, the focus should be on developing a trend line, over a period of years so that it is possible to make more accurate comparisons of different companies and industries. A once off review of profits or assets is not sufficient. This underpins the notions that learning about sustainable development requires long-term mechanisms to be maintained. This is clearly reflected in several methodologies employed at the macro level but as yet, not applied to individual business analysis in this area (Gil and Sleszynski 2003; Redefining Progress 2001).

Fifth, the method should be accessible to all firms to enable small and medium enterprises to participate. The potential for some current methods to further increase the advantages of MNCs (over SMEs) has been highlighted by several authorities as set out previously. This is made more important by the business demographics of Australia, noted in Chapter One, where there is a preponderance of small business. If small businesses are excluded from the assessment by virtue of paucity of data, then a major proportion of the business community is left out of the picture.

To achieve these requirements it is proposed, based on the findings from this research, to incorporate the following attributes in the preferred method:

- The general prescription of capital theory in relation to the retention or growth of capital/assets as the basis for contribution to sustainable development.

- Use the three pillars approach for aggregating information and monitoring achievement, or otherwise, of strong form sustainability.
- The measure is a single purpose measure about contribution to sustainable development and is not intended to operate as a measure of business longevity.
- The beneficial attributes of the ISEW approach from the macro level.
- Build on successful index approaches, such as the United Nations' Human Development Index (HDI) (Streeten 1995), which allow rich and poor nations to use the same index and be compared with one another, but allow rich nations to use more data if this is available. This could be applied to SMEs and MNCs in a business setting.

Consequently, the logic for the new measurement tool is that if a company is to be considered to have made a positive contribution to sustainable development, then its assets must increase over time. This is reflected in Equation 3.6 below.

Equation 3-6: $CAt1 > CAt0$

Equation 3.7 applies where, *CA* is company assets and t_0 and t_1 are the times for the company's annual report. Equation 4-3 below reflects the conventional picture of the constitutive elements of company assets-

Equation 3-7*:* $CA = PA+IA+EconA$

In the above equation, *PA* are physical assets (building plant and equipment), *IA* are intangible assets (licences, copyrights and brands) and *EconA* are economic assets (cash, shares and bonds etc). This ensures that all key assets (covered by capital theory) are incorporated and the longer term implications of continued growth in intangible assets noted in Chapter Two are recognised.

Unlike other scales for sustainable development however, the actual size of a firm can change without there being a net impact on the overall scale of the business community. For example, an acquisition of one business, in part or whole, by another has the effect of increasing the acquiring business's assets but there is no necessary or different physical impact. Also, there is no automatic indication of greater/lesser contribution to sustainable development because one business has more assets and another has less. Another example is provided by an agricultural firm that acquires a large piece of equipment that clears trees more quickly – consequently, the physical

assets have grown in one regard (new equipment) but if the equipment is used to clear a previously untouched forest, then this loss of bio-systems services may offset the increased asset value, of the new equipment, to a greater or lesser extent. These examples bring to light the need for consideration of two important things –the *nature of assets* and the *time period for measurement*.

In relation to the *nature of assets*, if all that is considered are the company's assets, then, for the reasons noted earlier in regard to supply chain analysis and business obligations beyond the factory gate, such an approach is not liable to be accurate in bringing to light contributions to aggregate sustainable development. The wider set of assets to be incorporated is as follows-

Equation 3-8*: CA (sd) = PA+IA+EconA+EcoA+SA*

The physical assets *(PA)*, intangible assets *(IA*) and economic assets (*EconA*) are the ones that would normally be reported on by firms using current accounting standards. Ecosystem service assets *(EcoA)* relates to those natural assets used or damaged by the business and social assets *(SA)* covers both human and social capital as previously noted.

The conventional assets of a business are likely to be distributed in different physical places. For example a factory maybe located in one city and an office located in another. This is a stumbling block in relation to conceptual models of measurement in relation to sustainable development for business because these assets sit within different physical environments. Deegan (1999b) has previously identified the problems arsing from this issue as it makes one of the primary functions of sustainable development (namely matching of physical scales) very difficult. At the macro scale we have noted that Daly(1991) suggests that the economy must operate within and match the scale of the natural resources it has available.

To overcome this issue of distributed locations for various assets of the firm it is proposed to use the total assets as a surrogate for defining the overall scale of the firm. In this way, the total assets picture of a firm operates as a surrogate for the physical boundaries of a particular geographic location. A firm's assets will be used to map the boundaries and constitutive elements of the firm. In so doing it is intended to

measure the performance of the firm, in contributing to sustainable development against this 'map' of the firm's assets. This is in the same way that a local authority would use a topographical map to illustrate the boundaries of its jurisdiction and to provide the basis for measuring sustainable development for that district.

Also, companies consume natural resources and pollute, through solid waste or gaseous emissions, to varying degrees. These 'extractions' and 'emissions' operate outside the map of the firm and are incorporated in the thinking of externalities. It is intended to operate on the basis that it is possible, using the research that has been done on life cycle analysis (incorporating matter and energy intensity analyses) to convert all of the firm's consumption of ecosystem services into standard units of matter and energy equivalents (DeSimone and Popoff 1997; Fussler and James 1996) In this way it would be possible to establish a net balance of the firm's assets comprising the result of adding up both the good and bad assets. Currently firms are used to depreciating their assets due to the effluxion of time or the reduction in functionality (Ratnatunga, Romano *et al.* 1993). This extended approach would also see total asset values being depreciated by the present value of future wastes and emissions.

In relation to the *time period for measurement*, it is considered that 'point in time' measures (such as adjustments to profit figures) are likely to be subject to much volatility. A useful measure of contribution to sustainable development needs to reflect movements over at least a one year time period, be indicative of normal operating conditions and avoid, as much as possible, the fluctuations caused by investor or financial market sentiment at any point in time. Gil and Sleszynski (2003) make a similar point in relation to the operation of the ISEW.

Using Equation 3.6 it is possible to determine whether the assets for a second period are more than or less than the preceding period. If the assets have grown then the company has passed the first test in relation to making a contribution to sustainable development. Because however, the actual size of the firm may have increased or decreased for reasons related to sale, acquisition and so on, this test is not sufficient. The issue is whether or not the performance of the firm, relative to its new scale, has changed compared to its original size. To answer this there is a need to have an

additional, 'efficiency' test, adopting the view that the first test is actually an 'absolute' measure of contribution to sustainable development. An 'efficiency' or 'relative' measure could logically involve applying some ratio measures, using the total assets as the 'scale' for comparative purposes. It is necessary to consider more completely these 'efficiency' measures.

It is not unusual to apply a range of ratios to illustrate company performance (Ratnatunga, Romano *et al.* 1993). These ratios are applied to give insight into profitability, liquidity, asset structure and gearing and include price earnings ratio, the quick ratio, debt ratio and times interest earned ratio. In this situation our interest is to determine whether business performance, in relation to those issues of relevance to sustainable development, has improved or not. In simple terms the business performance measures (of efficiency) could logically be grouped under the 'three pillars', namely social, environmental and economic.

If so, then the indication of improved 'efficiency' contribution to sustainable development over the time period would be indicated by the following condition-

Equation 3-9 $$BPM_{S-t1} + BPM_{Eco-t1} + BPM_{Econ-t1} \geq BPM_{S-t0} + BPM_{Eco-t0} + BPM_{Econ-t0}$$

In this equation, BPM_S, BPM_{Eco} and BPM_{Econ} are the business performance ratios for each of the three pillars respectively and *t1* and *t0* are the times for the companies' annual reports. Simple business performance indicators relevant to sustainable development could be (a) staff numbers relative to total assets (social pillar), (b) pollution emissions relative to total assets (environmental pillar) and (c) earnings relative to total assets (economic pillar). A discussion on the most appropriate measures for inclusion in the equation follows. In the meantime these examples or proxies for indicators are expressed as equations below:

Equation 3-10: $$BPM_s = \frac{totalstaff}{CA} \qquad BPM_{Eco} = \frac{pollution}{CA} \qquad BPM_{Econ} = \frac{earnings}{CA}$$

The combined conditions for contribution to sustainable development by a business therefore involves increasing both the absolute (effectiveness) and ratio (efficiency) indicators, over the reporting period, as follows –

Equation 3-11:

$$CA_{sd,t1} \geq CA_{sd,t0}$$

and

$$BPM_{s,eco,econ,t1} \geq BPM_{s,eco,econ,t0}$$

An aggregate increase in both measures over the reporting period is likely to represent a contribution to weak form sustainability. An increase in each of the ratio and absolute measures for each pillar of sustainable development is likely to constitute a contribution to strong form sustainability. These conclusions are based on the requirement that all assets associated with the company and all relevant business performance measures are included in the calculation. This would of course require more business performance measures to be considered, than the three example ones considered above, if the assessment was seeking to be a comprehensive one. The expansion of these example measures is considered further, below.

The approach set out above is similar to the macro ISEW, so that by tracking key indicators over time it is possible to create an index of company contribution to sustainable development. At the moment the theoretical limitations of quantifying the monetary values of the ecosystem services utilised by a firm are put to one side.

The index of business contribution to sustainable development is constructed as follows:

Equation 3-12:

$$\begin{aligned} &Business\ Sustainable\ Development\ Index\ (BSDI) = \\ &Economic\ Index + Social\ Index + Environmental\ Index \end{aligned}$$

Each index for each pillar of sustainable development would comprise the ratio (efficiency) measure and the absolute (effectiveness) measure for that pillar as follows:

Equation 3-13:

$$\begin{aligned} &BSDI = \\ &Economic\ Index\ (Econ.\ \text{Ratio} + Econ.\ \text{Absolute}) \\ &+Social\ Index\ (Social\ \text{Ratio} + Social\ \text{Absolute}) \\ &+ Environmental\ Index\ (Eco.\ \text{Ratio} + Eco.\ \text{Absolute}) \end{aligned}$$

The absolute measure within each index for each pillar would comprise the assets related to that pillar and the ratio measure would comprise the Business Performance Measure for that pillar. This is set out in the following equation:

Equation 3-14:

$$\begin{aligned} &BSDI = \\ &EconomicIndex([PA_{t0} + IA_{t0} + EconA_{t0}] + BPM_{econ,t0}) + \\ &SocialIndex(SA_{t0} + BPM_{s,t0}) + \\ &EnvironmentalIndex(EcoA_{t0} + BPM_{eco,t0}) \end{aligned}$$

Whilst the approach set out in Equation 3.14 sums the three indexes, there is substantial richness of analysis provided by being able to review the contribution made by each sub index. This also provides the opportunity to ensure that a beneficial total index is not being achieved by offsetting negative results in one index with one or both of the other indexes.

There is a further opportunity provided by this type of index approach and that relates to applying a technique employed by the Human Development Index (HDI) in dealing with nations with varying levels of information (Streeten 1995). The operation of the HDI was considered earlier in this Chapter. The application of this type of approach to the BSDI is illustrated below, using the Social Index of the BSDI as a guide. Equation 3.15 represents Level One of the index and CA is company assets, *S* are full time equivalent staff employed by the business and t_0 is the time of reporting.

Equation 3-15: Level One Social Index $= SA_{t0} + \frac{S_{t0}}{CA_{t0}}$

Equation 3.16 adds additional optional information for Level Two and *A* is workplace accidents and *T* is workplace training and development.

Equation 3-16: Level Two Social Index $= SA_{t0} + (\frac{S_{t0}}{CA_{t0}} + \frac{A_{t0}}{CA_{t0}} + \frac{T_{t0}}{CA_{t0}})$

Finally, Level Three is achieved by adding additional information about community contribution by the company, where *ComS* is community service delivered by the company.

Equation 3-17: Level Three Social Index $= SA_{t0}(\frac{S_{t0}}{CA_{t0}} + \frac{A_{t0}}{CA_{t0}} + \frac{T_{t0}}{CA_{t0}} + \frac{ComS_{t0}}{CA_{t0}})$

The Sub Indexes within the overall index would each be weighted equally. This follows from the approach applied in the ISEW (Gil and Sleszynski 2003). In which case the Social, Environmental and Economic sub indexes comprise 33.3% of the

overall index. Whilst there may be some concern that business activity is more strongly weighted to the economic dimension, it is reiterated that the purpose of this model is to discern contribution to sustainable development and not to discern business longevity. For this reason and because there is no obvious basis for resolving a split other than an equal one, the equal weighting is considered appropriate. Also, this approach to equal weighting is simply a conservative starting point and it does not preclude future applications adopting a different weighting when information supports such an approach.

As well, each level of a Sub Index, for example within the Social Index, would carry the same overall weighting within the whole index so that there is no penalty for companies irrespective of the amount of data. At the same time, each element within each level of the Social Index would have the same weighting. So for example, at Level Two of the Social Index, each of the elements, namely Staff, Accidents and Training would be equally weighted. These prescriptions are important to ensure that the BSDI supports the comparison of performance between firms of all sizes and different levels of capacity. Capacity in the sense of having sufficient resources to obtain data for one or move levels of each of the sub indexes.

Using the same structure as outlined above for the Social Sub Index, Table 3.3 below summarises the levels and 'headline' elements for each of the sub indexes. Each sub level would comprise the same structure as set out above in the preceding equations. Please note that the 'ratio' component is not repeated in the table to avoid duplication and to keep the table simple. The ratio component would use each indicator for each level, divided by the Total Assets, to form the ratios for each level.

Table 3-4: The Sub Indexes and Levels of a Three Tiered Business Sustainable Development Index

Sub Index	LEVEL ONE	LEVEL TWO	LEVEL THREE
Social	Staff (no.)	Staff, Accidents and Training	Staff, Accidents, Training and Community Service
Environmental	Emissions (vol.)	Emissions and wastes	Emissions, wastes, material throughput and environmental contributions
Economics	Earnings (before interest tax and abnormals) ($)	Earnings and taxation paid	Earnings, taxation paid and no. of registered shareholders.

The index would commence with all base year values having an index value equal to 100. Each subsequent annual value would be converted to its index value relative to the base year value. For example, if staff numbers in the base year were 50 its value in the Social Index would be 100. If staff in the base year plus one, were 100 then the index value would be 200. That is 100/50 x 100 = 200.

The Business Sustainable Development Index (BSDI) outlined above will form the basis for data collection for this research. The three levels set out above need not represent the complete index. The index could be expanded to incorporate additional information as it becomes available. The three levels represented here simply reflect information that could be realistically expected to become available for a reasonable number of businesses at some point into the future. Also, over time it is hoped that future research will assist in identifying those Business Performance Measures that are most strongly linked to sustainable development. At this stage, the selected measures have been chosen based on two key issues:

- An assessment of measures identified in the literature by various authorities. (This assessment is detailed in Chapter Four)
- An assessment of the measures (relevant and available in business) which would fulfil the scope and functions requirements identified by this research as underpinning the application of sustainable development.

It is recognised that the choice of measures for the BSDI is a limitation and this was set out in Chapter One of this research.

However it is a limitation confronting all methods of measurement at all scales and institutions in relation to sustainable development. The specific objections to the application and construction of the ISEW were reviewed earlier in this chapter and the objections are the same as could be applied to the BSDI. The approach adopted here is justified using the two assessments set out in the above dot points and the methodology employed allows for other measures to be substituted as knowledge systems improve.

Consequently, it is contended that the BSDI provides a more complete approach to measuring business contributions to sustainable development than other, currently

available methods. A summary of the specific way in which the BSDI responds to the key themes and principles (scope), as well as the functions of sustainable development, is set out in Table 3.4 below. Compared to the earlier assessment made of consolidated indicator methods, the preferred method appears to provide a more complete view. At the same time it is able to operate to respond to different levels of data. In this way it is available for use by small and large business alike. In fact, it will make possible the comparison of performance across business demographics to a larger degree than is permitted by the more complex tools favoured by MNCs to date.

Table 3-5: Operation of the BSDI compared to the Scope and Functions of SD

Building Blocks and Functions of S D	BSDI Response
Resource Management	Distinguishes between the different forms of capital (e.g. social, environmental, and economic) and therefore allows for comprehensive impact assessment.
Growth	Maintains record of total assets and also tracks growth or decline in asset categories even when the size of the business changes due to acquisition or sale.
Pollution	Provides for tracking movements in levels of pollution and also, discounts the assets held by a company through capitalising future values of pollution.
Property Rights	All assets, including intangible assets, are able to be recorded and tracked.
Consumption	By having both 'ratio'(efficiency) and 'absolute'(effectiveness) measures, there is recognition of the impacts of increased consumption even if more efficiency is achieved
Equity	Maintaining visibility of the numbers employed, the level of taxation and the number of shareholders are key indicators for contributions to equity
Risk	Visibility of the different forms of 'capital' and the different 'levels' employed by the method, provide some scope for identifying risks beyond the factory gate.
Biodiversity	There is a limited capacity provided by the method to 'track' biodiversity. However there is recognition of eco system services within the environmental sub index and through this the impacts of business on biodiversity are potentially available (as systems of valuation and monitoring improve).
Community Participation	Level three provides information on community service.
Corporate Governance	The application of the BSDI reflects a voluntary extension of corporate governance obligations not inconsistent with existing governance obligations.
Supply Chain Analysis	The levels in the index provide clear scope to track business implications beyond the factory gate.
Accounting Concepts	The method would complement the application of full cost accounting concepts but it is also possible to apply it under conventional accounting conditions.
Link the Three Pillars	Provides visibility of movements in each pillar
Link Different Institutions	Provides several measures that indicate impacts on other institutions. For example – taxation paid; no. of registered shareholders; community service.
Match Physical Scales	This is achieved through the operation of both the ratio (efficiency) and absolute (effectiveness) measures
Match Temporal Scales	The BSDI is directed towards annual review so as to track movements in total assets over time. Also, by employing total assets as the 'benchmark' or 'map' of the business's territory, movements in size will not inhibit comparisons over time.

The summary analysis in this table suggests that the BSDI operates in a much broader way than existing systems methods. In the next chapter it is proposed to review the techniques used by others in related research projects to discern apposite approaches

and also, to resolve the most appropriate values to be used in the BSDI method during the data collection process.

3.11 Conclusion

To some extent any method for measuring sustainable development is a 'work in progress' given that it is likely to be many years before human knowledge systems are improved to incorporate the wide implications of sustainable development. The BSDI developed in the second part of this chapter has been developed through a synthesis of previous theory and endeavors at both the general and business scale. This preferred method will now be carried forward to the next chapter, which will focus on applying the method to business in Australia. The next chapter will review techniques employed by others in applied research projects and will also review appropriate data attributes for populating the BSDI equation. The analysis in this chapter has also identified an area for future research which will be carried forward to Chapter Six.

This future research issue was identified during the analysis of the capital theory method and also during construction of the indexes and sub indexes within each pillar of the BSDI. There is scope for detailed analysis into resolving whether there is any basis for alternative measures for use in Levels One, Two and Three set out in Table 3.4 for use in the BSDI. The measures adopted in this research are based on those measures which are available at the business level and which have been associated with considerations of sustainable development for business. The future work would involve a more detailed, technical mapping process from the aggregate level of capital theory to the business scale so as to confirm the most important causal links between the two scales of sustainable development. One of the criticisms noted earlier in relation to the ISEW was the lack of established linkages between the items in the index and the prescriptions of sustainable development at the macro level (Atkinson and Hamilton 1996). To some extent this highlights an issue confronting all efforts at all levels of sustainability. That is, it has been noted that it is not possible to measure business contribution to sustainable development without some reference to what this research and others have referred to in the business setting as 'effectiveness' measures. In fact it is likely that this issue pertains at all levels in a system – that is, contribution to sustainable development by one part of a large system is only measurable through reference, in some way, to the larger scale. One way of acting on

this relationship is to set performance measures which link the whole system with its component parts. The need to establish the linkage between the individual business entity and the aggregate national scale has provided an important pathway for improving the measurement of business contribution to sustainable development. However, more detailed research into the mapping of these linkages would be very beneficial into the future.

As a part of this mapping process it would also be appropriate to make a more detailed assessment of the weightings of the pillars in the index and sub indexes. The approach taken in this research is based on there being no information to the contrary of equal weightings but it would be beneficial to take a more active approach and analyze this issue further.

4 RESEARCH METHODOLOGY FOR MEASURING BUSINESS CONTRIBUTIONS TO SUSTAINABLE DEVELOPMENT IN AUSTRALIA

4.1 Introduction

Having established the BSDI as a method for measuring business contribution to sustainable development in the preceding chapter, the first section of this chapter considers research techniques used by others in measuring business performance in relation to sustainable development (and related issues such as the environment) in applied situations. This review will inform how to most effectively apply the BSDI in an Australian setting and also will assist in deciding on the particular data to be used for populating the new index.

It was noted in Chapter Three that, because of the limited and early knowledge in relation to applying methods for measuring contribution to sustainable development, it is important to compare and assess the selection of data attributes prior to populating the BSDI. The issue and the choice arise because there is no firmly established relationship between specific data attributes and sustainable development. One of the major concerns previously expressed in this research regarding business choices of suitable data attributes has been the decision not to include level of employment (staff numbers) as a key attribute of business contribution to sustainable development. This is one of the many choices which will be informed by reference to other applied research in the first part of this chapter.

The second section deals with the specific methodological issues of applying the BSDI in this research. It covers data sources, sampling frame, units of measure, definitions and statistical methods in the context of the specific questions for this research. Three types of analysis are proposed to be undertaken covering – model portfolio analysis, case study analysis and industry analysis. Again, the knowledge obtained from other applied research projects in this area will be used to inform the techniques to be applied in each of these areas of analysis.

4.2 Review of Research Methods Related to Measuring Business Contributions to SD

There have been a very limited number of studies that have applied conceptual models for measuring business contribution to sustainable development to business circumstances. There are three studies of particular relevance to this research. However, there have been a large number of studies in relation to business and environmental performance. This body of work has been extensively reviewed by Wagner (2001) and this review is considered further below. Prior to reviewing each study in detail, important aspects of each study are summarised in the Table 4.1 below.

Table 4-1: Summary of Applied Research Methods

Type	Researchers	Key Features
Event Studies	Wagner	Relate specific or single events on the share prices of selected firms.
Regression Studies	Wagner	Most suitable for studying multi causal models where there are a large number of cases and where the model being used is well established.
Model Portfolio Studies	Wagner	These studies are based on the segregation of firms into groups with different characteristics.
Industry Studies	• Atkinson • Measuring Environmental Performance of Industry (MEPI)	Provide valuable information on the data attributes applied to different groupings of firms based on their industry classification.
Single Firm/Case Studies	• Figge and Hahn • Atkinson	Provide valuable information on the data attributes used to populate conceptual models of business performance in relation to sustainable development.

There are several notable points in relation to this information. The Wagner (2001) research, which is covered by the first three entries in the above table, sets out to review the accumulated body of knowledge in relation to wide ranging efforts to establish a linkage between business performance (in a variety of guises) to environmental outcomes. In so doing it identifies important methodologies of specific relevance to this research. The MEPI research (Tyteca e*t al.* 2002) is a very wide-ranging review of the performance of companies in selected industries in numerous countries in Europe. Whilst the primary focus of this research is ostensibly environmental performance, the dimensions of performance considered include dimensions consistent with an assessment of sustainable development.

The Atkinson (2000) study covers the application of the business savings method as discussed in detail in Chapter Three. Atkinson has collected a small amount of data in relation to selected industry groupings and considered the results when using the genuine savings approach to these industries. The benefit of this work is to see the application of one method of measurement of sustainable development being applied to a number of industry groupings. The setting is the United Kingdom. The Figge and Hahn (2002) work is a limited application of their theoretical efforts described in detail in Chapter Three. The primary benefit of this research is to review the application of data to a sustainable development measurement model to an individual business. A more detailed analysis of each of these research projects is set out below

4.2.1 Event Studies

The events based studies relate predominantly to the impact of specific or single events on share prices. The researchers are seeking to understand the impacts of significant environmental events (positive or negative), such as oil spills, product recalls and the publication of external ratings of pollution performance, on the share market performance of public companies. Wagner (2001) concludes that event studies indicate that positive and negative events lead to positive and negative impacts (of a similar magnitude) in market prices. The magnitude of impacts is equal to about +37c to – 70c per share and it would appear that this magnitude of impact indicates the relatively lower importance of environmental performance compared to other business related events such as mergers and acquisitions.

It is also concluded that there are substantial limitations to events studies including:

- difficulty in assessing time series data
- the use of stock market performance as a measure of economic performance (instead of more reliable historic accounting profitability measures)
- limited scope for using this approach in inter industry studies

These attributes of event studies make them generally unsuited to the type of issues and questions as well as the type of analysis being proposed by this research.

4.2.2 Regression Studies

Regression studies are generally suitable for studying multi causal models and they seek to assess not only the total variance explained by a set of independent variables but also how influential each individual variable is once its interaction with all independent variables is accounted for (Wagner 2001). Overall however, it is necessary to recognise that regression analysis is only viable where there are a large number of cases and also, where there is a well established model and the relationship between variables is well understood (Wagner 2001). This immediately limits, on both accounts, the capacity for applying this type of method to this research project at the present time in Australia. First, because there is limited data and second, because the model being applied in this research is very preliminary and the relationships between the variables in that model have not been extensively studied.

There are some key aspects of this part of Wagner's research however, that are specifically relevant to this project. Wagner's focus is on those regression studies that deal with emissions or environmental management data as the measures of environmental performance. Data in relevant studies was normalised using annual sales figures. Wagner uses the term 'normalised' to refer to the operation of bringing all data to a standard base level for comparison. This is regularly done in economics when dealing with costs which vary from year to year because of inflation (Mansfield 1999). In the case of research dealing with businesses whose size or activity levels may change from year to year the normalising operation brings the size or activity to a base level for comparison purposes. By using this approach it is possible to compare performance from year to year even though the scale of production or the size of the firm may change from year to year.

This gives general support for the approach in the BSDI of using annual total assets as a mechanism for determining the 'size' of a firm's operation from a sustainable development perspective. Such an approach allows the measurement of a firm's contribution to sustainable development to be similarly normalised for changes in the size or production output of the business. Wagner (2001) also identifies research undertaken by Cohen and Kumar that looks at tangible and intangible assets in relation to environmental performance. This research suggests that firms with low

(poor) environmental performance have lower intangible asset values. This also supports the approach in the BSDI, where it is proposed that performance would be determined by business measures incorporating both tangible and intangible assets.

4.2.3 Model Portfolio Studies

Model portfolio studies are based on the segregation of firms into groups with different characteristics. In the case of Wagner's (2001) review, the performance under consideration is environmental. The null hypothesis is that firms with similar characteristics should show similar performance. Portfolios can cover one industry, several industries or all industries. An alternative to creating a model portfolio is to use an existing portfolio which has been constructed by another party. So far Wagner suggests that the evidence from these types of studies is mixed in arriving at a conclusion about the relationship between environmental performance and economic performance.

The portfolio approach allows comparison between portfolios with different characteristics although it only assesses average performance across the portfolio and its variation. Wagner (2001) suggests that in fact this is its strength, in that it allows for establishing systematic differences in economic performance over a large magnitude of environmental performance. There are some key features of the portfolio studies reviewed by Wagner that are relevant to this research and these are considered below.

First, values of environmental variables were normalised using firm revenue. This reiterates the point made above, in relation to regression studies, on the applicability of a normalising approach in this research. Second, the statistical tools used to compare portfolios were the standard parametric tests of difference (for ratio or interval level data) and where necessary the non parametric Mann – Whitney tests (for ordinal level data) were used to discern whether there was a real difference between the portfolios or whether in fact the variation was simply attributable to normal variation in a single population. This supports the use of parametric tests of difference in the portfolio analysis component of this research.

Third, inter industry and inter firm differences were considered by using industry classification as a basis for improved understanding of these performance differences. This supports the use of industry analysis in this research to compare and benchmark results with individual company results. Fourth, studies used return on assets, return on equity and total return as economic measures. This supports the adoption of similar measures (specifically Total Assets and Operating Profit) in this research.

One notable study by Edwards (cited in Wagner 2001) compared a total of 51 firms from those which had been screened for high environmental performance and compared them with others not recognised for their environmental performance. This research used return on capital employed and return on equity as the bases for comparing business performance. In the first stage the average profitability based on the two ratios of all firms in each sector were compared using standard parametric T tests. This was directed towards learning whether firms which had high profitability also had high environmental performance. The first part did not confirm that high profitability was linked with high environmental performance.

A second stage then compared the best (financially) performing non-listed firms with the corresponding listed firms again using T tests. This second stage sought to discern a lesser degree of difference in performance (given that both populations were high performing compared to the more marked difference in profitability of the first two populations) but given that the first part did not show a strong relationship between high profitability and high environmental performance this second stage proved to be of limited value in supporting the original hypothesis. Overall, therefore Edwards (cited in Wagner 2001) found limited support for the view that environmentally excellent firms have above average financial performance.

Based on the analysis of methods provided by Wagner in relation to environmental performance, and considering the objectives of this research, it is apparent the model portfolio approach is highly suited to this research. In particular it allows the analysis of business performance measures that are not stock market dependent and also, it provides for the systematic identification of differences in business performance across a wide range of sustainable development performance.

4.2.4 Industry Studies

Industry studies compare the aggregate performance of firms in related sectors with a view to discerning sector wide variations and trends. The MEPI Project (Tyteca *et al.* 2002) is an extensive analysis covering six industrial sectors across six European countries. It reviewed environmental performance of industry groupings using a set of simple ratios and as well, it undertook detailed comparative case studies of firms in four sectors. This research is particularly relevant to this analysis because of the:

- overall approach to considering business and environmental performance
- determination of the specific variables used for analysis
- approach employed for normalising performance of different firms
- knowledge gained from the variability of the results.

It is proposed to consider each of these aspects in some detail.

The researchers approach sees environmental performance measurement as sitting in a wider context of the debate about corporate social responsibility. In most cases indicators are simple ratios. On important outcome of the results was to produce scorecards that showed tables and graphs giving the average, median, minimum and maximum values of important variables. Example indicators include tonnes of hazardous waste per unit of production or per Euro value added. Results were analysed within specific industries with an emphasis on electricity and pulp and paper sectors. These indicators support the efficiency ratios proposed in the BSDI.

The project is based on a bottom up approach to data. This means the project uses data which is consistently available, compared to more conceptual approaches that cover more aspects but for which there are large data gaps. This issue was discussed in Chapter One of this research in the context of the possible theoretical limitations in using data which is available compared to a more theoretical approach. Because of the current early level of knowledge regarding the relationship between specific data attributes and sustainable development, the risk of reduced validity has been balanced by the scope and function tests developed in Chapter Two. As well, by reviewing the attributes applied in other research and taking into account the specific features of this research, the risk of reduced validity is lessened.

Three main types of performance indicators were developed for MEPI. These were:

- Physical indicators concerned with materials and energy inputs and outputs. These include waste generation (CO_2, SO_2, NO_2 and VOC emissions to air), water and energy consumption, heavy metal emissions and COD/BOD.
- Business activity and business management indicators linking physical aspects of environmental performance to information on business performance. The activity indicators covered operating profit, number of employees and value added (sales minus cost of materials). Management indicators covered International Standards Organisation (ISO) certification, disclosures of environmental investments and reporting of non-compliance events.
- Impact indicators relating physical output data to potential environmental impacts. The emission of ozone depleting substances to air is an example of these indicators.

These performance indicators are consistent with the typology for eco efficiency ratios noted earlier (Burritt 2002) and provide clear support for the example measures, such as staff numbers and pollution emissions, incorporated in the BSDI in Chapter Three.

Values of important variables were normalised (using the same technique employed by Wagner (2001) and explained above) and included 'variable per functional unit', 'variable per employee' or 'variable per functional unit sales'. An important point of methodology was that instead of working with the value of indicators themselves, the researchers used rankings derived from them. The main reason given was the non-homogeneities observed in some of the variables. For a particular industry, it was not just the global impact measure (emissions to ozone) that was measured but the levels of each contributing emission such as CO_2, NO_2, and SO_2.

There are two important differences on this point between the MEPI research and the research in this dissertation. First, the detail in relation to the sub components of emissions is not readily available in Australia and second, the scale of research resources applied to the MEPI project, to collect detailed data, was very large compared to the research in this dissertation. The need in this BSDI project to consider a supplementary 'ranking' step is therefore not warranted. This project is

only able to obtain information for the overall emission level and therefore the problem of having data on the different gases which contribute to greenhouse emissions does not arise. It was only because of the variations identified in this contributory data that the MEPI research converted the data to rankings and thereby reducing the scope for error in results.

As indicated above, results were presented as scorecards to allow comparison to benchmarks and trends. In spite of the scale of the study the research found that many of the potential influences on performance (such as the size of the plant under review, in the case of the electricity industry) were not statistically significant and that a key conclusion was the need to collect more data on fewer variables. The researchers stress the need for care in the interpretation of results because of the difficulty of obtaining adequate data across even the key variables.

An example of the difficulty found is provided by the analysis of the electricity industry in which it was found that those sites with ISO certification performed worse than those without. This runs counter to what would be expected when firms actively seek to improve performance but is reflective of the complexity of change management in business. It also reinforces the need to ensure that the management techniques employed (such as quality accreditation or sustainability reporting) actually result in the desired outcome. This is particularly relevant to the reservations, mentioned earlier, in regard to the contribution to sustainable development which may, or may not, be arising from businesses adopting the triple bottom line (Elkington 1999) or producing reports like those recommended by the Global Reporting Initiative (2000).

In summary, the MEPI study (Tyteca *et al*. 2002) provides this project with insight into relevant variables as well as simple ratio indicators of performance. Further, the research supports using readily available information as a primary method to achieve effective comparative analysis and highlights that complex business change processes may not always achieve desired outcomes. This is particularly so in relation to the inconsistency of performance results arising from firms that have introduced quality systems to improve environmental management.

A further 'industry' study is provided by Atkinson (2000). Atkinson has made a considerable contribution to the conceptual consideration of measuring contribution to sustainable development both at the macro and business levels. The model employed by Atkinson, for the business level (referred to as the business savings approach in this research) has already been reviewed in Chapters Two and Three. So, it is intended to briefly consider how Atkinson applies this conceptual model to an analysis of nine industry sectors and one single corporation.

Atkinson (2000) uses the following variables:

- *value added*: this is equal to sales minus cost of materials. In dealing with an individual company assessment, Atkinson uses profit on ordinary activities. This supports the use of operating profit by this research.
- *environmental damage*: this is drawn from an evaluation of energy externalities and incorporates estimates of the ultimate impact of polluting activities on human health (morbidity and mortality) and non-health factors (forest damage, material and buildings damage). This research uses a monetised value for greenhouse emissions, adopted by the Australian Greenhouse Office (2001)
- *corporate genuine savings*: the difference between value added and environmental damage estimates. This research departs from this approach in adopting the BSDI and in so doing, not making adjustments to profits as the only measure of contribution to sustainable development. This approach is set out in detail in Chapter Three.

In effect Atkinson (2000) employs a very simple approach to analysing both industry and individual business level data. If the result of his equation is negative, then the business operation is not making a contribution to sustainable development. Atkinson suggests that his approach could be extended to included social as well as environmental costs. Most importantly also, Atkinson employs accounting measures of business performance to discern contribution or otherwise to sustainable development. This is consistent with some of the methods used in the model portfolios research considered by Wagner (2001) and also by the MEPI project (Tyteca *et al. 20*02). This research applies accounting measures extensively in the BSDI.

4.2.5 Single Firm or Case Study Research

The value of the Figge and Hahn (2002) research is primarily in providing an example of the application of a conceptual model to a single firm. Whilst Figge and Hahn (2002) do not undertake any systematic analysis of industries or companies in their research, they do provide interesting information on the variables and ratios relevant to their model.

The variables employed are:

- value added for the economic pillar
- CO_2 equivalents for the environmental pillar
- work accidents for the social pillar.

Ratios employed are:

- Eco efficiency = value added divided by CO_2 equivalents
- Social efficiency=value added divided by accidents

It is considered that employing accidents as the variable to represent the social dimension is a very internally focused, narrow perspective of social contribution. It may be justified as a secondary or tertiary level indicator but falls a long way short of representing a strong or robust indication of a firm's social contribution. Overlooking the total employment of a firm in considering social contribution would seem to be a perspective strongly supported by industry oriented lobbies and interests and its omission is considered to be a significant weakness in any such approaches. As noted earlier, the proposed BSDI approach uses 'number of employees' as a 'headline' indicator of the social contribution of business to sustainable development. This is supported by Topfer (2000) and Tyteca *et al.* (2002).

4.2.6 Summary of Issues from Applied Research

There are a number of key issues that will be carried forward into the methodology for this research, which have been gleaned from the applied research considered above. This is revealed in studies especially associated with environmental performance but also in emerging approaches to considering the measurement of business contribution to sustainable development. There are several issues of specific relevance to this research. Accounting measures of performance are widely employed; however, Wagner's (2001) research uncovered the use of share market values. The

weight of approach would seem to support the application of accounting measures as being more 'stable' given the volatility of share market prices. Also, given that the objective of this research is specifically to focus only on measuring contribution to sustainable development, the relevance of share market prices is substantially reduced. The connection between share market values and sustainable development has not been demonstrated in any findings assessed by this research.

Model portfolio approaches, as well as industry sector analysis, are both supported as mechanisms for comparative analysis. They enable an analysis of large numbers of businesses with identified characteristics and the identification of significant differences through the application of appropriate statistical tests of difference. Factors for normalising performance have been used widely and range from sales to volume of production. The employment of 'total assets' as a normalising approach, as proposed by the BSDI model to be employed by this research is therefore reasonably founded. The example measures used in Chapter Three to populate the primary (first) level of the BSDI (namely operating profit, staff numbers and greenhouse gas emissions) are supported. It is proposed to take these issues forward into considering the specific methodology to be used in applying the BSDI conceptual method in the Australian business setting.

4.3 Applying the BSDI to Measuring Business Contribution to SD

This section sets out the proposed method for applying the BSDI to measuring business contribution to sustainable development in Australia. This research is exploratory because of the preliminary nature of the models that seek to explain sustainable development and business and because of the data limitations confronted by all research in this area. In this context, the primary objectives of this research, (in addition to the development of a comprehensive model for measuring business contribution to sustainable development) are reiterated as follows:

a. Assess the performance of two groups of selected Australian companies with a view to discerning differences in performance between the two groups. This follows a technique employed in a number of like studies and reported on by Wagner (2001). Portfolio A comprises companies that form part of a portfolio of

Australian companies recognised for superior performance in relation to sustainability. Portfolio B comprises other companies that have not been included in the sustainability portfolio. Because of limited availability of data, only contribution to the economic dimension of sustainable development is measured. The period of review is from 1992 to 2001 and this is linked to the availability of continuous data in relation to each firm's operations. Statistical analyses in the form of student T tests are used to identify differences year by year.

b. Assess the performance of a pair of selected Australian companies with a view to discerning differences in performance between each company. One company has been recognised for superior sustainability performance. Each of the three pillars of sustainable development is compared as well as the overall contribution to sustainable development. The period of review is from 1995 to 2001. This approach is very similar to the method employed by the MEPI project but is applied to individual firms and not the industry groupings used by MEPI. Comparative analysis of each company's performance year by year over six years is undertaken using simple descriptive statistical techniques.

c. Apply the BSDI method to relevant industry groupings to provide a context and benchmark for reviewing the performance of firms within these industry groupings. The three dimensions of sustainable development are reviewed; however, this industry information is only available for five different industries for the period from 1994 to 1998. Previous work by both Atkinson (2000) and the MEPI project (Tyteca *et al.* 2002) support this approach, although its value at present is severely limited by the paucity of data.

Previous research, as analysed in the preceding section, supports the multiple types of analysis (portfolio, industry and case study) proposed in this research. However, this research employs a novel approach to dealing with limited data availability. The BSDI model for measuring business contribution to sustainable development is constructed so as to permit exploration of different settings employing different 'levels' of data.

Specifically the BSDI operates when:

- Only one pillar of information is available. This is the case for the model portfolio analysis in this research
- All three pillars are available for each individual business. This is the case for the case study analysis in this research.
- Only aggregate data is available, albeit for the three pillars. This is the case for the industry analysis in this research.

Further, it is proposed to use accounting measures of performance unlike some other studies which have employed stock market indicators of performance. This is driven by the focus of this research on only seeking to measure contribution to sustainable development and not company longevity or performance. Research dealing with stock market indicators is unlikely to contribute to the understanding of what underlies company contribution to sustainable development and is most likely to be assessing company sustainability qua longevity. Company longevity may or may not have a connection with business contribution to sustainable development and that is not within the scope of this research. It is within this overall setting that it is proposed to review specific matters of methodological detail.

4.3.1 Variables and Operational Definitions

All of the potential variables required for this research are contained in the equation, developed in Chapter Three, for the Business Sustainable Development Index (BSDI). This equation is set out again below:

Equation 4-1:

$$\begin{aligned} &BSDI = \\ &EconomicIndex([PA_{t0} + IA_{t0} + EconA_{t0}] + BPM_{econ,t0}) + \\ &SocialIndex(SA_{t0} + BPM_{s,t0}) + \\ &EnvironmentalIndex(EcoA_{t0} + BPM_{eco,t0}) \end{aligned}$$

The business performance measures *(BPM)* are expanded as follows:

Equation 4-2: $BPM_s = \frac{totalstaff}{CA} \qquad BPM_{Eco} = \frac{pollution}{CA} \qquad BPM_{Econ} = \frac{earnings}{CA}$

It is not possible to obtain all of this data for the three types of analysis in this research. The variables for which data are available for each analysis are set out below.

For the model portfolio analysis, only the economic index component of the above equation can be completed. This part of the index is set out in full below:

Equation 4-3: $$EconomicIndex = (PA + IA + EconA) + (\frac{earnings}{CA})$$

The two expressions contained in parentheses on the right hand side of the equation represent the 'effectiveness' and 'efficiency' indices respectively, which make up the base level of the Economic Index. For the model portfolio setting, the operational definitions for each of the variables are set out in Table 4-4 below.

Table 4-2: Operational Definitions of Variables: Model Portfolio Analysis

Variables	Operational Definition
Physical Assets *(PA)*;Intangible Assets *(IA)*; Economic Assets *(EconA)*	The most appropriate, available measure is Total Assets. Total Assets is a value required to be reported by all public companies in Australia and represents the value of all assets, no matter of what type, held by a company.
Earnings	For this and the other two analyses as well, this variable is operationally defined as Earnings Before Interest, Tax and Abnormals (EBITA). This value is comprehensively recorded by Australian companies and represents a stable measure of financial performance.
Company Assets (CA)	Company Assets are the total of physical, intangible and economic assets and for the three settings within this research are the same as Total Assets as set out above.

In regard to Total Assets, this variable represents the 'gross' assets of a company before liabilities are subtracted to give Net Assets. The 'gross' perspective is considered more appropriate because it reflects the assets being employed (even if not fully owned) by the company and is therefore the closest value relevant to the notion of capturing the true 'scale' of a company's operations. In regard to EBITA, it is considered to be stable because it avoids the complexities associated with the contemporary treatment of such items as taxation, interest and abnormals. The potential volatility of these items could skew the underlying financial value created by a firm and are avoided for that reason.

In the case study, two companies are analysed and this provides the opportunity to use the first level of the business sustainable development index (BSDI) for each of the three pillars. Consequently, in addition to the variables encountered in the model portfolio analysis above, there are number of additional variables that require to be

operationally defined. These relate to social and environmental pillars. The full level one equation is set out below and the additional variables and their operational definitions are set out in Table 4-3 below the equation.

Equation 4-4:

$$BSDI = (EconAssets + \frac{Earnings}{CompanyAssets}) + (SocialAssets + \frac{Staff}{CompanyAssets}) + (EvironAssets + \frac{Emissions}{CompanyAssets})$$

Table 4-3: Additional Operational Definitions of Variables: Case Study Analysis

Variables	Operational Definitions
Staff *(S)*	This is the number of staff employed by the company directly, expressed as Full Time Equivalents (FTEs).
Emissions *(E)*	This is the volume of emissions by the company directly, expressed as CO_2 equivalents.

For the industry analysis, no further variables are required. However, it is important to point out that the information used is not obtained directly from company reports as is the case for the other two settings. The data used for this setting is aggregate data compiled by the Australian Bureau of Statistics (ABS) (1999a; 2001c) and the Australian Greenhouse Office (AGO) (2001). This data (for all variables except emissions) is aggregated by ABS for a wide range of industry groupings. The industry groupings employed are based on ANZSIC Classifications (ABS 2001a). The ABS employs a specific methodology in compiling these aggregates for each industry division and sub division. The data for the emissions variable are obtained from the Australian Greenhouse Office (2001) and the methodology employed by that office in aggregating industry emissions is set out in their report. For the purposes of this research the intent of the variables, in their aggregated form, from both sources, is consistent with the operational definitions set out in the tables above.

4.3.2 Levels of measurement

All measurements of all data for all variables are ratio level. A consolidated listing of all variables, related abbreviations and units of measurement for each variable is set out in Table 4-4 below.

Table 4-4: Variables, Abbreviations and Units of Measurement

Variable Name	Variable Abbreviation	Operational Definition	Variable Unit of Measure
Company Assets	*CA*	Total Assets	Australian Dollars
Earnings	*EBITA*	Earnings Before Interest Tax and Abnormals	Australian Dollars
Emissions	*E*	Emissions of Greenhouse Gas Equivalents	Giga Joules of CO_2 Equivalents
Intangible Assets	*IA*	Part of Total Assets	Australian Dollars
Physical Assets	*PA*	Part of Total Assets	Australian Dollars
Staff	*S*	Staffing numbers in Full Time Equivalents	Whole numbers

4.3.3 Population and sampling

The populations and approach to sampling are considered separately for each type of analysis to be undertaken in this research. For the model portfolio analysis the population is the Top 500 companies in Australia (by amount of dollar capitalisation). The sampling frame is provided by the Connect 4 Database (2001) of these companies. Within this population, there is a group (portfolio) of companies which have been identified by the Strategic Asset Management Group for contribution to sustainable development (Manning and Wade 2001). Each of these company's annual reports back to 1992 was reviewed to determine whether data was available in order to satisfy the required variables. All companies with available data are included in the sample or model portfolio of sustainable development companies in this research. This resulted in a model portfolio of twenty-eight companies.

The second model portfolio developed for this setting represents a stratified sample from the population of companies in the Top 500 excluding those companies included in the portfolio of companies recognised for contribution to sustainable development.

The companies included in this second model portfolio were determined on the basis of:

1. Availability of data for the necessary variables for each year back to 1992 and up to 2001.
2. Similarity, to the extent possible, with companies in the first model portfolio. The primary aspect of similarity sought is industry classification however, this is not a simple matter given the heterogeneous nature of some company's operations.

The data for each of these companies in each of the portfolios is set out at Appendix One.

There are two important issues to be considered in reviewing the portfolios for this part of the research. First, by the very nature that the two portfolios comprise businesses which have multiple years of continuous, publicly available information it means that they are not necessarily fully representative of all businesses in Australia. It means that they have stayed in operation and therefore have demonstrated a level of longevity, market resilience and independence which does not make them a fully representative sample of Australian business. Many small and privately owned businesses are not included in this sample. As well, many publicly listed businesses which are in operation today but were not in operation in 1992 are not included in the sample. This does not in and of itself reduce the value of the analysis, which is directed to discerning differences in the performance of the sustainability oriented portfolio compared to those which are not in that portfolio. The comparison is only valid over a reasonable time frame for the reasons enunciated in Chapter Three regarding the particular implications of research in this area.

Therefore, whether the comparison would change significantly if a wider sample of firms was able to be selected for comparison is subject to conjecture and could only be determined if substantial resources were available to collect information which is not currently publicly available. The methodology employed remains valid to the extent that it compares two groups of firms both of which have data available for the entire period and one group of which has been recognised for contribution to sustainable development. The added value of expending additional resources on the small and privately owned firms, in addition to the publicly listed firms for which data

is not available for the full period, is not sufficiently clear at the early stage of the research effort into sustainable development in Australia to warrant support, from this research's findings, for future research activity.

The second issue relates to the difference in the two selected portfolios. An analysis of the two portfolios using both total assets and operating profit per annum indicates a substantial difference in the size of the firms which are in each portfolio. This difference is significant. A students T test has been performed on the two portfolios for each year for each of these measures. It shows significant difference and this is illustrated in Table 4.5 below.

Table 4-5: Summary of T Test Results for (1) Assets (2) EBITA

Year	Total Assets T Value	Total Assets p Value	EBITA T Value	EBITA p Value
1992	2.41	.02	1.64	.11
1993	2.42	.02	2.50	.02
1994	2.40	.02	2.60	.01
1995	2.40	.02	2.90	.01
1996	2.38	.02	2.98	.00
1997	2.23	.03	3.00	.00
1998	2.22	.03	3.20	.00
1999	2.20	.03	2.86	.01
2000	2.16	.04	3.15	.00
2001	2.16	.04	2.59	.01

The full T test results for Total Assets and Earnings (EBITA) are set out in Appendices Four and Five. The summary results in the table above indicate that there are differences between the firms in each portfolio when the values of Total Assets and EBITA are compared over time. The difference in the size between the two portfolios is also reflected in the overall values for each portfolio as set out in Table 4.6 below.

Table 4-6: Portfolio Totals for Asset and EBITA Values

PORTFOLIOS (A) and (B)	1992	2001
Assets (A)	$463,921 M	$895,824 M
Assets (B)	$44,584 M	$104,456 M
EBITA (A)	$7,546 M	$19,282 M
EBITA (B)	$1,655 M	$4,105 M

It is not immediately evident why there is such a significant difference in the scale of the firms in each portfolio although it is possible to conject regarding reasons. It could well be a reflection of the particular nature of the methodology used by the creators of the sustainability oriented portfolio. The size difference may also be a reflection of the business demographics in Australia where there is a limited number of large firms. Consequently if there are a substantial number of these large firms in Portfolio A then it may be difficult to find a further portfolio with firms of a similar large size. The analysis of the two portfolios is undertaken in more detail in Chapter Five and the possible reasons for the differences are considered in further detail in the conclusions in Chapter Six.

The methodology employed remains valid to the extent that it compares two groups of firms both of which have data available for the entire period and one group of which has been recognised for contribution to sustainable development. The added value of expending additional resources to analyse the demographics of business in Australia is not sufficiently clear at the early stage of the research effort into sustainable development in Australia to warrant support, from this research's findings, for future research activity. A more appropriate approach could be to further analyse, if commercial sensitivities permitted, the methodology utilised to establish Portfolio A. As noted above, further consideration is given to this issue in the conclusions in Chapter Six.

The population for the case study analysis is the same as for the model portfolio analysis. The two companies are from the same industry classification. Each has data available for each variable for level one of the full BSDI for a period of six years. There are very few companies in Australia for which this data is available especially for such an extended period. The data for each of these companies is set out at Appendix Eight. The population for industry setting comprises all industry groupings in Australia. The first sampling frame is provided by the Australian Bureau of Statistics (2001c) report on Australian industry performance. Then the second frame is provided by the Australian Greenhouse Office (2001) analysis of Australian industry performance in relation to greenhouse gas emissions. There is only a limited number of industry groupings for which the emissions data is available. The data for those industries is set out in Appendix Fourteen.

4.3.4 Statistical analysis

The statistical analysis employed for each setting is a product of the question under review, the hypothesis and the data available. The statistical analyses undertaken for each setting of this research are set out in the following table.

Table 4-7: Summary of Types of Analysis and Statistical Purposes

Analysis Type	Statistical Analysis
Model Portfolio	Simple descriptive statistical techniques plus T-test of difference for each year covering- • Economic Index • Total assets • EBITA • EBITA/Assets Ratio
Case Study	Comparative analysis of each company's performance year by year over 6 years is undertaken using simple descriptive statistical techniques.
Industry	Comparative analysis of each industry's performance over four years is done using simple descriptive statistical techniques.

The statistical analyses proposed to be undertaken are each supported by reference to the information gained from earlier applied research.

The T test is supported on the basis of there being two independent portfolios and a level of measurement of ratio or interval data. The primary limitations encountered in this research relate to the availability of data. This availability issue operates at two levels. Firstly, it is not possible to obtain a large sample of companies, for which all data is available to review the operation of the sustainable development index over an extended period. Secondly, the operational data available for any companies is not comprehensive when considered in the light of the implications of sustainable development. Information about the social and environmental assets of a company is not readily available because it is not easy to calculate.

The vast majority of data collected for this research is publicly available by way of the annual reports of the companies involved. The data for Firm B emissions (in the case study setting) is not published data and the assistance of Firm B in providing this data is acknowledged at the beginning of this dissertation.

4.4 Conclusion

Based on methods employed in like research, it is proposed to use the BSDI to undertake three types of analysis – portfolio analysis, case study analysis and industry analysis. This is proposed in order to achieve an early but as comprehensive a picture of Australian business performance in relation to sustainable development as is possible. The analysis is constrained by data availability but the tiered index BSDI enables the review to consider three different settings with differing amounts and type of data. The knowledge gained from other applied research has confirmed the use of the example data attributes proposed in Chapter Three. These data attributes for the headline (level one) indicators for each pillar in the BSDI are earnings (EBITA), total staff numbers and greenhouse gas emissions. The use of total assets (company assets) as the basis for normalising results and reflecting changes in company scale (size) is also well supported by others' applied research.

Preliminary analysis has discerned a considerable difference in the size (as indicated by total assets and operating profit) of the firms which comprise the portfolios in the portfolio analysis aspect of the research. There are limited alternatives and it is not considered that this reduces the reliability of this research. This issue will be considered in more detail in Chapter Six, following the data analysis to be undertaken in Chapter Five. The next chapter considers the specific questions to be applied to these three types of analysis in Australia and reviews the results from the data collection undertaken.

5 ANALYSIS OF BUSINESS CONTRIBUTIONS TO SD IN AUSTRALIA

5.1 Introduction

The analysis set out in this Chapter is structured around the hypotheses that have been developed in response to the research objectives. To achieve the objectives of this research it is proposed to apply the BSDI method, developed in Chapter Three, in undertaking portfolio analysis, case study analysis and industry analysis. The tiered approach means that some analysis is possible even under conditions where data is limited to the base level of only one of the pillars of sustainable development. The use of different types of analysis allows this exploratory research to gain a broader assessment of the implications of sustainable development on business behaviour and outcomes in Australia. As noted in the preceding chapter, all of the data collected for the three types of analysis are contained in the Appendices.

Prior to reviewing each of the questions, it is reiterated that the BSDI method departs from previous methods employed for the measurement of business contribution to sustainable development because it:

- Is a synthesis of an index method of measuring contribution to sustainable development, used at the macro level, and a conventional ratio analysis approach to measuring business performance. Current methods predominantly apply ratio analysis.
- Focuses on the movements in company assets and not, as current methods do, on making 'green' adjustments to business profit figures.
- Sets out to only measure a firm's contribution to sustainable development to assist in clarifying the business actions that achieve the maximum outcomes from a sustainable development perspective. It is not intended to be an adjustment to current business measures of profitability or longevity to accommodate the implications of sustainable development.
- Uses both efficiency and effectiveness performance measures in an endeavour to link business outcomes with the macro prescriptions of sustainable development.

The hypotheses are set out below followed by detailed data analysis.

5.2 Hypotheses

Having completed the first objective of this research in Chapter Three, through construction of the BSDI method, this chapter deals with the remaining three objectives as previously outlined in Chapter One. Whilst the remaining three objectives of this research were referred to in Chapter One as objectives two, three and four, they will be referred to as objectives one, two and three in this chapter given the first objective has been dealt with.

The first objective is to review the performance of firms from two different portfolios; one portfolio comprising those firms that have been recognised for contribution to sustainable development and the other portfolio comprising firms that have not been recognised in relation to sustainable development. This objective is to be achieved through model portfolio analysis and the hypothesis that relates to this objective is as follows:

Hypothesis One: There will be no material differences in the economic performance of firms that have been recognised for contribution to sustainable development and those firms that have not been so recognised.

The second objective is to assess the contribution to sustainable development of two firms in the same industry; one firm has been recognised for contribution to sustainable development and the other one has not been so recognised. This objective is to be achieved through case study analysis and the hypothesis that relates to this objective is as follows:

Hypothesis Two: There will be no material differences in the contribution to sustainable development of a firm that has been recognised for contribution to sustainable development and a firm, in the same industry, which has not been so recognised.

The third objective is to apply the preferred method of measuring business contribution to sustainable development to selected Australian industries. This objective is to be achieved through industry analysis and the question and hypothesis related to this objective are as follows:

Hypothesis Three: Selected Australian industries are not making an increasing contribution to sustainable development.

Each type of analysis, associated with each hypothesis, is undertaken in turn, starting with Model Portfolio Analysis.

5.3 Model Portfolio Analysis

The model portfolio analysis undertaken in this research follows on from the approaches identified in Wagner's (2001) research regarding business and environmental performance. These approaches sought to clarify whether variations in performance between portfolios with different characteristics were significantly different. The hypothesis for this part of the analysis is that there will be no material differences in the economic performance of firms which have been recognised for contribution to sustainable development and those firms which have not been so recognised.

There are several steps in the analytical process required to test hypothesis one. The approach involves comparing two model portfolios comprising Australian businesses. The first portfolio comprises firms which have been recognised for contribution to sustainable development (called Portfolio 'A' for convenience) and the second portfolio comprises firms that have not been specifically recognised for contribution to sustainable development (called Portfolio 'B').

An Economic Sub Index of the BSDI for each firm in each portfolio is constructed using the equation developed in Chapter Four and set out below.

Equation 5-1: $$EconomicSubIndex = ([PA_{t0} + IA_{t0} + EconA_{t0}] + BPM_{econ,t0})$$

The first part of the equation on the right hand side comprises Company Assets (CA) made up of physical, intangible and economic assets. The business performance measure, being the second part of the equation on the right hand side is equal to Earnings divided by Company Assets.

The simplified version of the Economic Sub Index for this research is set out in Equation 5.2 below. The values of the two parts of the equation on the right hand side are indexed prior to being summed to make up the Economic Sub Index.

Equation 5-2: $$Economic\ \text{Sub}\ Index = Company\ Assets + (Earnings / Company\ Assets)$$

The data for each variable was collected from the annual reports for each firm (Connect 4 Database 2001). This data is set out at Appendix One. As these values are all nominal, step one involved the conversion to real Australian Dollars. The conversion to real dollars uses the Australian Bureau of Statistics Consumer Price Index (CPI) for each of the years from 1992 to 2001 using a CPI, which has a base year of 1990 (ABS 2001). The CPI values for each year and the converted, 'real' dollar values for each firm in each portfolio are shown at Appendix Two.

Using these real values, the Economic Sub Index for each firm in each portfolio for each year is then constructed using the equation noted above. As well as calculating the Economic Sub Index for each firm, the efficiency and effectiveness components of the Economic Sub Index for each year are also calculated. The two expressions on the right hand side of the Economic Sub Index equation make up the effectiveness (absolute) and efficiency (ratio) components respectively. By keeping track of these two components over time it is possible to review the contribution that each one makes to the Economic Sub Index. The Economic Sub Index for each firm for each year in each portfolio, together with the related efficiency and effectiveness components are set out at Appendix Three.

Using this information it is proposed to undertake several types of analysis as follows-

- Review the performance of firms within each portfolio and compare the characteristics of their respective indexes.
- Review the performance of the consolidated portfolios using the Economic Sub Index as the basis for this comparison
- Assess statistical differences between the values for each of the variables for each year in each portfolio, as well as the values of the Economic Sub Index for each year, to discern the extent of difference

Each analysis is set out below and the results are summarised at the end of this Section.

In order to understand more clearly the operation of the Economic Sub Index prior to reviewing the performance of all firms in each index, the Economic Sub Index for an example firm is illustrated in Figure 5-1 below. This illustration shows the movement of the Economic Sub Index and the related absolute and ratio components across the

study period. For this particular firm, the Economic Sub Index has increased considerably, from 100 in 1992 to 217 in 2001. The absolute component comprises total Company Assets for the sample firm and the ratio component comprises the Earnings (being EBITA) divided by Company Assets. The ratio component is giving an indication of the 'efficiency' of assets employed in producing earnings, whereas the absolute component operates as an effectiveness measure. The need for both components is directly related to the nature of the firm as an institution of sustainable development as set out in Chapters Three and Four.

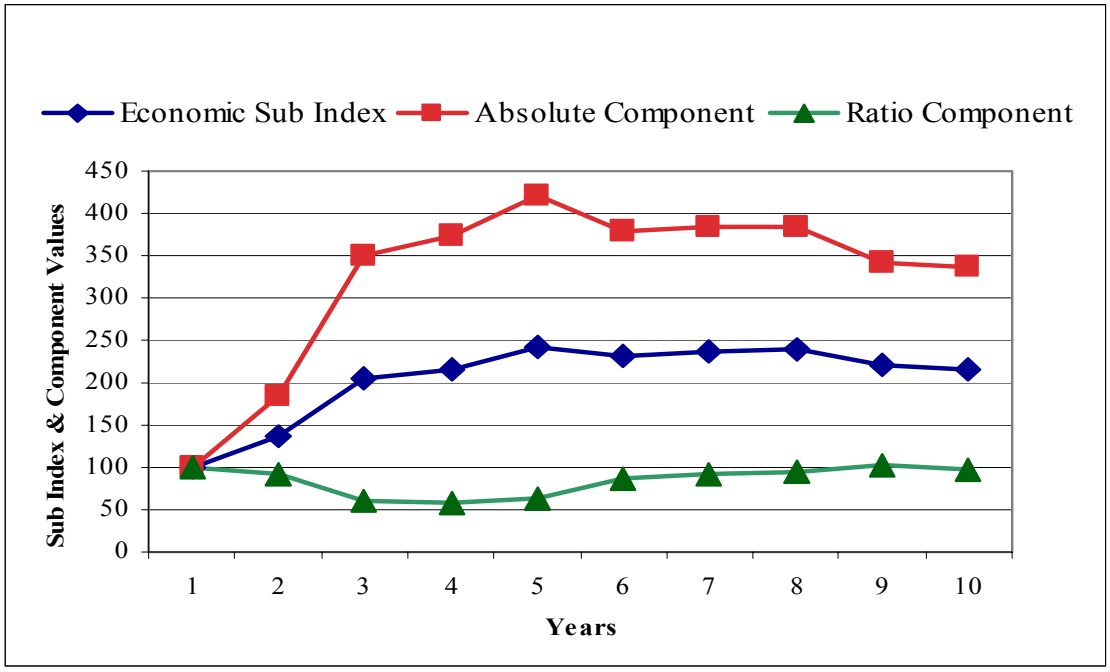

Figure 5-1: Example Firm's Economic Sub Index and Related Components

The Economic sub index in the final year was more than double the starting value of the index. For this research a higher index result represents a higher contribution to sustainable development. However, in the absence of having data to support the other pillars of sustainable development (namely, social and environmental), the complete contribution to sustainable development is far from clear. The absolute (effectiveness) component has been the main contributor to this upward movement in the overall index. The ratio (efficiency) component has in fact fallen slightly over the time period meaning that the current utilisation of assets (relative to the production of earnings) is slightly less efficient than it was in 1992. This does not auger well for making an increased contribution to sustainable development but there is insufficient information to be conclusive in the absence of the other data for the full index.

With this example in view, it is now proposed to move to the first step in the comparative analysis of the two portfolios. It is proposed to review the operation of the Economic Sub Index and related components for each firm and to compare the characteristics of the results between portfolios A and B. Some simple descriptive categories provide insight and Table 5-1 below provides a summary of information using these categories.

Table 5-1: Summary of Descriptive Data (Ordered by Category) for Portfolios A and B

Category No.	Category Description	Portfolio A	Portfolio B
1	Firms for which the Economic Sub Index improved when the last year value is compared to the first year value.	75%	93%
2	Firms for which the absolute component improved when the last year value is compared to the first year value.	89%	86%
3	Firms for which the ratio component improved when the last year value is compared to the first year value.	43%	64%
4	Firms for which the Economic Sub Index increased for each year under review.	43%	46%
5	Firms for which the Economic Sub Index was lower than the first year value for five (5) years or more.	11%	18%

Analysis indicates that more firms in Portfolio B increased their Economic Sub Index results compared to Portfolio A (See Category No. 1). At the same time, firms in Portfolio A depended more on increases in the absolute component (accretion of assets) to achieve improvements in the Economic Sub Index (See Category No. 2). Firms in Portfolio B were more likely to have improved performance in relation to the ratio component, that is, the efficiency of assets in producing earnings (See Category No. 3). Finally, there are a small number of firms in each portfolio whose performance (Economic Sub Index) was inferior to the base year during five (5) or more years for the period under review (See Category No. 5).

Portfolio B scored higher percentages than Portfolio A in relation to categories 1, 3 and 4. The difference is most marked in relation to the categories 1 and 3. On the

other hand, Portfolio A scored higher percentages (but only by relatively small margins) than Portfolio B in relation to categories 2 and 5. In considering the overall result the portfolios have some balancing attributes and Portfolio B may have performed slightly better overall because of the size of the gap in performance in categories 1 and 3. However, whilst the overall result may not be markedly different, there appear to be some considerable differences observed in relation to how firms actually achieved their performance. Specifically, the firms in Portfolio A were more likely to have increased overall asset holdings (see Category No. 2) whereas firms in Portfolio B were more likely to have increased 'earnings to assets' efficiency (see Category No. 3). This has considerable implications given the particular nature of what contribution to sustainable development actually means for business, as considered earlier. The 'moveable' scale of business operations makes discerning contribution to sustainable development more challenging in a business setting than other 'fixed' scale settings.

The second type of analysis to be undertaken to review and compare performance across the portfolios is to measure the index performance of the portfolios on a consolidated basis. To do this it is necessary to sum the values that comprise the variables in the Economic Sub Index for each firm as set out in Table 5.2.

Table 5-2 Portfolios A and B: Consolidated Totals

PORTFOLIOS (A) and (B)	1992	2001	CHANGE: 1992-2001	PERCENTAGE CHANGE: 1992-2001
Assets (A)	$463,921 M	$895,824 M	$431,903 M	+93%
Assets (B)	$44,584 M	$104,456 M	$59,872 M	+134%
EBITA (A)	$7,546 M	$19,282 M	$11.736 M	+155%
EBITA (B)	$1,655 M	$4,105 M	$2,450 M	+148%
EBITA/Assets (A)	.0163	.0215	.0052	+32 %
EBITA/Assets (B)	.0371	.0393	.0022	+6 %

The characteristics of the consolidated totals will be reviewed firstly by considering each of the absolute and ratio components and then by an overall review. The difference in the total value of Company Assets between the two portfolios is very marked and this was noted earlier in Chapter Four when considering the population for this research. As noted, the smaller size of Portfolio B is possibly a reflection of Australian business demographics, in that there are a limited number of firms that can accumulate scale and operate primarily in the Australian market place. The selection of firms for Portfolio B however, took no specific account of size other than that

which is implicit in the sampling frame. The only specific requirements for selection were set out in Chapter Four and covered the availability of information for the period under review.

As indicated in Chapter Four, it is possible that it is the larger Australian firms that are represented in the portfolio of businesses selected for contribution to sustainable development (that is, Portfolio A) but this is not given as a reason for selection. This surprising result seems to be consistent with the analysis immediately above, wherein it was identified that individual firms in Portfolio A seemed to achieve their results more from asset accretion than EBITA/Assets 'efficiency'. This of course raises significant questions as to whether the methods used to determine the inclusion of firms in Portfolio A could possibly be more concerned with firm longevity than actual contribution to sustainable development. This will be further considered in Chapter Six.

The issue of difference in scale is similarly apparent in the EBITA figures for the respective portfolios; however, the growth in both dollar values and percentage terms for both Assets and EBITA is very substantial for each portfolio. Portfolio A firms achieved a comparatively higher increase in total EBITA whilst firms in Portfolio B achieved a comparatively higher increase in total Assets. This is probably not unexpected given the already higher levels of Assets in Portfolio A. However, there is a very marked difference in the 'efficiency' performance between the two portfolios that is not readily explicable. The ratio performance of Portfolio B (at the beginning of the period) is more than double that of Portfolio A (specifically 2.2 times better in achieving earnings for each dollar of assets employed). It is noted that this performance is slightly reduced to 1.8 times by the end of the period which is reflected in the better percentage improvement in this ratio by Portfolio A during the period (32% improvement for Portfolio A compared to 6% for Portfolio B over the period). Again, this issue will be further considered in Chapter Six; however, it is surprising that the 'efficiency' of Portfolio B would be that much better than Portfolio A given the recognition afforded the businesses in the latter portfolio.

Another type of analysis performed on the consolidated portfolios involved constructing an Economic Sub Index for the two consolidated portfolios. The sub

index so constructed provides equal weighting to both ratio and absolute components and in so doing seeks to balance out the competing demands of efficiency and effectiveness issues for business in relation to sustainable development. Each portfolio's sub index and their respective components started with a value of 100 in 1992. This starting point and the values for the final year of the study are illustrated in Figure 5-2 below. Both portfolios experienced considerable increases over the period with Portfolio A's index increasing to 224 and Portfolio B's index increasing to 241

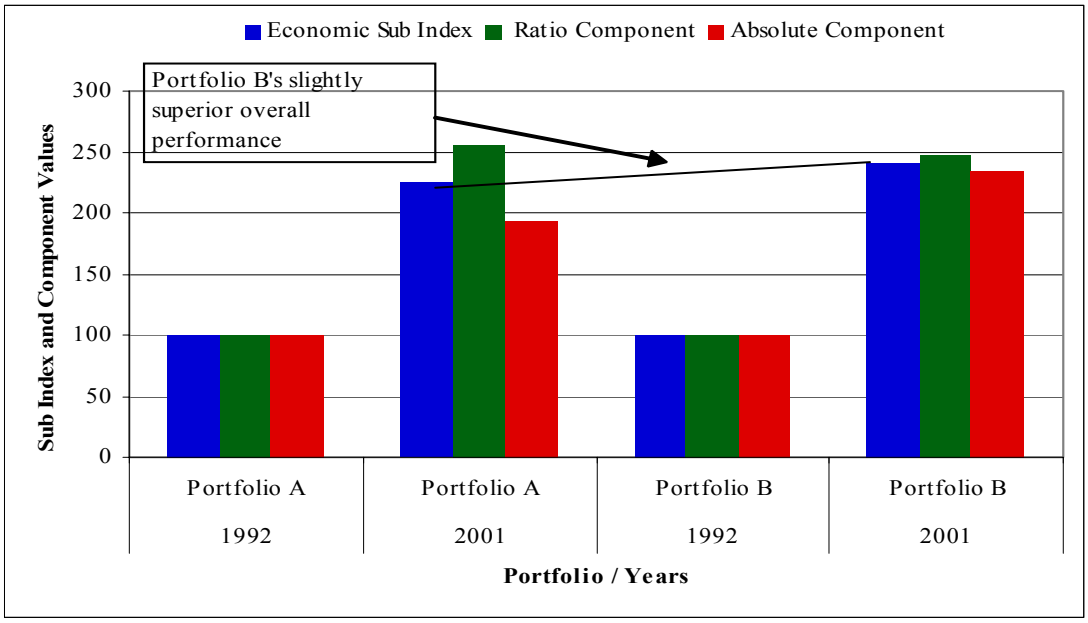

Figure 5-2; Consolidated Portfolios Economic Sub Indexes

The consolidated sub index result confirms the slightly superior performance of Portfolio B identified in the preceding analyses. Portfolio B's final year index value is 17 higher than Portfolio A's final value of 224. This is not a substantial difference and is not as large as the difference in the absolute component results. In fact the picture of component performance is also generally consistent with the results considered from the preceding analysis of the consolidated portfolios but is slightly at odds with the first analysis of firms within the portfolios.

The improvement in the consolidated absolute component of the sub index is somewhat greater in Portfolio B than in Portfolio A (Portfolio B's absolute component moved up to a value of 234 compared to 193 for Portfolio A). The first type of analysis in this section indicated that an increase in the absolute component occurred in 89% of the firms in Portfolio A and 86% in Portfolio B. The increases in absolute values for firms in Portfolio B were relatively higher than the increases in

Portfolio A. Regarding the ratio component, Portfolio A's final value was 256 compared to Portfolio B's final value of 248. The results are very close however, it is noted that only 43% of firms in Portfolio A achieved increases in ratio performance compared to 64% in Portfolio B. This seems to indicate that a relatively smaller number of firms in Portfolio A had relatively higher increases in ratio performance.

A further perspective, and a technique which has been applied in other like research (Edwards cited in Wagner (2001)), is to undertake a statistical test of difference between each of the portfolios for each of the years of the study. It is possible to undertake a series of T-tests of difference on the basis that the samples are independent. To thoroughly assess the extent of difference between the two portfolios, tests of difference have been performed on two data sets using a level of significance of .05. It is considered necessary to perform the tests on the two types of data sets (namely the components of the sub index as well as the sub index itself) in order to more clearly understand where differences may be arising in the operation of the two portfolios.

The first data set comprises the variables that underpin the calculation of the Economic Sub Index. These variables are (1) Total Assets, (2) EBITA and (3) EBITA/Total Assets. The full details of the results for each of tests of difference are set out in Appendix Four, Appendix Five and Appendix Six respectively and summarised in Table 5-3 below. The other data set comprises the Economic Sub Index results for each firm in each portfolio for each year under study. The full details for this test of difference are set out in full in Appendix Seven and summarised in Table 5-4 further below. Part of this table was considered earlier in Chapter Four; because of the important differences in size discerned; however, it is considered beneficial not to split the overall analysis of the information at this point.

Table 5-3: Summary of T Test Results for (1) Assets (2) EBITA (3) EBITA/Assets Ratio: (p=. 05: d.f. = 54)

Year	Total Assets T Value	Total Assets p Value	EBITA T Value	EBITA p Value	EBITA/ Assets T Value	EBITA/ Assets p Value
1992	2.41	.02*	1.64	.11	-0.81	.42
1993	2.42	.02*	2.50	.02*	-1.07	.29
1994	2.40	.02*	2.60	.01*	-0.27	.79
1995	2.40	.02*	2.90	.01*	-0.48	.63
1996	2.38	.02*	2.98	.00*	0.31	.76
1997	2.23	.03*	3.00	.00*	-0.38	.71
1998	2.22	.03*	3.20	.00*	0.07	.94
1999	2.20	.03*	2.86	.01*	0.07	.94
2000	2.16	.04*	3.15	.00*	0.32	.75
2001	2.16	.04*	2.59	.01*	-0.45	.65

The 'p' values which are significant are marked with an asterisk. The results in the table above indicate that there are differences between the firms in each portfolio when the values of Total Assets and EBITA are compared over time; however, there is no significant difference between the firms in each portfolio when the values of EBITA/Total Assets are compared over time. This is consistent with indications from the earlier analysis undertaken above. There is a clear difference in the size of the firms comprising the two portfolios but there is no material difference in the 'efficiency' performance of the firms in the two portfolios.

Table 5-4: Summary of T Test Results for the Economic Sub Index: (p=. 05: d.f. = 54)

Year	Economic Sub Index T Value	Economic Sub Index p Value
1992		
1993	-1.14	.26
1994	-1.49	.14
1995	-0.87	.38
1996	-0.73	.47
1997	-1.18	.25
1998	-0.80	.43
1999	-0.31	.76
2000	-0.95	.35
2001	-1.19	.24

The results from the T Test for the Economic Sub Index set out in Table 5-4 above indicate that there is no significant difference in the values of the sub indexes for each portfolio, over time. It would seem that whilst there is a clear difference in the 'size' or

'scale' of the firms in Portfolio A compared to Portfolio B, (as seen in the differences in Assets and EBITA), there is little difference in relation to the ratio component performance and the overall sub index as well. This accords with the indications from the earlier analysis of the two portfolios.

5.4 Review: Model Portfolio Analysis

The Economic Sub Index of the Business Sustainable Development Index (BSDI) has been constructed for 28 firms in two portfolios over a period of 10 years. The resulting analysis compared the distribution and values of movements in the index for each portfolio and for each of the key components of the Economic Sub Index. As well as these descriptive measures, a T-test of difference was performed for each year for the primary variables as well as a test of difference in relation to the operation of the Economic Sub Index for each portfolio. The overall analysis discerned that there are clear differences in the size or scale of the firms in the two portfolios, with the firms in Portfolio A being generally larger (measured according to the variables of this study) than the firms in Portfolio B. However, there is little difference in the performance of the two portfolios when the EBITA/Assets Ratio and the Economic Sub Index are separately compared. This may have important implications in relation to the basis for firms being recognised for contribution to sustainable development. These issues will be considered further in Chapter Six. The next section covers the case study analysis.

5.5 Case Study Analysis

This analysis follows from the previous work undertaken by Figge and Hahn (2002) and Atkinson (2000) in applying measures of business contribution to sustainable development at the individual firm level. The hypothesis to be tested is that there will be no material differences in the contribution to sustainable development of a firm which has been recognised for contribution to sustainable development and a firm, in the same industry, which has not been so recognised.

There are several steps of analysis required to test this hypothesis. The approach involves comparing the performance of two firms over an extended period of time using the Business Sustainable Development Index (BSDI) as the primary basis for comparison. For ease of reference the company that has been recognised for

contribution to sustainable development is called Firm A and the other firm, in the same industry but which has not been specifically recognised for contribution to sustainable development, is called Firm B. A full index of sustainable development for each firm is constructed using data obtained from each company's annual reports.

This nominal data for Firms A and B, and converted data showing real dollars for each year, is at Appendix Eight and Appendix Nine respectively. At the end of the analysis period Firm A held assets in the order of $7,500 million, employed just over 3,000 staff and created approximately 3million tonnes of greenhouse gas emissions in the previous year. Firm B at the same time held assets of $6,300 million, employed just over 8,300 people and created approximately 4.3million tonnes of greenhouse gas emissions in the previous year. Firm A has been internationally recognised for contributions to sustainable development and Firm B has not. As noted earlier, both firms are in the mining industry.

Prior to reviewing the BSDI constructed for each firm over the study period, a further avenue of analysis to assist in more broadly understanding the comparative performance of the two firms is available. This has been achieved by way of detailed scrutiny of the company reports of each firm for each year to discern specific events and actions. The annual reports of each firm for each of the years under review have been scrutinised (Connect 4 Database 2001) and summary tables of significant social and environmental events are recorded in the event summaries at Appendix Twelve and Appendix Thirteen respectively. An event summary of economic issues was not prepared because there was very little difference in the information presented by the two firms in relation to economic performance.

A review of the environmental event summaries has identified the following key points:

- Firm A presented its first annual environmental report some three years in advance of Firm B (95/6 compared to 98/99)
- Firm A reported environmental audit activity some 3 years in advance of Firm B (95/96 compared to 98/99)
- Both firms reported joining the Australian Greenhouse Challenge in 96/97

- Both firms reported commitment to the Minerals Industry Code for Environmental Management
- Firm A reported adoption of 14 environmental standards against which audits are carried out whereas there is no such indication of this from Firm B.
- Both received Australian recognition, for environmental performance, but Firm A has received international recognition from separate sources (99/00)
- Firm A has been actively contributing to the public debate on particular environmental issues. This firm has funded the presentation of information that is contrary to the general scientific position regarding the warming effect on the earth of certain gaseous emissions.

It is apparent from this information that Firm A has been far more proactive in environmental issues as evidenced by it consistently being several years ahead of Firm B in introducing several improvements in environmental management and reporting.

However, there is a relatively high level of similarity in the intentions and approach of each firm in relation to these environmental issues. The stated intentions to improve environmental management and the methodology employed to do so, appear to be quite consistent between the two firms. The main difference has emerged in relation to Firm A's willingness to fund research that enters the debate about the extent of the problem in relation to global warming. This could be interpreted as an extension of the licence to operate issue considered in earlier chapters and an effort on the part of this firm to promote a low level of government regulation in this area. This is not inconsistent with the position taken by the mining industry's peak body (Minerals Council of Australia 2000).

A review of the social event summaries has identified the following key points:

- Both provide clear and regular information regarding lost time frequency injury rate.
- Both give significant prominence to fatalities and strongly indicate how unacceptable these are.
- There are clearly different directions in several areas of human resource management, namely:
    - centralisation (Firm B) versus devolution (Firm A)

  - preference for contractors (Firm A) versus preference for own staff (Firm B)
  - Focus on local employment issues (Firm B) versus focus on international HR policies (Firm A)
- Firm A introduced integrated training regarding Occupational Health and Safety and Environmental Management in 00-01. No such development was reported for Firm B.
- Firm A introduced a 'fitness for work' standard from 96-97 and reported over 13,000 individual random tests during 00-01. No such development was reported for Firm B.

There is a marked difference observed in the approach adopted by the firms in relation to social issues. This is particularly so in relation to the local focus of Firm B and its interest in local, internal appointments, local apprenticeship development and an overall recognition of employment as important corporate obligation. The focus of Firm A is very different with much more importance being given to sub contracting and the development of internationally oriented HR practices.

In considering events summaries, as part of this case study, it is important to recognise that they are guides only and it is not proposed that conclusions can be definitive; however there are some important differences worthy of recognition. For example, Firm B has had a more 'localised' focus and sought to improve employment and advancement on a local basis. This apparently has not been conducive to recognition for contribution to sustainable development. The difference in the overall approaches of the two firms indicates some significant differences in attitudes and values towards business. This is particularly so in relation to the social dimension whereas, the differences in the environmental approaches appears to be one of timing, more than substance or approach. It is beyond the scope of this case study to discern the origins of these differences. It is not clear if the differences are in fact a logical consequence of the specific circumstances of each business or whether in fact there have been substantially different management perspectives to begin with. It is now proposed to review the data in relation to the indexes, sub indexes and components of the BSDI for each firm.

The BSDI for each year for each firm is constructed, but only after the following operations have been performed:

- Dollar values for earnings and economic assets are converted to real dollars using the Consumer Price Index as above (ABS 2001).
- The value of social assets is monetised using the average weekly earnings in Australia for staff (ABS 2001).
- The value of ecological assets is monetised using an estimated value of carbon credits (of $30 per tonne of carbon dioxide equivalents) for emissions (AGO 2001).

Appendix Ten sets out the values of the consumer price index, average weekly earnings and carbon dioxide equivalent emissions values used to the convert each firm's actual data into real dollars for constructing the BSDI.

The BSDI is constructed using the equation established in Chapter Four. Based on the data that is available, the operating equation for construction of the BSDI is set out below.

Equation 5-3

$$BSDI = (EconAssets + \frac{Earnings}{CompanyAssets}) + (SocialAssets + \frac{Staff}{CompanyAssets}) + (EvironAssets + \frac{Emissions}{CompanyAssets})$$

The detailed BSDI for each firm is set out in Appendix Eleven and a summary perspective of the BSDI for each firm is set out in Figure 5-3 below.

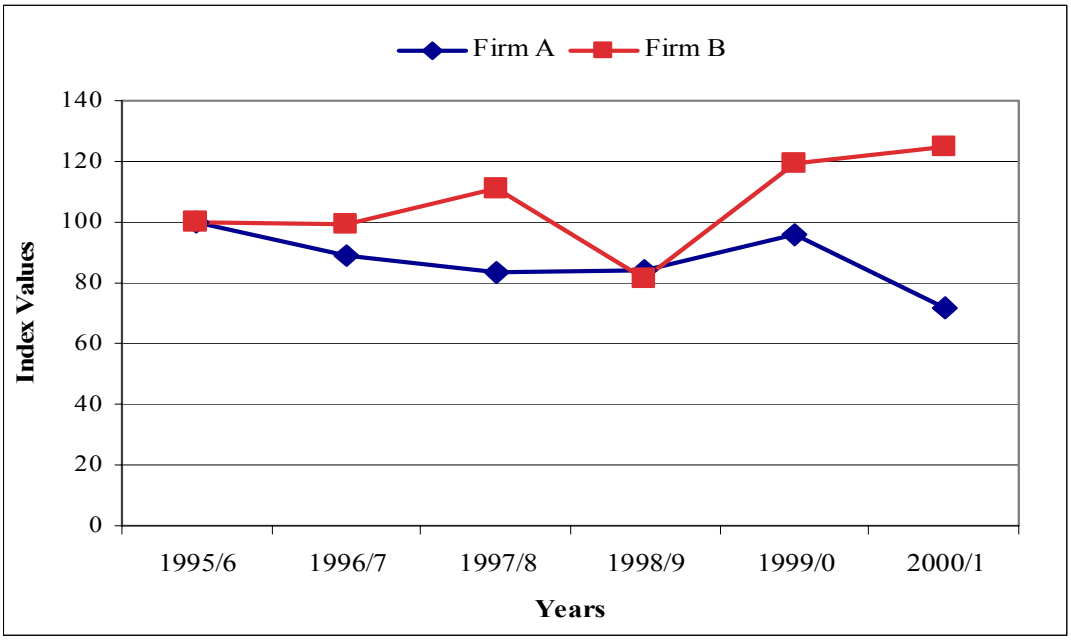

Figure 5-3: BSDI for Firms A & B: 1995-2001

This figure and the associated data highlights that Firm A has not performed above its 1995/6 index ranking since then and Firm B has performed better than its initial index level on three of the five years under study. In the last year reviewed (2000/1) Firm B's index value was 25% higher than its first year value whereas Firm A's index value was 28% lower than its first year value, using the BSDI as the basis for measurement and comparison. It would appear that there is a considerable difference in the measures being used to 'recognise' firms for contribution to sustainable development, compared to the method applied by this research. It is possible that the index masks a variation in performance at the beginning of the period which predisposes Firm A to superior performance in relation to sustainable development. Otherwise it is difficult to reconcile the performance indicated by Figure 5-3 above. Further analysis is necessary to better understand the underlying drivers of this performance over the period.

A further perspective of performance is gained by reviewing the operation of the sub indexes in the context of overall index performance for each firm. Figure 5-4 below sets out for each year the values of the BSDI and the Economic, Social and Environmental Sub Indexes for Firm A.

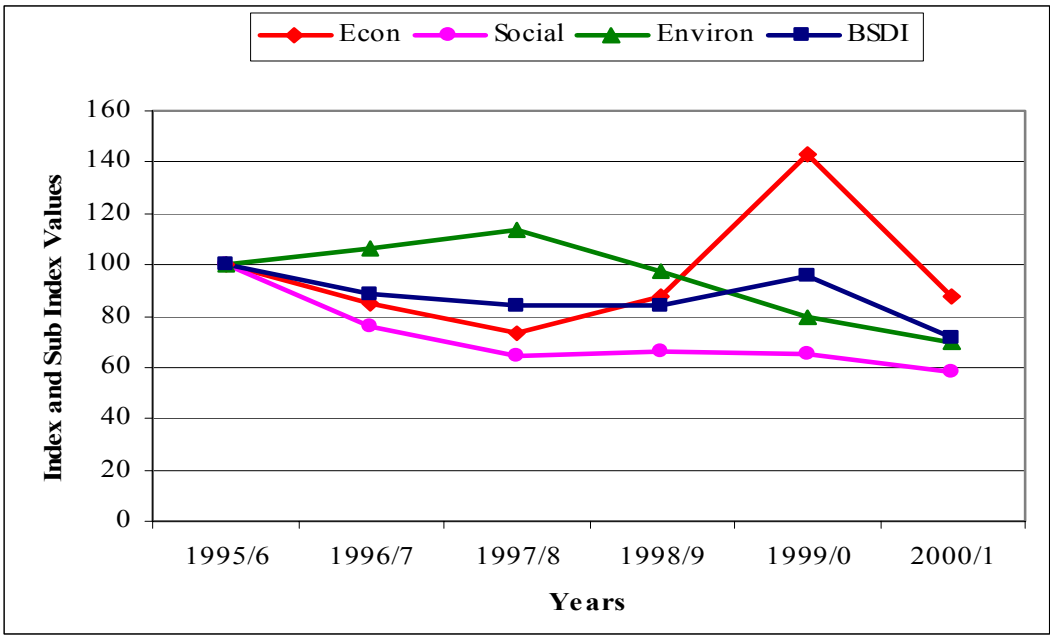

Figure 5-4: BSDI and Sub Indexes: Firm A: 1995-2001

It is noted that Firm A's Social Sub Index was a lower value than the BSDI value for each year of the study whilst the other sub indexes were higher in value than the BSDI values for part of the study period. The average value of the BSDI for the 5 years was 84.78 whilst the average values of the Sub Indexes were Economic 95.12; Social 66.06 and Environment 93.16. Both the Economic and Environmental pillars underpin Firm A's index performance. The implications of lower values for the Social Sub Index in relation to this firm's contribution to sustainable development will be considered further in Chapter Six.

Figure 5-5 below sets out for each year the values of the BSDI and the Economic, Social and Environmental Sub Indexes for Firm B.

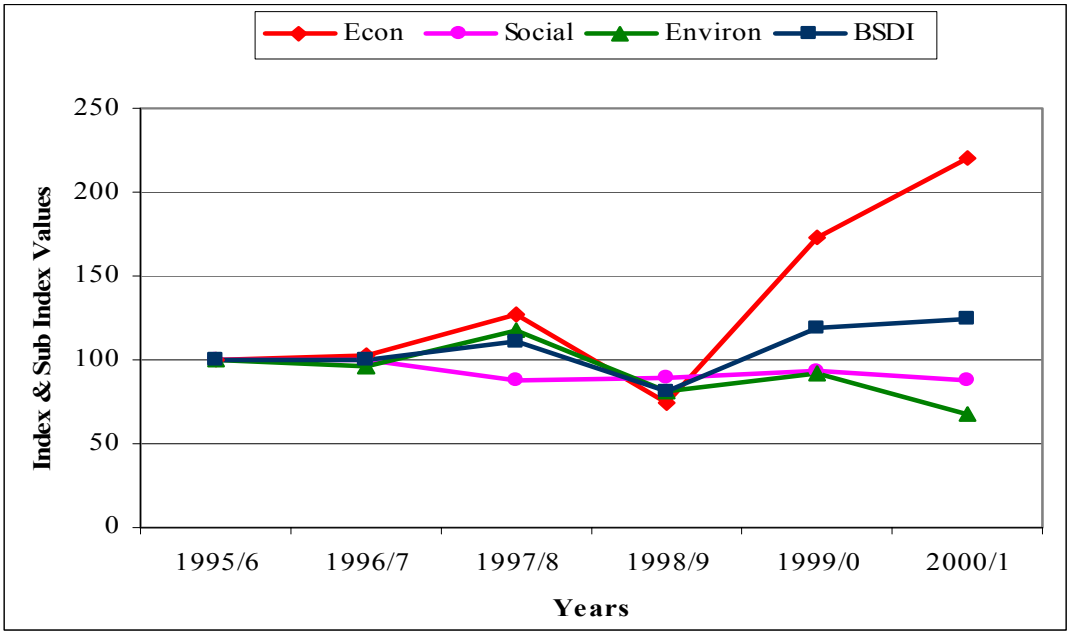

Figure 5-5: BSDI and Sub Indexes: Firm B: 1995-2001

It is noted that Firm B's Economic Sub Index out performed the BSDI for each year except one and that it had a major growth in the last two years. The average value of the BSDI for the 5 years was 107.11 whilst the average values of the Sub Indexes were Economic 139.34; Social 91.46 and Environment 90.49. The contribution of the Economic Sub Index to Firm B's index performance is very significant; however, the Social Sub Index has had a much higher value during the review period than the Social Index values which averaged 66.06 for Firm A.

The average BSDI and sub index values over the study period for each firm are summarised from Figures 5.4 and 5.5 and incorporated in Table 5.5 below.

Table 5-5: Average BSDI and sub index values: Firms A and B: 1995-2001

Firm	BSDI (Average)	Economic Sub Index (Average)	Social Sub Index (Average)	Environmental Sub Index (Average)
Firm A	84.78	95.12	66.06	93.16
Firm B	107.11	139.34	91.46	90.49

Over the study period the index and sub index averages for Firm B are substantially higher than Firm A, except for the environmental pillar for which the average values are similar. These results appear to be inconsistent with the recognition afforded Firm

A. This raises questions regarding the scope for firms to influence recognition without reference to actual performance outcomes.

An analysis of movements in the absolute and ratio components of the BSDI for each firm may give further insight into the performance underpinning the operation of the BSDI and the sub indexes. It could be that Firm B has achieved its higher index and sub index values noted in the preceding analysis, through increases in one or the other of the absolute or ratio components. To determine these underlying performance issues it is necessary to consider each sub index (Economic, Social and Environmental) and within these sub indexes, to review the operation of the ratio and absolute components. This will be undertaken in turn for each sub index and Figure 5-6 summarises the Economic Sub Index and related components for both firms

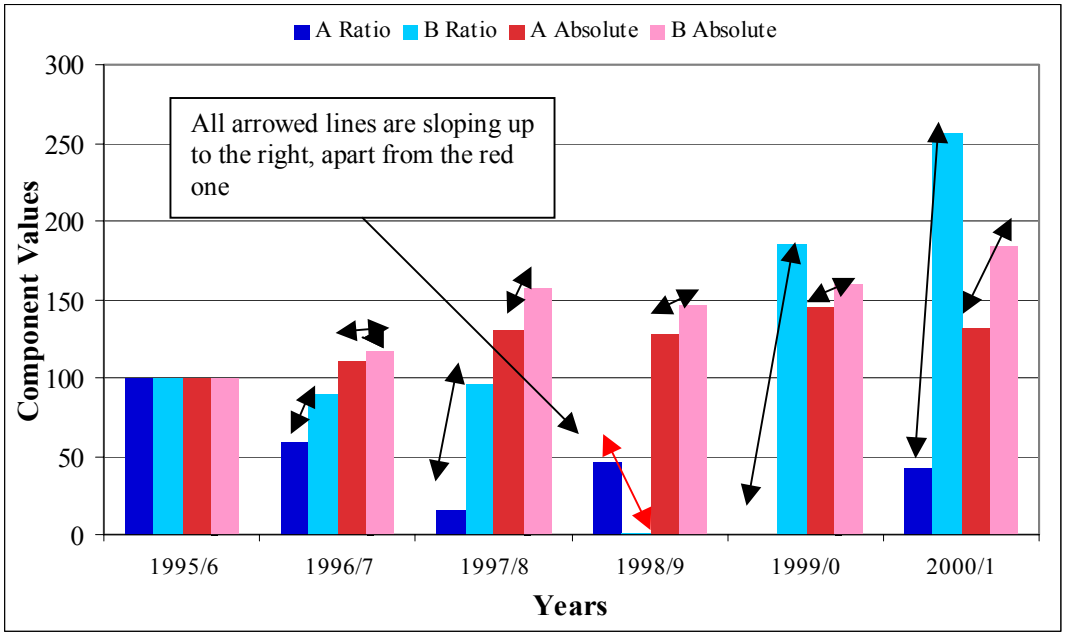

Figure 5-6: Economic Sub Indexes and Related Components: Firms A and B: 1995-2001

The arrowed lines in the figure above highlight the comparative values of each firm's ratio and absolute components within the Economic Sub Index. The direction of the arrows indicates that, except on one occasion, the values of Firm B's ratio and absolute components were higher than that of Firm A in the same year.

From prior analysis it is known that Firm A values for the Economic Sub Index were higher in one of the study years compared to the starting index value. Firm B sub index values were higher than the base year in four years. However, each firms'

absolute component of the Economic Sub Index increased relatively smoothly for most years and was larger than the first year for all years. At the same time, the ratio component was very volatile for both firms, with the index range being as low as 1 and as high as 250. Firm A increased its ratio component value for one of the study years and Firm B increased this component for two of the study years. The results make the contributions of both firms to the Economic pillar of sustainable development very questionable given the reliance on the absolute component for results.

It is reiterated that because successful firms achieve larger asset values through expansion of business as usual or acquisition of other business, this does not, in and of itself, achieve greater contribution to sustainable development. This has potential implications in relation to considerations of weighting of the sub indexes which comprise the BSDI and as noted earlier this research has adopted an equal weighting for each sub index and each component within each sub index. This issue will be considered further in Chapter Six.

Figure 5-7 below summarises the Social Sub Index and related ratio and absolute components for both firms.

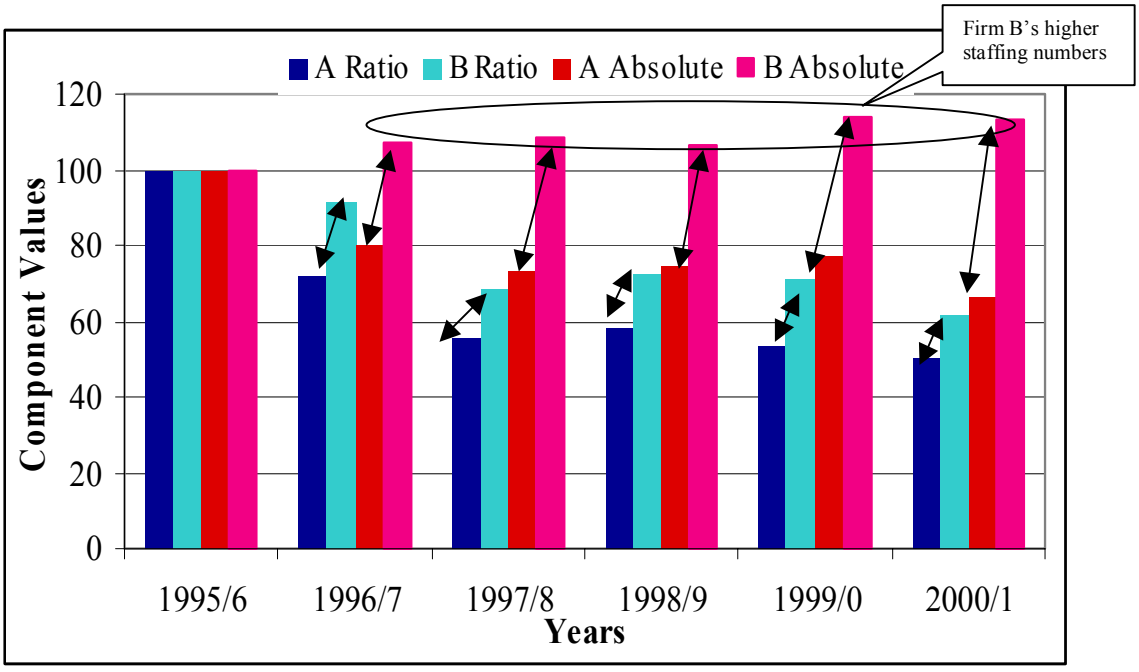

Figure 5-7: Social Sub Indexes and Related Components: Firms A & B

The arrowed lines in the figure above highlight the comparative values of each firm's ratio and absolute components within the Social Sub Index. The direction of the

arrows indicates that all of the values of Firm B's ratio and absolute components were higher than that of Firm A in the same year.

Previous analysis revealed that each firms' Social Sub Index was less for each year compared to the base year. In fact Firm A's ratio and absolute indicators were both less for each year compared to the index year. However, Firm B's ratio component was less for each year but its absolute component was greater for each year when compared to the base year. This means that Firm B employed more people at the end of the period compared to the beginning of the period. It is considered generally that firms have a social obligation to provide employment (Topfer 2000). The recognition, or otherwise, of this by firms seeking to improve contribution to sustainable development is not clear. This is highlighted by the performance information, set out above, for Firm A in relation to employment. Again, this issue needs to be considered further in Chapter Six.

Figure 5-8 summarises the Environmental Sub Index and related components for both firms.

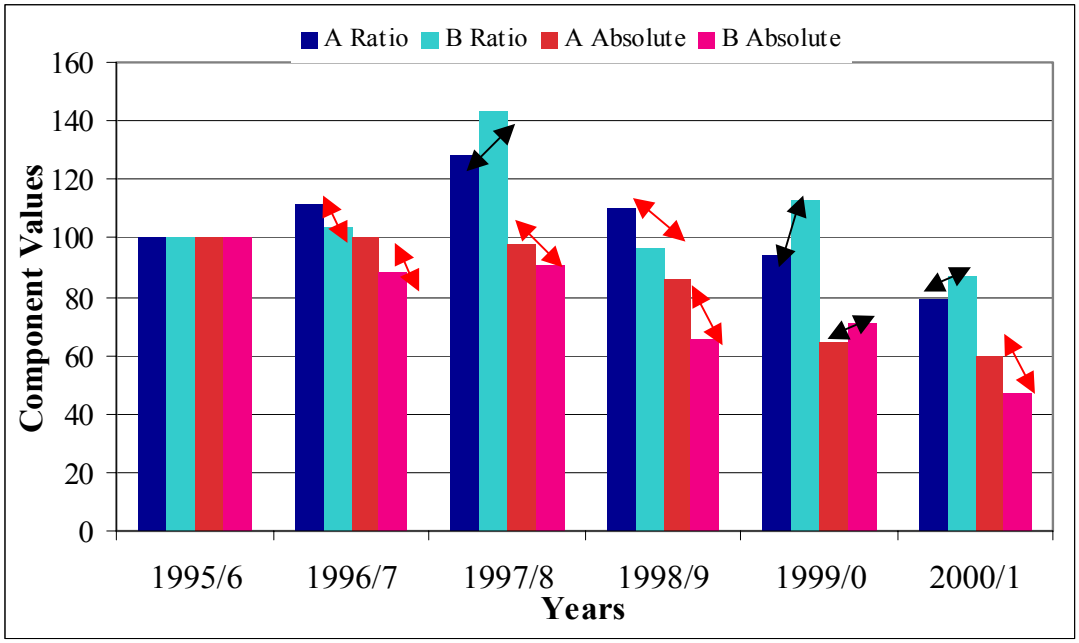

Figure 5-8: Environmental Sub Index and Related Components: Firms A and B: 1995-2001

The arrowed lines in the figure above highlight the comparative values of each firm's ratio and absolute components within the Environmental Sub Index. The slope of the arrows indicates a change from the preceding two sub indexes where the arrows were

mostly sloping up to the right. In this case there are more arrows sloping down to the right. This indicates higher values of Firm A's ratio and absolute indicators.

The earlier analysis of the Environmental Sub Index indicated that Firm A's sub index was a higher value than the base year for two years and Firm B's performance was higher for one year only compared to the base year index. In relation to the ratio component, Firm A's ratio component was higher for three years compared to only two years for Firm B. Effectiveness results were consistently below the base year for both firms, with Firm A recording only one year above the base year value whilst Firm B's values were below for each year compared to the base year. The results suggest that both firms are continuing to contribute increased pollution. At the same time the event summaries considered above, indicated very considerable emphasis by both firms in this area.

5.6 Review: Case Study Analysis

A full index for each of the subject firms has been constructed for a period of 5 years, in addition to the base year of 1995/6. Both firms are in the mining industry and one (Firm A) has been highly recognised for its contribution to sustainability and the triple bottom line. The analysis undertaken has sought to identify the differences, in the overall BSDI, each contributing index (Economic, Social and Environmental), as well as the ratio and absolute components of each contributing sub index. In addition analysis has linked each firm's performance with annual report information so as to understand more fully the differences in performance between the two firms.

The analysis in relation to the full index has shown Firm B to have increased its index value more than Firm A, since the base year of this study. The major difference seemed to be related to the comparative difference in the values of the Social Sub Index. The analysis in relation to annual report information has highlighted that Firm A has generally been more proactive in systemising its operations and in adopting improved techniques, especially in relation to environmental issues. However, apart from this timing difference, the approaches in relation to environmental issues seem to be quite similar. This is not the case with the people related, social issues. Firm B has clearly focused on more localised, employment issues than Firm A. Firm A has had an

international agenda and its approach in the social arena has seen it rationalise staffing levels far more vigorously than Firm B.

Firm B has performed better than Firm A over the study period using the BSDI, sub indexes and components as the basis for this assessment. In undertaking this analysis, and considering the components of each sub index as well as the sub indexes themselves, there are a considerable number of 'reference points' for comparison. In fact, when all of the components and sub indexes within the BSDI are added up for the period of the case study, there are a total of 50 reference points which have been established for this case study. That is, there are 50 opportunities for each of the case study firms to make an improvement to base year performance and to increase the likelihood of contribution to sustainable development. These reference or measurement points are:

- *BSDI Reference Points*: these are the index values for each year for each firm. These are illustrated in Figure 5-3 and there are five (5) BSDI reference points for each firm.
- *Sub Index Reference Points*: these are the sub index values for each of the three sub indexes for each firm for each year. These are set out in Figures 5-4 and 5-5 and there are a total of fifteen (15) Sub Index reference points for each firm. That is, three index values for each of the five years under study.
- *Components of Sub Indexes Reference Points*: these are the ratio and absolute components of each Sub Index that indicate the efficiency and effectiveness weighting of each sub index. These are set out in Figure 5-6, 5-7 and 5-8 and there are thirty (30) Component reference points for each firm. That is, two component values for each of the three indexes for each of the five years under study.

Analysis reveals that Firm A performed better than the base year on thirteen occasions from a potential of fifty opportunities and Firm B performed better than the base year on twenty three occasions from the same potential of fifty opportunities.

In analysing the comparative performance of Firms A and B in relation to each of the reference categories separately, it has been identified that:

- For the BSDI, Firm B improved above the base year on four occasions and Firm A did not achieve any improvements.
- For the three pillars (Sub Indexes) there are fifteen measurement points (3x5) and therefore fifteen opportunities for improvement. Firm A showed improvement on three occasions and Firm B showed improvement on five occasions.
- In relation to the ratio and absolute components, there are thirty measurement points (2 x 3 x 5) and therefore thirty opportunities for improvement. Firm A showed improvement in four ratio measures and six absolute measures (a total of 10 improved results). Firm B showed improvement in five ratio measures and ten absolute measures (a total of 15 improved results).

These results, whilst only exploratory and indicative are clearly challenging in relation to the current perceptions and recognition of firms for contribution to sustainable development. The full implications and conclusions from this analysis will be considered further in Chapter Six. The next section considers sustainable development performance in Australia through industry analysis.

5.7 Industry Analysis

The industry analysis in this research follows from the work of Tyteca *et al*. (2002), in their wide ranging industry analysis in Europe, as well as a much smaller scale industry analysis in the United Kingdom by Atkinson (2000). The hypothesis to be tested is that selected Australian industries are not making an increasing contribution to sustainable development.

The analysis in the preceding section provided the opportunity to construct a BSDI for two firms. This part of the analysis provides the opportunity to construct a similar index but at the industry level. The index is constructed using information at the aggregate level industry data collected by both the Australian Bureau of Statistics and the Australian Greenhouse Office for industry groupings. The industry groupings used are consistent with the Australian Standard Industry Classification (ABS 2001). There is a limitation, to the extent that all emissions are able to be allocated to each industry, and the Australian Greenhouse Office considers these by industry (2001). In this context, it is nonetheless valuable to provide:

- Early indication of the contribution of various industries to overall national sustainable development outcomes.

- A benchmark for consideration by firms within particular industries.
- Early indication of the impact on industry performance of industry level action in relation to sustainable development.

The nominal data for all variables for each industry for each year are set out in Appendix Fourteen.

As with the preceding questions, analysis begins with the construction of a Business Sustainable Development Index (BSDI) for each selected industry grouping. In this case it is more properly referred to as an Industry Sustainable Development Index (ISDI). To do this, the same operations as undertaken in the preceding analyses are undertaken to convert dollars, staffing and emissions to real values. The calculated real values for each variable for industry are set out in Appendix Fifteen and the values used for the conversions are set out in Appendix Sixteen. Appendix Seventeen sets out the ISDI for each industry for each year. Figure 5-9 summarises the results for each industry grouping across the years for which data are available.

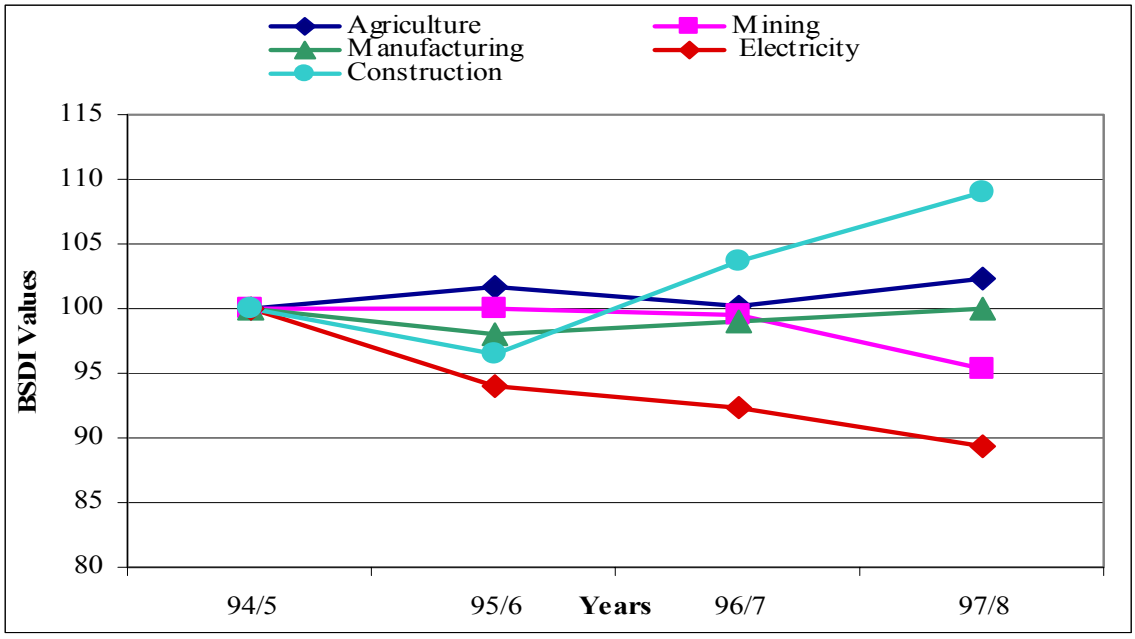

Figure 5-9: ISDI: Five Industries: 1994-1998

The above figure demonstrates that there was limited movement of the index for all industries under review during the study period and is presented in such a format to highlight this point. The range of the Y axis has been limited to show only index values between 80 and 115. Because of the closeness of the results it is not easy to distinguish the minor variations in performance without the limited range on the Y

axis. Three industry groups improved their ISDI performance for the study period (Agriculture, Manufacturing and Construction) whilst two industry groups reduced their ISDI performance for the study period (Mining and Electricity). Overall however, of the fifteen (15) data points for measurement (3years x 5 industry groupings), there were seven (7) instances of improvement.

A more detailed analysis of the implications of sustainable development for these industries is obtained by reviewing performance against each contributing Sub Index. The calculated Economic, Social and Environmental Sub Indexes are detailed at Appendix Seventeen and each of these Sub Indexes is reviewed in turn below.
Figure 5-10 sets out the Economic Sub Index for the five industry groupings for each of the four years under review.

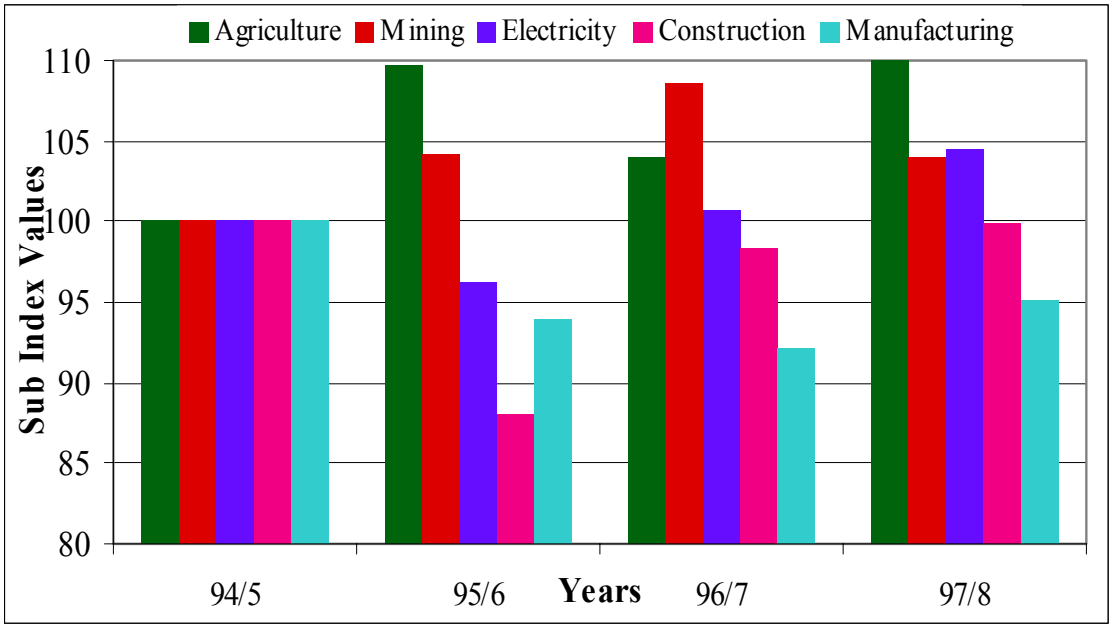

Figure 5-10: Economic Sub Indexes: Five Industries

Analysis reveals that Agriculture and Mining increased their Economic Sub Indexes for each year whilst Construction and Manufacturing saw deterioration in the sub index performance for each year. Electricity went down then up. The range of variations for each industry for each year was relatively small – 88 to 110 and of the fifteen data points for measurement and improvement (5x3), there were eight (8) instances of improvement

Figure 5-11 sets out the Social Sub Index for the five industry groupings for each of the four years under review.

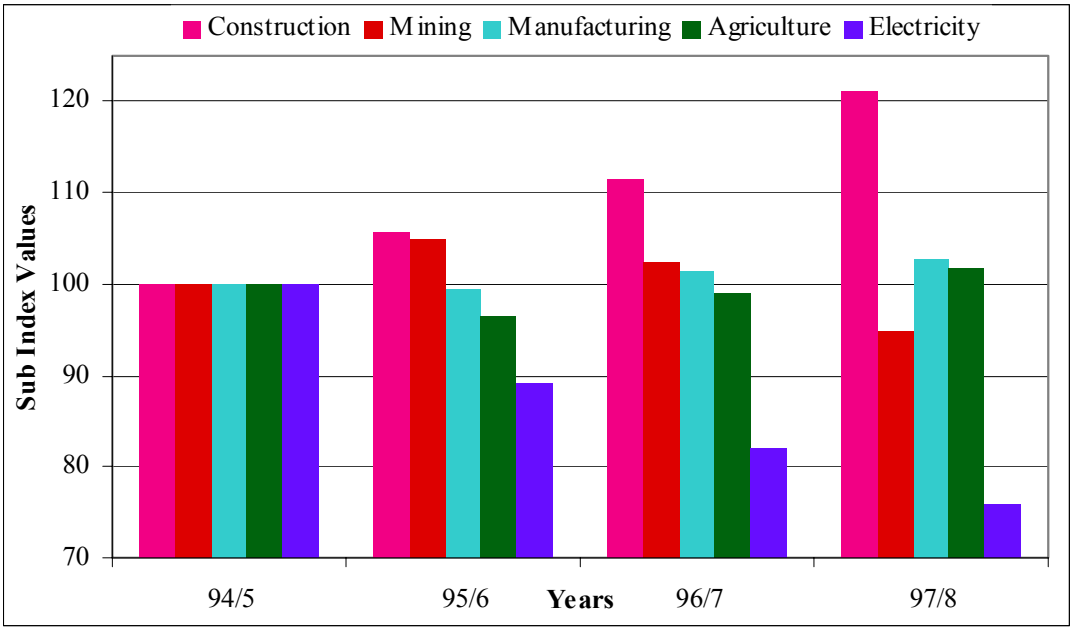

Figure 5-11: Social Sub Indexes: Five Industries: 1994-1998

There is a substantial change in the order of those industries with the highest index values for the Social Sub Index, compared to the preceding Economic Sub Index. Analysis shows that Construction saw substantial improvement well beyond any other industry, whilst Electricity saw a substantial reduction. The range of results across index values for each year was relatively large - 76 to 121. There were eight (8) improvements achieved from the potential fifteen (15) opportunities over the study period.

Figure 5-12 sets out the Environmental Sub Index for each industry grouping for each year of the period under review.

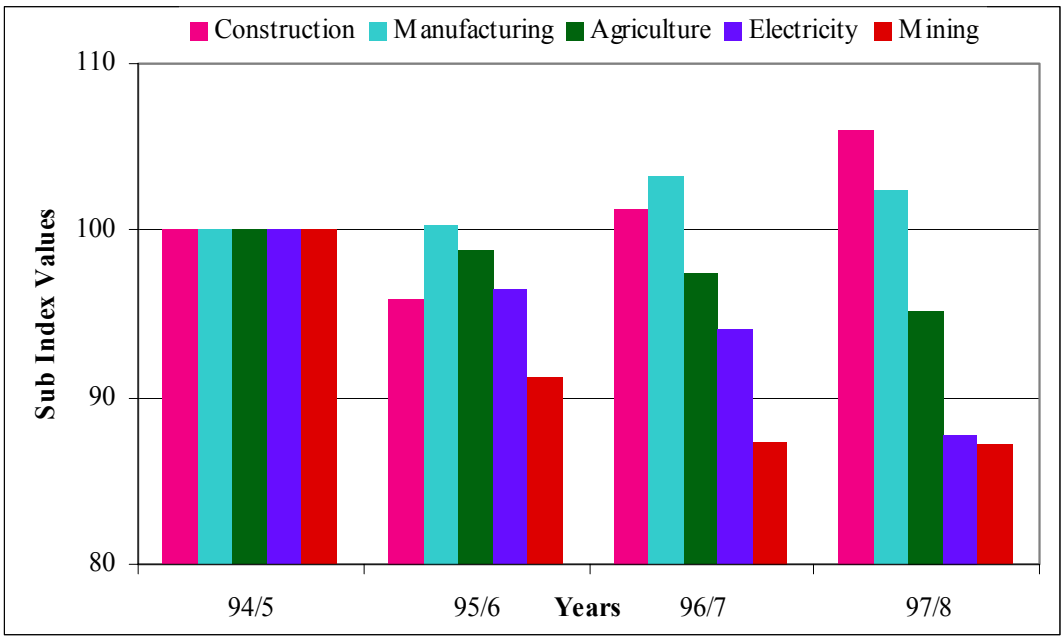

Figure 5-12: Environmental Sub Indexes: Five Industries: 1994-1998

It is noted that Manufacturing and Construction had an overall improvement for the period whilst Mining, Agriculture and Electricity performance fell during a period of heightened environmental issues for these industries. This Sub Index has the most limited range of variation – 87 to 106 and there were only five (5) improvements recorded in a potential of fifteen (15) opportunities.

5.8 Review: Industry Analysis

The methodological issues associated with the aggregation of environmental information as noted earlier, together with the limited years for which all data is available, limit industry level analysis. From analysis of published information by industry representative bodies and associations, it is apparent that some industry bodies have made a considerable and concerted effort to accommodate the implications of sustainable development within their overall policy and approach. This is most evident in the approaches of the Mining and Electricity industries (Electricity Suppliers Association of Australia 1999; Minerals Council of Australia 2000). The extent to which this is making a difference is very difficult to discern at this stage and it is certainly not apparent in the information collected by this research when these industries are compared with others.

It is considered that good information at the industry level could be used to promote business awareness of the sustainable development issue for individual firms in their respective industries. The performance of these industries may have been comparatively much less satisfactory, from a sustainable development perspective, had it not been for the efforts which have been made over the past five or so years. The performance of an industry is obviously not consistent across firms and the extent to which 'leaders' in a firm may provide the impetus for industry reform is also not clear. This question will be further considered in Section 5.9 when the performance of the firms reviewed in the case study is compared to industry level information for the mining industry.

5.9 Benchmark Analysis

This research has obtained information across three business settings in Australia in an endeavour to develop a broader understanding of the implications of sustainable development on business performance. In so doing it is possible that information from one setting may be helpful in considering results from another. In this regard it is considered appropriate to firstly undertake some business to industry level benchmarking, before completing this Chapter with a review of all analyses undertaken.

The application of benchmark analysis follows the work of both Tyteca *et al.* (2002) and Figge and Hahn (2002) in comparing an individual business's performance with that of the industry average performance information. In Question Two both firms are in the mining industry and in Question Three, the mining industry is one of the five industry groups reviewed. This means that we are able to 'benchmark' the performance of the two selected mining firms with the overall performance of that industry for those years for which we have data for both firms and the industry as a whole. The most effective way of doing this is to compare the ratio (efficiency) component of each of the Indexes for both firms and the industry. This analysis is done for each ratio component for each sub index and this is set out below.

The triple markets approach of Figge and Hahn (2002) involved the calculation of what they referred to as sustainable value added and this required knowledge about the efficiency of production of the industry. Under Figge and Hahn's approach only

those businesses producing at better than average industry efficiency would be permitted to increase production. This provides an opportunity for industry groups to explore the potential for increasing contribution to sustainable development by employing such an approach on a 'voluntary' basis. The next section compared the performance of the case study firms with the industry averages for each ratio component of the three pillars of the BSDI.

The ratio component of the Economic Sub Index for the mining industry and the two firms is set out in Table 5-5.

Table 5-6: Comparison of Industry and Firms A&B 'Earnings Assets' Ratio: 1995-1998

Organisation	95/6	96/7	97/8
Mining Industry	0.01	0.01	0.01
Firm A	0.08	0.04	0.01
Firm B	0.02	0.01	0.02

An analysis of this information reveals that Firm A was substantially superior to both Firm B and the industry 'average' for the initial two years. However, Firm B was superior to both industry and Firm A in the final year when the latter two were very similar.

The ratio component of the Social Sub Index for the mining industry and the two selected firms is set out in Table 5-6 below.

Table 5-7: Comparison of Industry and Firms A&B 'People Assets' Ratio: 1994-1998

Organisation	95/6	96/7	97/8
Mining Industry	0.04	0.04	0.03
Firm A	0.03	0.02	0.02
Firm B	0.07	0.07	0.05

Analysis of this data reveals that Firm B employed more people relative to its size than firm A and the industry. This is not surprising given the information revealed through the above analysis of each firm's annual reports. It highlights a significant difference in the approach adopted by Firm B and may well reflect the localised nature of much of this firm's activities. Firm A employed fewer resources than the industry average and this highlights the limited attention which appears to be given to 'employment' by those recognised as contributors to sustainable development and

suggests a continuing emphasis on the economic efficiency aspects of sustainable development.

The ratio component of the Environmental Sub Index for the two firms and their industry are set out in Table 5-7

Table 5-8: Comparison of Industry and Firms A&B 'Emissions Assets' Ratio: 1994-1998

Organisation	95/6	96/7	97/8
Mining Industry	0.06	0.06	0.06
Firm A	0.01	0.01	0.01
Firm B	0.02	0.02	0.01

From this table it is clear that both firms outperformed the industry average by a considerable degree. This highlights the potential danger that, whilst 'leaders' in an industry may be performing very well, the overall industry result may still be poor, if a large number of other (potentially smaller) operators are performing well below the leaders.

Overall, the benchmark analysis of each of the ratio components of the indexes has generally revealed superior performance by the two firms under review, except most markedly in relation to the operation of the Social Sub Index. This highlights what is clearly a significant issue in regard to the current models of sustainable development. Firm A has been widely recognised for contribution to sustainable development. It is clear that improvement in employment by this firm is still measured according to the view that 'less is better'. This is not necessarily consistent with a model of firms contributing to sustainable development but is more consistent with the conventional 'economic efficiency' view of business activity. This issue will be considered in more detail in Chapter Six.

The performance of an industry which comprises many firms depends on the majority of those firms, not just a few. Whilst some players may be leaders in their industry – and it would not seem unreasonable to anticipate that the two case study firms reviewed in this research may be likely to be leaders given the population of companies from which they were selected - the issue for communities and nations is that overall industry performance must result in an enhanced contribution to

sustainable development if the impacts of conventional economic growth are to be avoided. This touches on the policy implications of sustainable development in that, currently, sustainable development tends only to be the province of larger businesses. It also touches on the reservation previously noted in regard to the adoption by industries of the triple markets approach suggested by Figge and Hahn (2002). If the measures employed did not cover all pillars of sustainable development, then such industry benchmarking may further increase the comparative competitive position of MNCs and unwittingly lead to less not more contribution to sustainable development. These industry issues, in addition to the approach to employment discussed above, warrant further analysis in Chapter Six.

5.10 Conclusion

The analysis undertaken in this Chapter used a tiered model to measure business contribution to sustainable development. This permits research using different levels of available data. This is well illustrated by the analysis undertaken to test hypothesis one. The model portfolio analysis seeks to discern differences in the economic performance of firms that have been afforded different levels of recognition in relation to sustainable development. The analyses employed simple descriptive statistics as well as T-tests of difference and the results indicate considerable differences in some aspects of the make up of the firms (especially in regard to their sizes as measured by assets and earnings).

However, little difference has been discerned in relation to their contribution to the economic pillar of sustainable development when both ratio and absolute components are considered. This suggests that current approaches to recognising contributions to sustainable development may well be biased towards firms which demonstrate characteristics of asset accretion and may not be discerning real contributors to sustainable development. Because of the changeable scale of firms there is a potential that current methods do not recognise both the absolute and ratio components of business contribution to sustainable development. This is an issue which will be explored more fully in Chapter Six.

The case study analysis provided the opportunity for reviewing two firms for which it was possible to measure the BSDI over a period of six years. This analysis highlights

the impact of efficiency and effectiveness measures across the three pillars and provides additional information regarding the impact of these measures on perceived and actual contributions to sustainable development. It focuses attention on the problem of using a hybrid measure for seeking to understand both firm 'longevity' and firm 'contribution to sustainable development'. It clearly shows that a firm which has been internationally recognised for contributions to sustainable development (Firm A) has not performed as well as another firm in the same industry (Firm B) across ratio and absolute dimensions. This result is reinforced by the relative performance of the two firms in relation to the overall BSDI.

The industry analysis provided useful information about the operation of different industries however, the limited time series does mean that the major issues for further consideration arise more from the benchmark analysis of data with the firms from the case study analysis than in regard to the actual results currently available for industry groupings in Australia. It does indicate however that some industries which have shown a keen interest in sustainable development (namely mining and electricity) are not performing as well as other industries. This is an issue which warrants some further elaboration, particularly in relation to the public policy implications of the sustainable development debate for industry groupings. This will be considered further in that part of Chapter Six dealing with implications for public policy and future research.

Chapter Six will now proceed with the conclusions to be drawn from the analysis undertaken in this chapter. In addition, the implications of this research and its conclusions will be considered in relation to business management, policy and future research.

6 CONCLUSION

6.1 Introduction

This Chapter comprises five key topic areas. The first of these seeks to draw conclusions, based on the analysis of the business settings in the previous chapter and to resolve the hypotheses established for the research questions. The next section summarises the contribution of this research to the body of knowledge of sustainable development in a business setting. The subsequent two sections deal in turn with the implications of this research for business management practice and public policy. The final section puts forward issues identified by this research that may warrant consideration in future research projects.

To begin with, each business setting will be reviewed in turn and then general conclusions drawn from the overall research.

6.2 Model Portfolio Analysis

The hypothesis for this analysis is that there will be no differences in the economic performance of the two model portfolios. Analysis undertaken in Chapter Five reveals that there is no difference in the economic pillar of performance (in relation to sustainable development) for the two portfolios. The hypothesis proposed is therefore confirmed. The conclusion from this is that, the action of firms recognised for contribution to sustainable development is not sufficiently different so as to cause a change in the economic performance of those firms when compared to firms which have not been so recognised.

In the process of considering this question it has come to light that there are in fact important differences in the characteristics (not the performance) of those firms recognised for contribution to sustainable development compared to those which have not been so recognised. This characteristic is size (or scale) and it has been measured in this research by way of the dollar value of assets and earnings. From this it is possible to suggest some early lines of thinking about why this may be the case.

First, it could be that firms which are large (as those in Portfolio A generally are) may appear to be making an increased contribution to sustainable development when in fact they may simply be making a larger contribution because of their size and the continued accretion of assets. It is considered important to recognise, in any method for measuring business contribution to sustainable development, that both efficiency and effectiveness measures are important because of the scope for a business to become smaller or larger independently of any contribution to sustainable development. This issue was explored in Chapters Three and Four. By becoming large and or larger, there may be increased profit, employment and environmental initiatives however; this increase is only relative to the prior size of the business.

Whereas, if considered from an overall industry perspective there may not have been any change in these factors and there could in fact be a diminution in contribution to sustainable development by the larger entity. This diminution may be reflected in reduced ratio measures for one or more of the three pillars of sustainable development. This is rather unique to the business issue of measuring contribution to sustainable development as most other scales (for example regional scale or national scale) are more or less fixed by virtue of the physical limits of the particular scale.

Second, it may be that in fact the very size of large companies (and the additional resources and opportunities of that scale) affords a greater opportunity to market and promote aspects of business activity related to the economic, social and environmental pillars of sustainable development. This opportunity may arise because large companies have access to substantial financial and technical resources that can be deployed in activities that contribute to enhanced perceptions of their performance. An example of this is the implementation of management systems and improved reporting of environmental activities by large business. It is not clear that this improves actual performance, compared to others which are not reporting. In fact, in the MEPI project (Tyteca *et al.* 2002) reviewed in Chapter Four, the researchers found instances where the introduction of contemporary management approaches (such as quality accreditation) seemed to be related to reduced performance.

However, it does provide the opportunity for recognition simply because the resources of the large business have made such information accessible to reviewers. Other

smaller businesses may be performing relatively better, but lack of information limits the scope for comparison. As a result of which, such recognition affords large business the opportunity to support its case to continue to operate within the existing governance arrangements and to continue to maintain its 'licence to operate'. This notion of 'licence to operate' (Deegan 1999a; Elkington 1999; Reinhardt 1999) was identified in Chapter Three (3) as a key issue for motivating business to consider sustainable development issues. The reasons for this are to counter moves from various environmental and social change agents to moderate current business levels of freedom to operate (Beder 1997; Mayhew 1998; Welford 1997).

Third, in considering the conclusions in relation to the model portfolio analysis, it is important to recognise that in fact large business (as represented by those companies in Portfolio A) may be contributing more to sustainable development but that those actions, whilst contributing to sustainable development, may not be captured by the primary level measures of economic performance covered by this research. This issue relates to the potential that the secondary and tertiary levels of the BSDI which have not been incorporated in this study (due to the lack of publicly available data) may modify the results achieved so far.

These secondary and tertiary levels of the economic sub index cover issues such as taxation and number of shareholders. In addition, information in relation to the social and environmental pillars could be expected to influence the final results as well. Because of limited longitudinal data for the three pillars of sustainable development for the companies comprising the two portfolios that have been reviewed, it is only possible to seek to discern differences in the primary (level one) economic dimension. For these reasons it is too early to preclude the potential that these factors could influence the overall result.

It is reiterated that the early nature of this research and the relative immaturity of measures for considering contribution to sustainable development make any conclusions tentative. So, it is too early to be definitive about whether in fact those firms that have been recognised for making a contribution to sustainable development are in fact outperforming other firms in this regard. It is possible however, at this stage to be quite clear that, when looking at the economic pillar of sustainable

development, there is no discernable difference in the performance of the two portfolios when the method of measurement employed uses both ratio and absolute components as proposed by this research.

It is also quite clear that there is a very noticeable difference in the scale of the firms in the portfolio of firms selected for contribution to sustainable development compared to other firms. It is therefore reasonable to raise the possibility at least, that because of the potential confusion regarding business sustainability and contribution to sustainable development those businesses that are successful in sustaining their businesses (as demonstrated by continued asset accretion) are being mistakenly recognised for contribution to sustainable development. This possibility is accentuated by methodologies currently being employed to measure contribution to sustainable development not being complete in their scope or function as set out in Chapter Two of this research.

An outcome of this nature is not unexpected given the multi purpose nature of current methods employed for seeking to measure business contribution to sustainable development and the ongoing, early level of development about the most appropriate methodology. It also adds impetus to the suggestion made earlier in this research that it is important to isolate the measure to be used for sustainable development contribution from other business purposes. This issue will be taken up further when considering the implications for future business management practice

In summary, whilst the outcome to the hypothesis testing is clear in relation to this question, there is still a considerable amount of theoretical and applied analysis required to improve the bridge between macro notions of sustainable development and the individual business entity.

6.3 Case Study Analysis

The hypothesis for this analysis is that there will be no material difference in the contribution to sustainable development of the two firms. As a result of being able to apply the full BSDI to two firms over five years, it could be expected that it would be easier to arrive at a much clearer assessment of relative performance compared to the preceding question, which was only able to use one pillar of performance for analysis.

However, given the newness of the measurement method employed (this is its first application to a business setting) and also because the analysis involves both qualitative and quantitative data in regard to these firms, the task of determining a conclusion to the hypothesis is made more difficult. With this in view it is proposed to proceed to look at each of the pillars of performance, incorporating both qualitative and quantitative analysis before resolving the conclusion to this hypothesis.

In regard to the environmental pillar, Firm A is in front in regard to systematising and making more transparent its performance in relation to environmental impacts. Analysis showed that Firm B was some three years behind Firm A in relation to introducing contemporary environmental management approaches. Up to the last annual report reviewed, Firm B had still not moved to the point of having environmental standards driving particular outcomes. What is far from clear is whether this has really improved performance (or outcomes) in relation to sustainable development. Firm A has only marginally outperformed Firm B in relation to the Environmental Sub Index over the period (Firm A = 69.28 and Firm B = 67.10 in the last year). Also, from the information available, there appears to be a relatively high level of similarity of intent and approach by both firms in this dimension whilst recognising a 'timing' difference in regard to implementation of new initiatives and improvements. Firm A has definitely been quicker to act in this regard.

The same cannot be said in relation to the social pillar. From the performance of Firm A in relation to this matter (both quantitative and qualitative) it would appear that the business does not consider employment levels as a strong element in measuring and demonstrating the firm's contribution to sustainable development. Firm B has identified employment as a more important issue through the information obtained from annual reports. This approach could well be associated with this particular firm's circumstances and the existing issues surrounding its operations. Firm B employed more people over the period of the study (absolute measure) although that employment was not as high (based on the ratio of assets and people) as it would have been if the ratio of the first year was applied to the last year.

It is not possible to discern whether in fact the attitude of Firm B is a response to what is achievable given the specific nature of its operations or whether its management

would have followed this approach even if they were operating Firm A. It would not be unreasonable to suggest that a business with a more distributed workforce (such as Firm A) may in fact be less 'place' sensitive and therefore be less inclined to be concerned about the industrial and productivity implications of downsizing its workforce in any particular place. Evidence from both firms' annual reports does show a marked difference in their 'social' intent, unlike the similarity of intent evidenced in the environmental pillar. Quantitative results for this pillar show a marked difference also. Firm A's performance for the last year was 58.51 and Firm B's was somewhat better, at 87.45.

The most marked difference in performance over the study period occurred in relation to the Economic Index (Firm A = 87.23 and Firm B = 219.67 in the last year) and the primary component of this difference was the ratio component (Firm A = 42.33 and Firm B = 255.67 in the last year). There was no difference discerned in the intent or approach of both businesses in regard to this pillar. This is not unexpected given the fundamental, long term focus there has been by business on the economic pillar. It was noted however, that Firm B regularly recorded the contribution its staff had made to improvements in productivity. It is outside the scope of this study to determine any causality regarding the approach of Firm B to the social pillar and the increase in productivity over time in the economic pillar.

It is an issue however, which bears heavily on the long term arguments and approaches in regard to business management and sustainable development. There has been extensive research over many years in relation to those characteristics which makes firms successful (Dawes 2000; Roman 1999; Vorhies and Harker 2000) and thereby sustainable (in the longevity sense). In the future it is anticipated that researchers may be seeking to make a link between those firms that demonstrate commitment to sustainable development and the longevity of those firms (Dunphy and Griffiths 1998). This is well beyond the scope of this research as it has a focus on identifying the manner in which it is most appropriate to measure and analyse business contribution to sustainable development.

Now, in considering overall performance, Firm B improved its BSDI by more than 25% and Firm A reduced its index score by more than 28% over the study period.

These results are materially different but they are clearly at odds with the recognition of Firm A as an outstanding contributor to sustainable development. In any event it is possible to conclude in relation to the hypothesis set out above, that there is a difference in the quantitative (BSDI) performance and qualitative (Events Summary) performance of the two companies in relation to sustainable development. However, the difference is not as would have been logically expected. The firm that had not been recognised for contribution to sustainable development has clearly outperformed, on a quantitative basis, the firm that had been recognised for contributions to sustainable development over the study period.

The methodology employed for quantitative analysis does not allow a determination of whether Firm A was predisposed at the commencement of the study period to higher levels of contribution to sustainable development. This is a limitation of any such index-based method, deployed in the manner of this research. The BSDI is simply a measure of performance relative to the base year for each firm studied.

Having concluded this from the quantitative data, there are also important differences noted regarding the qualitative information. In particular, Firm A has been clearly more proactive on the environmental front, introducing initiatives well in advance of Firm B. In regard to the social pillar it is clearly more than just a timing difference. The intent and approach towards staff by both firms is clearly different. Most importantly, Firm A, which has been recognised for contribution to sustainable development, clearly does not put a high value on growth in staff numbers as an ingredient in its assessment of contribution to sustainable development.

This adds to concerns already expressed by some authorities to the effect that the application of the definitions approach to sustainable development in the business sector is enabling large business to ‘write the rules’ of sustainable development with the intent of maximising the opportunities of an unimpeded licence to operate (Beder 1997; Mayhew 1997; Welford 1997). This research is far too exploratory to be conclusive in this regard however, the results from this limited analysis of two firms does show serious differences between ‘perception’ and ‘reality’ and the application of a structured approach such as the BSDI is able to capture the critical ingredients of business contribution to sustainable development. This is achieved through the

application of ratio and absolute measures for each of the three pillars of sustainable development.

It would also appear reasonable to expect, based on developments to date, that governments will not act to substantially limit business licence to operate (Diesendorf 1999; Vogel 1983). To some degree this increases the need to ensure that appropriate methodologies are developed and made widely available for use in assessing business contribution to sustainable development. It is similarly important that these measures are simple and accessible to a wide audience of users – not just big business. Full cost accounting methods have been available for some time (Gray 1992) however, as noted by Reinhardt (1999) the cost and complexity of implementation will continue to be a barrier to this approach. Definitions approaches (Elkington 1999; GRI 2000) have gained popularity in business because they allow considerable flexibility. However, it has been noted in Chapters Two and Three of this research that there are a number of limitations to these methods.

There are substantial areas for both operational and theoretical development in resolving the most appropriate method/s for measuring business contribution to sustainable development. At the moment however, popular methods do not fully expose and explore the specific problems associated with these issues when considered at the individual business scale. Dyllick and Hockerts (2002) have identified a potential theoretical bridge for these problems through the introduction of notions of ‘sufficiency’ ‘equity’ and ‘effectiveness’.

However, these terms are not yet well defined or understood in the business arena. The most apparent dilemma regarding the possible operation of these new concepts which was uncovered in this analysis lies in the treatment of the social pillar. In particular, the application of ratio and absolute measures to staff numbers as a primary level indicator for this pillar. The performance of Firm A demonstrates this point. There seems little doubt that big business considers increasing staff efficiency (that is, less staff per total assets) as a necessary and important business objective (Cocks 2003). It follows therefore that big business methodologies for measurement of contribution to sustainable development would be expected to reflect this continuing

drive for reduced staffing and this is evidenced in big business reporting on this measure (Dow Chemicals 2000; WMC Limited 2001).

This is one of the many important issues which have not yet been resolved in the debate to establish more comprehensive methods for measuring business contribution to sustainable development. In view of this and returning to the testing of the hypothesis for this question, it is concluded that the hypothesis is not confirmed. There are in fact material differences in the contribution to sustainable development of the two firms. There are differences in both qualitative and quantitative measures during the period under review and there is a significant difference in the BSDI results overall. However, the result is not as would have been expected and it is in fact the firm (Firm B) which has not been recognised for contribution to sustainable development that has made a greater contribution to sustainable development than Firm A.

6.4 Industry Analysis

The hypothesis related to this analysis is that Australian companies are not making an increasing contribution to sustainable development. Of the five industry groupings reviewed, three groupings scored a higher ISDI for the last year. However these improvements were of a very small scale with an index improvement of 8.93 being the biggest improvement over the full study period of three years. Also, the industries that encountered a reduction in their indexes saw only a relatively small (but significant) shift downwards. The Electricity ISDI reduced by 10.60 over the three years. Unlike the preceding Question, the performance of the sub indexes for each pillar of sustainable development, for each industry, does not provide the basis for any conclusions at the sub index level for this question.

The general conclusion in relation to the hypothesis for this question is that there was no substantial variation in performance of these selected Australian industries during the study period. Also, some authorities posit that there is a substantial mismatch between current resource consumption and the world's long-term stock of resources (Daly 1991; Lovins, von Weizshcker and Lovins 1997). This being so, and given the minor changes in the selected ISDIs over the study period, it follows that, in the very broad context of this question, the hypothesis proposed is confirmed and that

Australian industries are not making an increasing contribution to sustainable development.

6.5 Benchmark Analysis

Whilst the conclusions drawn from Question Three are necessarily limited, the availability of some industry data does provide an avenue for increased understanding in relation to the performance of particular firms relative to their industry benchmarks. Given the availability of mining industry data and that the two firms reviewed in Question Two are in the mining industry, the opportunity has been taken to review information from both Questions Two and Three. This provides the scope to enrich the analysis and conclusions drawn from Question Two.

Analysis has revealed that the two selected firms are generally superior when compared to the industry except in relation to the ratio component of the social pillar. Overall this is saying that the industry provides more employment, as a ratio with assets, than the selected firms. This further highlights the issue identified from the conclusions in relation to Question Two, regarding the 'definition' of the social pillar and what properly constitutes contribution to sustainable development for this pillar.

It has been suggested based on the conclusions from Question One that larger firms which have the resources are seeking to increase their competitive advantage by marketing their involvement in sustainable development. At the same time, based on the results from Question Two and this benchmark analysis, it is possible that large business may be reducing its contribution to the social pillar by continuing to reduce the level of employment provided as a ratio of assets employed.

To take this line of argument one step further, if it was possible to establish measures of business contribution to sustainable development that were (1) available to all sizes of business and (2) make performance against each pillar of sustainable development visible, then it may become clear that, in spite of not having the resources to make all the advances in relation to environmental reporting which have been made by large business, small to medium enterprises may in fact be making superior contributions to sustainable development when compared to their larger, more resource rich

competitors. It is not possible to draw this conclusion from the research at this stage given the very limited data that is available for collection. However, there is sufficient indication from this early data to suggest that there are serious implications for public policy that would warrant future research in relation to sustainable development at both the individual firm and industry level.

6.6 General Conclusions

In light of the foregoing conclusions in regard to each hypothesis and the subsequent opportunities afforded by benchmark analysis, it is possible to make some broad conclusions. These conclusions are exploratory only, given the limitations of this research already mentioned. However, there is sufficient uncertainty and contention arising from the specific results to warrant broadly based conclusions for the purposes of helping to shape and guide further research and analysis in this critical area. These broadly based, exploratory conclusions are:

- Current methods seeking to measure contribution to sustainable development may in fact be weighted in favour of measuring firm longevity instead of actual contribution to sustainable development
- Conventional approaches to business growth and economic efficiency are being used to underpin business contribution to sustainable development in an endeavour to maintain existing benefits and a relatively unimpeded licence to operate
- Current methods may in fact favour large firms over small firms as a result of not being comprehensive in covering both ratio and absolute components for each pillar of sustainable development. This is also being compounded by the resource advantages of large business in being able to provide additional reporting and promotion of achievements. The impact of these factors may be accentuated by giving equal weighting to each sub index in a business setting where successful firms are able to increase their asset holdings without increasing asset utilisation rates.
- The approach to measuring business contribution to the social pillar may be the most contentious in view of the potential contradiction between conventional business logic (i.e. marginal efficiency) and the logic of sustainable development (i.e. adding to the asset base for all types of assets).

These broad ranging conclusions provide an introduction to the consideration of the contribution made by this research and the discussions regarding public policy, business management and future research which follow.

6.7 Review of Research Contribution

The primary contribution of this research is two-fold. The first contribution is to put forward a viable improvement to the current methods available for measuring business contribution to sustainable development. The improvement is directed towards enhancing the completeness of 'scope' in relation to the building blocks of sustainable development as well as completeness of 'functionality'. The second contribution is achieved through the application of this method to different settings within the Australian business landscape.

Chapter Two reviewed the key approaches to sustainable development and proposed simple 'scope' and 'functionality' tests for assessing different approaches to sustainable development. The scope test seeks to ensure that approaches to sustainable development, at the business level especially, do not omit important aspects from the general, broad conception of sustainable development. The function test seeks to make a small step in building a link between the broad ranging implications of sustainable development and the need for improved methods that measure contribution to SD. The notions of matching and linking are introduced for this reason and the objective is to build methods of measurement which are able to quantify the extent to which an organisation's actions contribute to these functions being achieved.

Chapter Three reviewed current methods of measurement used by the key approaches to sustainable development and identified key differences between the measurement problem at the business level compared to macro measurement methods. Because of the unique institutional and governance arrangements that apply to business, it is not possible to simply decompose macro methods and apply them to measurement of business contribution to sustainable development successfully. The distributed operation and impact of business and its changeable size (through merger and acquisition) represent significant challenges to the measurement issue.

Developments at both the macro level and the business level were reviewed and previous work by others provided the basis for building an improved method for measuring business contribution to sustainable development. The key, underpinning theory for this new approach included:

- three pillars concept which groups all aspects of sustainable development under one of three headings viz economic, social and environmental (Figge and Hahn 2002)
- capital theory approach which works from the assumption that sustainable development requires the maintenance of capital (asset) stocks and that to be sustainable generations should live on the 'interest' from their assets (Faucheux and Muir 1997; Stern 1997)
- economic approach focusing on the allocation, distribution and scale of resources which has led to the development of widely based indexes for monitoring national sustainability (Daly 1991)

This underpinning theory provided the background for then analysing specific developments in relation to the measurement problem at the business level.

At the business level, the work of Atkinson (2000), Dyllick and Hockerts (2002) and Figge and Hahn (2002) provided the framework for seeking to extend the scope and function of business methods. Dyllick and Hockerts (2002) introduced the notions of 'sufficiency' 'equity' and 'effectiveness' to the existing efficiency framework of business in an endeavour to link business contribution to sustainable development to the macro implications of SD. This together with the work done on macro indexes such as the ISEW (Gil and Sleszynski 2003) and the HDI (Streeten 1995) matched by the absence of such methods at the business level provided the basis for building an improved measurement methodology.

The proposed Business Sustainable Development Index (BSDI) has the following characteristics:

- Is a synthesis of an index method of measuring contribution to sustainable development, used at the macro level, and a conventional ratio analysis approach to measuring business performance. Current methods predominantly apply ratio analysis.

- Focuses on the movements in company assets and not, as current methods do, on making 'green' adjustments to business profit figures.
- Sets out to only measure a firm's contribution to sustainable development to assist in clarifying the business actions that achieve the maximum outcomes from a sustainable development perspective. It is not intended to be an adjustment to current business measures of profitability or longevity to accommodate the implications of sustainable development.
- Uses both efficiency and effectiveness performance measures in an endeavour to link business outcomes with the macro prescriptions of sustainable development

The scope and functions tests developed earlier in the research are used to review the BSDI and this review is set out in Table 3.5 in Chapter Three.

Chapter Four reviewed applied research by others and outlined the methodology for applying the BSDI in Australian business settings. The methodology employed three types of analysis. Portfolio analysis (Wagner 2001), case study analysis (Atkinson 2000; Figge and Hahn 2002) and industry analysis (Atkinson 2000; Tyteca et *al. 20*02) provided the basis for exploring different business settings with varying levels of data. Also, the previous work of these authorities provided the justification for the specific data attributes used to populate the BSDI algorithm. The use of assets, earnings, staff numbers and emissions as the primary level of data for the BSDI followed from the authorities cited earlier in this paragraph.

In Chapter Five, using this new BSDI method, analysis is undertaken in the Australian business environment. The objective was to discern whether firms seeking to give effect to sustainable development performed differently to others. As with other research undertaken in different jurisdictions, the Australian environment is difficult in relation to the collection of data for analysing business performance of sustainable development. As noted above, to overcome this, three types of analysis have been undertaken in three different business settings. The results and conclusions of this exploratory research into sustainable development in Australia raise some contentious issues which warrant further deliberation beyond the scope of this research. These issues are considered further in the following sections dealing with implications for business management practice, public policy and future research.

6.8 Implications for Business Management Practice

It is anticipated that there are three specific aspects of this research which will have implications for business management practice. The first of these is that a single purpose model of sustainable development will reduce confusion between firm size/longevity and contribution to sustainable development. The second of these is that a tiered model allows both small and large businesses to calculate and communicate their contribution to sustainable development. The third implication of this research for business management practice is that an integrated implementation comprising a definitions, charters and systems approach may achieve a comprehensive business outcome towards enhanced contribution to sustainable development. Each of these specific implications is considered in turn.

6.8.1 Single Purpose Measure

Sustainable development is recognised as a growing concern for business and the evolution of thinking in business regarding this issue is set out in Chapter Three. In the course of seeking to understand sustainable development, there are emerging efforts to develop methods to more accurately measure business performance in relation to sustainable development. This has been impeded by:

- Traditional accounting and management practices which have not generally incorporated recognition of social and environmental assets.
- Governance arrangements which limit a firm and its management within prescribed boundaries.
- The complexity and different scale of sustainable development when related to a firm's activities and impacts, which are spatially disparate.

Developments to date have focused on developing methods of measurement which use available company data as much as possible and which provide an overall business performance measure, as well as a measure of contribution to sustainable development.

This research has noted that efforts at the national level to measure sustainable development have tended to operate in addition to measures of existing economic and other performance (Pearce 2002; Gil and Sleszynski 2003; Streeten 1995) and contends that this is the most sensible approach in a business setting as well.

Continuing to seek to measure and understand conventional business performance and contribution to sustainable development in the one measure is too difficult for the same reasons that it is too difficult at the macro scale. Also, business is well used to using different measures to consider different aspects of business performance (Mansfield 1980; Ratnatunga, Romano and Waldmann 1993). Evidence of the failure of these integrated measures, at least in part, is provided by the conclusions drawn from Questions One and Two of this research.

It would appear that these integrated measures may in fact be more likely giving insight into business size/longevity as opposed to contribution to sustainable development. Knowledge and awareness of business longevity is a legitimate and important measure. But the longevity of a business is not a sufficient or appropriate surrogate for measuring contribution to sustainable development. Consequently, this research proposes a separate measure for calculating business contribution to sustainable development and it must be recognised that this has the limitations which would be anticipated from such a purpose specific measure. It does not give indication of the prospects for longevity of a particular firm and nor does it indicate the profitability or desirability of a particular firm from a return on investment (or any other financial) perspective

This has important ramifications for business managers who may find it very difficult to manage the expectations of stakeholders and shareholders with competing interests. It may also be very difficult to determine appropriate courses of actions given the potential divergent ramifications of sustainable development and say, return on investment or profitability. However, this is not a specific consequence of having a single purpose measure. These difficulties will arise irrespective of the method employed. However, it could be anticipated that the clarity provided by such a single purpose measure may well focus attention on the trade offs and contradictions between conventional business models and increased contributions to sustainable development.

6.8.2 Tiered Model

There is another very important implication for practitioners arising from this new single purpose systems approach to measuring business contribution to sustainable

development. The method proposed draws from the method employed by the Human Development Index in being able to be applied to situations where different levels of data are available (Streeten 1995). This potentially provides the opportunity for businesses that have limited resources to calculate their contribution to sustainable development and be compared with firms of similar size or large firms with substantially more resources.

It means however, that large firms would be expected to furnish more information and to complete more levels of the tiered model. In this way, resource rich and resource poor firms can use appropriate levels of information but be able to be compared with reference to an index measure. This index measure allows the contributing sub index measures (covering the three pillars) as well as the components of these sub indexes (ratio and absolute components) to be reviewed also. It also provides firms with a development pathway in terms of progressively increasing their knowledge and contribution to sustainable development as they increase their capacity to complete more tiers of information in constructing their BSDI.

It is further anticipated that such an approach also provides the opportunity for firms in the same industry to more easily compare results and to commence establishing benchmarks for the different components and sub indexes within the overall index. (This approach is presaged by Figge and Hahn (2002) in their triple markets approach reviewed in Chapters Two and Three of this research.) As well, it provides opportunities to understand those factors which may need specific attention in order to increase contribution to sustainable development by virtue of the fact that each sub index contains both efficiency and effectiveness measures for each tier of information. This, it is hoped, would lead to greater recognition and understanding of the important components within normal business operations which are likely to most impact on contribution to sustainable development. This is not necessarily easily discernable through current methods.

6.8.3 Comprehensive Implementation

Business implementations to improve the contribution by firms to sustainable development are likely to be demanding and complex projects given the limited theory and knowledge in this area. The situation is made more difficult because of the

tension between existing corporate governance obligations and the requirements of sustainable development. This has been noted in the discussion in Chapter Two regarding the increasing expectations concerning corporate obligations outside the factory gate at the same time as corporate governance confirms the primacy of the interests of direct shareholders in management of the firm.

Scope for managers to balance these expectations and achieve a successful project implementation may be enhanced by the application of a structured process in implementing sustainable development initiatives. This structure and the management of the project may be enhanced by using a three pronged implementation using the three approaches to sustainable development outlined in Chapter Two. The three approaches could be integrated into the one project plan comprising three phases, to match the three approaches to sustainable development.

The first phase involves goal setting and the goals of the firm could be developed ensuring that the goals are framed using the general principles of sustainable development. This goal setting phase would be enhanced by the use of a definitions approach (Elkington 1999; Dyllick and Hockerts 2002; Welford 1997). The second phase involves establishing milestones for mapping progress towards improving contribution to sustainable development. These milestones could be established using the methods employed by the charters approaches to sustainable development (Beaumont 1993; Dunphy and Griffiths 1998; Kinlaw 1993). This means that the firm is able to identify the organizational changes which are needed to bring about measurable change in the contribution to sustainable development. The charter approaches such as HR or TQM have been put to good use by many large businesses and their experience provides additional information for the implementation manager (Dow Chemical 2000; WMC Limited 2001).

The third phase involves establishing and measuring performance in relation to sustainable development targets. The systems approach (Atkinson 2000; Figge and Hahn 2002) is most useful in calculating particular targets and by learning the key drivers within the business that most impact contribution to sustainable development, managers could become alert to the strategies and actions which are most likely to enhance sustainable development performance. This is not dissimilar to other popular

approaches in management such as management by objectives and balanced score carding and the primary difference arises in the particular targets being sought.

In summary, the comprehensive approach to implementation comprises three project parts which would match the three approaches used in this research as well as the organizational performance framework noted in Chapter Two (Higgins 2001). The table below illustrates these elements of the comprehensive implementation approach for improving sustainable development in business.

Table 6-1: Comprehensive Framework for Implementing and Improving Business Contribution to SD

Implementation Phases	Approaches to SD	Performance Framework
Goal Setting	Definitions	Goals and Outcomes
Project Planning	Charters	Inputs and Outputs
Performance Management and Reporting	Systems	Efficiency and Effectiveness Performance Measures

6.9 Implications for Public Policy

The implications for public policy are quite significant because of the issues arising most specifically from Questions One and Two. In particular, it has been suggested by this research that current methods may in fact be favouring large business. As well, large business may be 'reshaping' the meaning of sustainable development in a business setting so as to protect current governance regimes in an endeavour to ensure continuing 'licence to operate' conditions.

A further important area for public policy has been highlighted by the paucity of information in relation to industry contribution to sustainable development. This was set out in the analysis and conclusions to Question Three. It is intended to consider these issues under 'general' and 'industry' headings below; however; there is a clear and strong connection between to the two areas.

6.9.1 General Policy Implications

The significance for public policy as a result of these conclusions could mean that if sustainable development is a notion that is owned and shaped by large business then small to medium business may not improve its performance in relation to sustainable development. This has significant ramifications if only from the point of view that small to medium business represents a large proportion of consumption, production and employment in Australia (ABS 2001; Fagan and Webber 1999). Potentially therefore, in spite of some large businesses improving performance, other sized businesses may in fact contribute to reduced overall contributions to sustainable development for business at large.

Further, it would be counter productive for business at large to be operating on an incorrect model or method of measuring sustainable development, thus making it much more difficult for regional and national governments to achieve improved outcomes in relation to sustainable development. It would be very difficult to improve the sustainable development outcomes for a developed country such as Australia without there being a commensurate increase in improvement in the majority of businesses in the nation. This is because of the high level of marketisation of the economy and the level of resources applied to business activity (Hamilton 2003).

6.9.2 Industry Policy Implications

It is considered also that there is an important issue in public policy regarding governments' knowledge and involvement in different industries within a developed nation. Industry and industry development are important to each of the state governments and the commonwealth government in Australia. There are many programs and high levels of expenditure directed to particular sectors and industries. Over time it would seem critical that governments more fully understand the extent to which particular industries or sectors are contributing to Australia's and Australians' well being.

To do this it would seem necessary to extend the scope of industry analysis to more completely understand the contribution which each sector or industry makes to sustainable development. There have been some efforts to expand and change

conventional industry analysis to take account of some of the ramifications of sustainable development (Sustainable Asset Management 2001). This could then be used to influence investment and development by governments in particular industries and to ensure that industry development was in fact increasing contribution to sustainable development.

At the heart of this issue is the current lack of knowledge between the macro conceptions of sustainable development (as indicated by capital theory) and what these mean for individual businesses and groups of businesses (i.e. industries). The analysis of capital theory in Chapters Two and Three identified the macro components and the relationship between these components that achieved sustainable development Faucheux and Muir 1997; Pearce 2002; Stern 1997). Whilst these prescriptions have distinct limitations (Stern 1997) there is a major limitation in understanding what prescriptions would need to apply at the individual business level to ensure achievement of macro sustainable development. Daly (1991) identified the problem some time ago and there are emerging strategies for determining what sustainable industry strategies may involve (Environment Australia 1992; 1999; 2001). There continues to be much work required in bringing this understanding to clearer focus in the business community at large and in particular for individual business operators.

More broadly, it would be beneficial to increase knowledge of sustainable development, particularly in communities and in small business. If communities large and small are not aware of and do not recognise the implications of sustainable development on their suburbs, districts, regions and catchments, then there is every likelihood that government expenditures on fixing problems will need to increase and community dissatisfaction with government may grow (Keating 2000). This portends an approach that regards communities, catchment groups and the like, as not unlike businesses and therefore they too should be seeking to measure their progress towards sustainable development (Cuthill 2002; Salvaris 2000).

The application of the tools for measuring business contributions to sustainable development to wider groupings is countenanced to some degree by recent efforts to establish broadly based sustainable development assessments for catchments and regions in Australia (Agriculture Fisheries and Forestry Australia 2001; National

Economics 2002). It is given further impetus by the concept of designating economic zones within Australia as a means of preserving areas and regions for the benefit of the nation's sustainability (National Economics 2002).

6.10 Future research

The conclusions drawn from this research earlier, as well as the discussion on management practice and public policy immediately above, highlight areas for potential future research. The areas already identified in both of these categories are:

- The relationship between macro prescriptions of sustainable development and individual business.
- The most appropriate data attributes for inclusion in a measurement method such as the BSDI, as well as the most appropriate weighting of these.
- Paucity of industry data to support increased benchmarking and performance improvement.

These issues are important and are especially so because it is unlikely that governments will seek to substantially increase the regulation of business (Vogel 1983). Efforts to improve and expand voluntary involvement and self reporting are likely to underpin future developments in sustainability measurement in business.

Sustainable development is the contemporary conception of a long held human concern (Bennett 2001). This research has sought to establish an improved method for measuring business contribution to sustainable development and has then applied this in an Australian setting. The results have been somewhat surprising and give indication that current methods of recognising business contributions to sustainable development may not be appropriate and in fact, may be misleading. In view of this, it would be most beneficial to undertake future specific research.

Being able to undertake research of industry performance over a much longer time frame would make the first and most important contribution. The second area of future research is prompted by advice provided by earlier researchers in so far as it not so much the complexity of the measures but in fact the repeated application of existing known measures which will contribute most to expanding knowledge in this relatively new field. In view of this it is proposed to consider future research opportunities under two simple headings of (1) Industry and (2) General.

In considering these areas for future applied research it is expected that there will be a considerable ongoing dialectic and consequently research effort, in relation to methods of measurement of business contribution to sustainable development. It would be heartening to think that this research would be more directed to improving our understanding of business contribution to sustainable development as opposed to expanding the tools of the already resource rich to better invest and expand their interests.

The experience from this research is that there is a paucity of data available at the industry level to support understanding of sustainable development in business. This has resulted in very limited conclusions flowing from industry question within this research. It is a generally accepted part of contemporary public policy to use industry diffusion as a mechanism for improving industry performance (Department of Industry Science and Resources 2001). In regard to sustainable development a key pillar is environmental and at present only limited information is available at industry level to support knowledge and understanding of impacts. This could be achieved using information on greenhouse gas emissions for more recent years than was available to this research and to improve the spread and accuracy of this information (Australian Greenhouse Office 2001). In regard to the latter, it was only possible to obtain this greenhouse data for a small number of industries. More work could be done to also establish simple surrogate measures of emissions for small to medium enterprises to allow these businesses to be measured and if appropriate, recognised for contribution to sustainable development.

Research in these specific industry areas would then enable a much clearer picture of industry wide trends and would enable benchmarks to be established for each component and sub index of the Industry Sustainable Development Index for each industry. Also, with more resources it may be possible, because a growing number of firms are showing interest in their contribution to sustainable development, to extend this current research to pick up a wider number of components so that multiple tiers of the BSDI could be calculated. This would contribute to greatly increased understanding and knowledge of the linkages between business actions and sustainable development.

Moving to consider future, general research, there is the potential for such research to cover an extremely diverse range of issues associated with sustainable development. However, taking into account the findings from the MEPI project (Tyteca *et al*. 2002) in Europe, the research which is considered most likely to have an important ongoing impact on the understanding and application of sustainable development in a business setting would be to systematically increase the coverage of firms for which it was possible to calculate a Business Sustainable Development Index (BSDI) and to undertake regular analysis of this expanding body of information. Each year, all the firms for which it is possible to obtain all three pillars of information could have their BSDIs calculated. Then movements in their BSDIs and related sub indexes would be analysed to progressively expand the knowledge of sustainable development in a business setting.

The primary improvements are likely to come from expanding coverage as opposed to undertaking more complex or sophisticated analyses (Tyteca *et al.* 2002). In this way trends could be identified, benchmarks improved and the unnecessary flight to ever increasing detail within company reports may be curtailed. This, it is hoped, may also increase the likelihood of the primary objectives of sustainable development being achieved. The building blocks of sustainable development are not served to any great degree by a small number of large businesses providing extravagant detail in their annual reports. Especially when the vast majority of small to medium business activity goes unreported and the community has little knowledge about the relevance or comparative value of the ever increasing detail in company and organisational annual reports.

Expanding the knowledge and application of sustainable development to business management is important because business has such a high impact on the economic social and environmental resources of the world. Knowing what constitutes a contribution by business to sustainable development remains a contentious issue and this research has highlighted the limitations of current approaches. Also, given the scale of business activity in contemporary life it is most unlikely that our nations and regions will achieve sustainability unless the majority of businesses make a real contribution to sustainable development. This will be supported if the indicators of

contribution to sustainable development expose all three pillars and recognise the essential importance of both efficiency (ratio) and effectiveness (absolute) components in the business setting.

Importantly there is a need to avoid the potential masking of results, in relation to business contribution to sustainable development, arising from successful businesses acquiring more assets. As well, single adjustments to profit and loss accounts provide limited information on progress towards sustainable development and favour those businesses whose profit levels are sufficiently high to cover both social and environmental losses. The tiered BSDI model suggested by this research provides a possible approach that is cognisant of the particular nature of the business setting and at the same time seeks to retain as much of the essential ingredients which characterise sustainable development at a macro level. However, there is still much that needs to be learned about the ramifications of sustainable development for business and the way in which business administration is able to give effect to its many implications. This research has endeavoured to contribute to this understanding and to provide an improved method for measuring contributions to sustainable development by business.

6.11 Conclusion

The type and scale of industrial growth in the world since World War Two has highlighted the tensions between conventional economic growth and the conservation of social and environmental diversity (Spangenberg 2001). During this time the expansion of application of market systems as the basis for economies has meant that firms are heavily involved in the debate. Business, especially big business, has been subjected to closer scrutiny and business people have been keen to preserve the rights and privileges afforded under modern approaches to corporate governance (Dunlop 2000; Elkington 1999; Stigson 1999; Vogel 1983).

These rights and privileges are components of a ‘licence to operate’ and go to the heart of how firms operate and the rules applied to their operations. Firms have endeavoured to convey their positive contribution to the changed expectations regarding economic progress. This is not only to preserve ‘licence to operate’ but because of the investment and value benefits accruing to those firms which are considered to be making wider social and environmental contributions. Substantial

investment pools are becoming available to those firms that are rated or ranked as operating in a socially responsible manner (Donovan 2002).

This is having the effect of changing the methods and approaches being applied to report on the performance of business (Dow Jones Group and Sustainable Asset Management 2001; Manning and Wade 2001). There are, in addition, claims of superior financial returns accruing to those who invest in these enlightened businesses. These claims are coming from firms themselves (WMC 2001) business advisors (Lagan 2001) and investment managers (Manning and Wade 2001). Because the activity of business is now having such a substantial impact on people's lives in all parts of the world and because it is important to better understand what constitutes enlightened business performance in contributing to enhanced social, environmental and economic outcomes, this research considered the ways which are being used to measure business performance in relation to these expanded outcomes.

Specifically, this research focused on methods of measurement of business contribution to sustainable development and whether firms that have been recognised for contributing more to sustainable development are in fact doing so. The focus on sustainable development is warranted for several reasons. First, sustainable development reflects many of the issues included within the broader 'conservation versus growth' debate. Second, whilst not precisely defined, sustainable development is sufficiently articulated to provide a starting point for use in an empirical comparative analysis of business performance. Third, sustainable development has been the starting point for many of the corporate approaches in responding to the broader expectations of business within the 'growth versus conservation' debate.

In broad terms, by employing a sustainable development approach, the objective is to moderate growth (unlike the prescription of the earlier Brundtland conception which saw the need to speed up growth) and the consumption of resources in line with the physical scale of the earth and to distribute this consumption more evenly across the peoples and places on the planet, both now and into the future (Daly 1991). Whilst such an objective is simple, achieving it is difficult.

The relationship between sustainable development and a single business entity is not fully understood, either in practice or theory (Atkinson 2000; Deegan 1999a; Elkington 1999). This is because sustainable development is a broad ranging concept, which operates in relation to natural or physical scales; whereas a firm is an entity which operates only within institutional boundaries and whose operations are not limited to one physical location. Even if a firm has only one office or factory, by the very nature of business activity, its operations extend beyond that one location.

This has prompted recent theoretical efforts to shift to describing (and measuring) company efforts in relation to sustainable development as being 'contributions' to sustainable development. Because one company's 'sustainable development' cannot be measured in isolation to all other participants in the national economy, the emphasis for measuring business activity in this area has moved to determining whether the company's contribution (the effect of its social environmental and economic activities) has been a plus or a minus on the nation's tally sheet (Atkinson 2000; Deegan 1999a; Tyteca, Carlens *et al.* 2002). This requires the measurement of business contributions to the economic, social and environmental dimensions (known as the three pillars) of sustainable development and this in turn, requires expanded measures of company performance to be developed (Deegan 1999a; Figge, Hahn *et al.* 2002).

The primary objectives of this research were to establish a comprehensive method of measuring business contribution to sustainable development and to assess (using that new method) whether firms that have been recognised for making a contribution to sustainable development are in fact doing so. These objectives were achieved through a range of approaches. First, a more complete method of measurement of business contributions to sustainable development was developed from an analysis of recent developments in the theoretical basis for measuring contributions to sustainable development Second, the economic performance of two groups (portfolios) of selected Australian companies was assessed with a view to discerning differences in performance between the two groups. This objective was achieved through model portfolio analysis and the hypothesis that – there was no difference in the performance of the two portfolios- was confirmed. Third, the performance of a pair of selected Australian companies from one sector, in this case, the mining industry, was assessed

with a view to discerning differences in performance between each company in relation to contribution to sustainable development.

The mining sector was selected because it represents a good example of the tensions in the growth versus conservation debate as well as highlighting the focus of companies to retain their licence to operate. This objective was achieved through case study analysis and the hypothesis that -there was no difference in the performance of the two firms- was not confirmed. In fact the firm not recognised for contribution to sustainable development was assessed as making a superior and significantly different contribution to SD when compared to the other case study firm. Fourth, the preferred method of measuring contribution to sustainable development was applied to five industry groupings to provide a context and benchmark for reviewing the performance of firms within these industry groupings. This objective was achieved through industry analysis and the hypothesis that -selected Australian industries are not making an increasing contribution to sustainable development- was confirmed.

It is considered that these objectives have been achieved (as set out earlier in this Chapter) and early conclusions have been put forward. These conclusions indicate that there are shortcomings in the methods currently employed to measure business contribution to sustainable development. These shortcomings include (1) incompleteness, when compared to broad principles and themes of sustainable development (2) confusion, in that current methods seek to measure both conventional business performance and contribution to sustainable development in one, synthesised measure and (3) inaccessibility, in that the cost of some popular business methods excludes many small to medium businesses from participating in the measurement process.

The BSDI developed in this research is a contribution to the development of methods to measure business contribution to sustainable development by (1) seeking to develop a more complete tool that links existing organisational efficiency and effectiveness performance measures with the broad concept of sustainable development (2) focusing on the development of a single purpose measure designed to give a perspective on the contribution of the firm or industry to sustainable development only and (3) adopting a ‘tiered’ index approach that allows small to

medium firms (SMEs) to participate in measurement of contribution to sustainable development.

The results indicate that this new method is able to be applied to different business settings (specifically industry, case study and model portfolio settings). This is a distinct improvement because of the patchy data which is available to research in this area. Preliminary results indicate that the apparent application of sustainable development techniques within a business setting is not having a positive impact on business performance to date. That is, there is no proof that those firms which have been recognised for making a superior contribution to sustainable development are in fact doing so. It is more likely, based on this research that firms are continuing with conventional business strategies in relation to profitability, market share and longevity.

The research suggests that it may be the ability of firms to market their efforts in regard to sustainable development, more than the actual contribution of these firms to sustainable development, which results in the perceived difference in business performance. The opportunity to market such efforts is primarily afforded those larger businesses that have the resources and the where-withal to do so. Based on the results of this research, big business and industry bodies may be using sustainability oriented issues to continue these conventional objectives, concurrently with seeking to protect licence to operate. This would appear to be a sound strategy (from a narrow business perspective) as governments (such as those in Australia and other developed nations) seem reluctant to limit business licence to operate. As well, investment funds appear to be attracted to businesses which market and promote their efforts consistent with the tenets of sustainable development. Over time, given the likely continued interest and concerns regarding sustainability, it will be important to continue research and learning in relation to improved methods of measurement of business contribution to sustainable development. This will enable communities, governments and investors to be better placed to recognise business performance consistent with the tenets of sustainable development. This research indicates that this capacity may be limited at the present time.

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APPENDICES

Appendix 1: Assets and Earnings: Nominal Dollars (Millions): Portfolios A and B

TABLE A1	Assets: Nominal Dollars (Millions): Portfolio A
TABLE A2	Earnings: Nominal Dollars (Millions): Portfolio A
TABLE A3	Assets: Nominal Dollars (Millions): Portfolio B
TABLE A4	Earnings: Nominal Dollars (Millions): Portfolio B

TABLE A1:1: Assets: Nominal Dollars (Millions): Portfolio A

COMPANY NAME	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Normanby Mining	1,732	1,698	2,319	1,962	2,212	2,614	3,076	3,397	3,626	3,847
WMC	3,999	4,138	4,969	6,116	6,982	7,670	9,049	8,916	10,371	10,012
BHP-Billiton	23,588	26,232	27,721	30,287	35,230	36,735	37,082	31,487	29,344	29,187
Woodside Petroleum	3,189	3,302	3,119	3,157	3,016	3,435	4,403	4,773	5,969	6,115
Caltex Australia	1,809	1,776	1,803	1,019	939	2,895	2,722	2,974	3,167	2,747
Orica	2,355	2,351	2,392	2,656	2,843	2,962	3,647	3,530	3,579	3,731
APN news and Media	231	260	475	520	587	685	713	1,018	1,063	2,485
News Corporation	26,221	27,272	26,946	30,190	30,763	41,358	54,484	53,972	65,585	84,961
John Fairfax	1,647	1,651	1,864	2,073	2,223	2,165	2,098	2,105	2,152	2,272
Coca Cola	2,290	2,903	3,223	4,651	6,092	9,466	8,463	8,789	8,789	6,353
Southcorp	2,039	2,234	2,072	2,383	2,721	2,841	3,093	3,163	3,419	4,391
Orbital	513	527	527	573	466	337	315	238	199	112
James Hardie	1,612	1,647	1,735	2,002	1,696	1,916	1,985	1,518	1,698	1,930
Lend Lease	2,555	3,026	3,084	3,480	3,543	4,674	6,483	7,291	10,942	9,127
Mirvac	281	286	283	361	375	435	538	2,038	2,239	2,360
Leighton Holdings	871	998	1,049	1,189	1,405	1,623	1,649	1,576	1,729	2,050
Coles Myer	5,728	6,235	6,910	6,568	7,070	6,697	7,173	7,704	8,136	8,278
Goodman Fielder	3,106	3,340	3,203	3,040	2,753	2,201	2,505	2,935	2,846	2,849
Foodland Associated	344	644	1,241	1,368	1,608	1,465	1,445	1,504	1,370	1,423
AMCOR	4,352	5,006	5,701	7,065	6,966	7,021	7,180	6,353	4,956	7,026
Mayne Nickless	2,184	2,415	2,331	2,700	2,810	3,006	3,093	2,412	2,378	3,214
ERG Australia Ltd	52	97	186	232	283	298	382	453	702	711
Brambles Industries	3,157	3,289	2,841	3,237	2,967	3,138	3,956	3,955	4,702	5,243
National Australia Bank	102,775	117,251	125,883	147,007	173,710	201,969	251,714	254,081	343,677	374,720
Australia and New Zealand Bank	101,138	103,045	103,874	112,587	127,604	138,241	149,720	149,007	172,467	185,493
Westpac	110,948	104,712	93,861	105,835	121,513	118,963	137,319	140,220	167,618	189,845
Commonwealth Bank	88,340	90,979	91,321	99,595	109,285	120,103	130,544	138,096	218,259	230,411
Stockland Trust Group	732	805	844	863	932	1,073	1,125	1,278	1,683	3,386

TABLE A1:2: Earnings: Nominal Dollars (Millions): Portfolio A

COMPANY NAMES	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Normanby Mining	135	183	226	187	209	206	180	152	193	134
WMC	287	239	197	545	628	344	150	326	1,124	328
BHP-Billiton	3085	3,814	4,212	4,583	4,288	4,219	2,070	948	5,857	5,501
Woodside Petroleum	63	135	140	225	313	434	470	517	1,470	1,261
Caltex Australia	34	74	112	39	44	43	130	146	61	-218
Orica	158	203	284	408	350	402	326	258	235	-170
APN news and Media	20	28	34	40	41	53	58	96	112	101
News Corporation	622	1,161	1,364	1,463	1,362	1,474	2,068	1,833	1,724	1,819
John Fairfax	27	114	169	216	152	118	168	208	270	191
Coca Cola	114	135	165	218	199	378	319	268	299	524
Southcorp	235	236	216	224	251	266	286	316	329	357
Orbital	33	10	-3	-4	-83	-138	79	4	13	27
James Hardie	28	23	47	-21	96	70	114	135	236	119
Lend Lease	189	248	265	295	290	359	413	516	756	241
Mirvac	13	2	12	28	34	47	60	144	163	184
Leighton Holdings	39	72	51	80	104	145	164	182	201	202
Coles Myer	659	643	661	730	578	615	675	751	813	573
Goodman Fielder	167	164	169	158	168	193	209	164	194	181
Foodland Associated	34	59	75	81	100	125	133	141	139	139
AMCOR	389	449	409	729	648	754	767	812	542	404
Mayne Nickless	153	165	182	178	133	176	209	162	122	241
ERG Australia Ltd	2	6	11	16	6	-58	14	21	35	6
Brambles Industries	287	259	242	295	332	376	415	463	502	225
National Australia Bank	1302	1,891	2,619	2,846	3,059	3,316	3,723	5,077	3,888	3,979
ANZ Bank	909	647	1,198	1,485	1,594	1,645	1,721	2,162	2,789	2,783
Westpac	-1622	548	984	1,389	1,624	1,913	2,063	2,153	2,547	2,734
Commonwealth Bank	661	945	1,054	1,523	1,776	1,816	1,912	2,160	3,538	3,405
Stockland Trust Group	75	83	90	95	96	96	101	110	136	220

TABLE A1:3: Assets: Nominal Dollars (Millions): Portfolio B

COMPANY NAMES	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	2001
Portman Mining Ltd	47	50	50	109	181	225	249	166	172	192
MIM Holdings LTD	5,641	5,894	5,633	4,351	4,076	4,857	6,504	6,154	6,840	8,336
Kidston Goldmines LTD	152	142	133	137	139	106	90	70	46	38
Southern Pacific Petroleum	61	62	59	69	77	127	126	151	156	137
GWA International Ltd	333	378	402	484	497	614	650	803	808	807
Futuris Corporation Ltd	222	304	346	380	447	1,334	1,496	1,639	1,828	2,040
Sunraysia Television Ltd	100	101	104	105	112	114	120	120	119	122
Prime Television	195	201	201	203	203	290	603	648	504	508
Coventry Group	153	166	194	217	235	228	218	274	265	255
Pacific Dunlop Ltd	5,984	6,450	6,745	6,958	5,945	5,593	5,342	5,219	5,086	3,476
Lion Nathan Ltd	3,859	4,030	3,974	3,798	3,739	3,691	3,879	4,070	3,405	3,495
Pacifica Group Ltd	298	461	470	498	528	809	992	985	1,102	893
Boral Ltd/ Origin Energy Ltd	4,375	4,786	5,610	5,979	6,059	6,334	5,918	6,883	6,104	6,829
Lang Corporation Ltd	162	176	196	181	176	584	519	510	754	1,277
Villa World	54	61	95	93	76	92	101	121	178	185
Coal and Allied Industries	749	746	659	686	646	574	636	856	1,005	2,539
Woolworths Ltd	2,336	2,156	2,391	2,924	3,102	3,564	4,084	4,702	4,817	5,083
Fosters group	8,157	7,370	6,304	6,145	5,055	4,944	4,420	4,908	5,101	9,250
Harvey Norman Holdings	146	185	260	373	424	514	652	835	1,158	1,381
Greens food Ltd	53	61	78	94	94	92	91	89	135	136
Spotless group	240	271	278	310	312	329	426	453	835	1,262
Brickworks Ltd	306	312	313	314	321	324	329	492	513	551
AUSDOC Group Ltd	50	41	55	76	93	86	252	287	311	297
ARGO Investments Ltd	540	604	661	634	744	1,025	1,103	1,243	1,308	1,525
St. George Bank Ltd	9,354	11,775	15,895	17,578	19,389	45,060	44,261	45,017	49,610	50,804
Metway/ Suncorp Metway	3,049	4,284	5,476	6,471	7,095	19,890	21,424	21,484	26,219	29,661
BT Global Asset Management Ltd	46	53	52	48	60	69	80	36	45	32
Bendigo Building Society/	1,174	1,333	1,551	1,681	1,941	2,629	3,171	4,204	4,913	6,982

TABLE A1:4: Earnings: Nominal Dollars (Millions): Portfolio B

COMPANY NAMES	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Portman Mining Ltd	14.22	1.61	-1.83	-1.80	-0.93	22.43	20.31	4.52	3.10	26.59
MIM Holdings LTD	145.80	126.80	43.30	-9.20	66.60	70.50	102.50	1.10	207.60	136.50
Kidston Goldmines LTD	14.44	18.82	15.63	11.75	1.12	-22.88	-2.15	-3.04	10.16	32.10
Southern Pacific Petroleum	-0.11	0.21	-2.23	-0.46	0.55	1.52	-1.54	-2.77	-14.50	-29.44
GWA International Ltd	19.45	34.91	44.48	47.31	48.32	42.12	56.97	65.54	74.59	62.91
Futuris Corporation Ltd	8.78	18.15	26.66	41.61	42.06	61.58	77.70	86.48	109.97	104.62
Sunraysia Television Ltd	5.36	5.89	6.00	5.32	8.33	9.64	12.66	13.50	15.08	11.55
Prime Television	0.54	7.42	11.12	15.12	21.23	23.35	18.42	-12.12	4.94	4.36
Coventry Group	15.81	19.02	20.29	20.03	14.81	16.11	13.53	16.44	12.62	13.20
Pacific Dunlop Ltd	317.20	384.74	463.73	381.69	263.65	265.84	225.80	256.70	192.30	993.60
Lion Nathan Ltd	108.60	128.60	209.70	23.12	378.30	333.00	346.30	356.00	202.30	299.10
Pacifica Group Ltd	16.01	22.53	29.57	34.15	33.93	43.40	38.35	53.23	55.77	29.93
Boral Ltd/ Origin Energy Ltd	278.06	355.06	424.71	443.41	248.63	271.07	292.21	326.32	231.42	373.09
Lang Corporation Ltd	3.12	6.15	8.16	4.51	4.10	13.29	-5.98	47.19	78.78	95.53
Villa World	10.27	19.77	22.75	16.96	7.55	9.82	17.39	11.87	10.93	-6.44
Coal and Allied Industries	72.98	52.22	21.79	70.56	0.50	-19.82	139.74	98.44	106.67	327.98
Woolworths Ltd	250.80	276.60	293.90	341.60	360.60	407.80	473.40	493.90	593.80	693.50
Fosters group	264.40	279.49	308.40	367.30	302.20	336.70	423.40	525.00	585.70	664.20
Harvey Norman Holdings	14.37	23.01	31.15	48.82	47.76	57.93	90.17	136.84	173.90	162.96
Greens food Ltd	2.97	5.33	6.16	1.49	1.69	4.22	3.08	6.05	8.29	4.00
Spotless group	31.02	26.58	21.15	29.84	32.18	39.18	50.12	65.48	66.89	57.72
Brickworks Ltd	29.80	27.51	27.06	28.50	16.92	15.42	23.53	47.01	53.28	64.69
AUSDOC Group Ltd	0.58	6.15	8.06	7.00	7.77	10.76	20.38	20.97	16.34	13.30
ARGO Investments Ltd	18.46	29.05	31.80	35.33	40.96	45.00	45.77	54.71	59.36	70.99
St. George Bank Ltd	81.61	122.98	183.48	217.08	263.75	385.71	491.00	521.00	570.00	661.00
Metway/ Suncorp Metway	35.88	49.35	75.56	72.33	77.32	243.00	294.00	346.00	510.00	511.00
BT Global Asset Management Ltd	5.30	10.18	5.10	2.07	2.02	13.33	19.75	-0.81	16.71	-6.22
Bendigo Building Society/	10.02	12.25	14.26	18.10	22.01	17.81	22.07	29.58	47.85	55.00

Appendix 2: Assets and Earnings: Real Dollars (Millions): Portfolios A and B

TABLE A2:1: Assets: Real Dollars (Millions): Portfolio A

COMPANY NAME	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Normanby Mining	1,615	1,566	2,101	1,722	1,864	2,173	2,557	2,789	2,908	2,910
WMC	3,727	3,817	4,501	5,370	5,882	6,376	7,522	7,320	8,317	7,574
BHP-Billiton	21,983	24,199	25,109	26,591	29,680	30,536	30,825	25,851	23,532	22,078
Woodside Petroleum	2,972	3,046	2,825	2,771	2,541	2,855	3,660	3,919	4,787	4,625
Caltex Australia	1,686	1,638	1,633	895	791	2,406	2,262	2,442	2,540	2,078
ORICA	2,195	2,169	2,167	2,332	2,395	2,462	3,032	2,898	2,870	2,822
APN news and Media	215	240	430	457	494	569	593	836	853	1,880
News Corporation	24,437	25,159	24,408	26,506	25,917	34,379	45,290	44,312	52,594	64,267
John Fairfax	1,535	1,523	1,688	1,820	1,873	1,800	1,744	1,728	1,726	1,719
Coca Cola	2,134	2,678	2,919	4,083	5,132	7,869	7,035	7,216	7,048	4,806
Southcorp	1,900	2,061	1,876	2,093	2,292	2,361	2,571	2,597	2,742	3,321
Orbital	478	486	477	503	392	280	262	195	159	85
James Hardie	1,503	1,519	1,571	1,758	1,428	1,592	1,650	1,246	1,361	1,460
Lend Lease	2,381	2,791	2,793	3,055	2,985	3,885	5,389	5,986	8,775	6,904
MIRVAC	262	264	257	317	316	362	447	1,673	1,796	1,785
Leighton Holdings	812	920	950	1,044	1,183	1,349	1,371	1,294	1,387	1,551
Coles Myer	5,338	5,751	6,259	5,767	5,956	5,567	5,962	6,325	6,525	6,262
Goodman Fielder	2,895	3,081	2,901	2,669	2,320	1,829	2,082	2,410	2,282	2,155
Foodland Associated	321	595	1,124	1,201	1,355	1,218	1,201	1,235	1,099	1,076
AMCOR	4,056	4,618	5,164	6,203	5,868	5,836	5,969	5,216	3,974	5,314
Mayne Nickless	2,035	2,228	2,112	2,371	2,368	2,499	2,571	1,980	1,907	2,431
ERG Australia Ltd	48	90	169	203	238	247	317	372	563	538
Brambles Industries	2,942	3,034	2,574	2,842	2,500	2,608	3,288	3,247	3,770	3,966
National Australia Bank	95,783	108,165	114,024	129,067	146,344	167,888	209,239	208,605	275,603	283,449
Australia and New Zealand Bank	94,257	95,060	94,089	98,847	107,501	114,914	124,456	122,337	138,306	140,312
WESTPAC	103,400	96,598	85,019	92,919	102,370	98,889	114,147	115,123	134,417	143,604
Commonwealth Bank	82,330	83,929	82,718	87,441	92,068	99,836	108,515	113,379	175,027	174,290
Stockland Trust Group	683	743	764	758	785	892	935	1,050	1,350	2,561

TABLE A2:2: Earnings Real Dollars (Millions): Portfolio A

COMPANY NAME	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Normanby Mining	126	169	205	165	176	171	149	125	155	101
WMC	268	220	179	478	529	286	125	267	901	248
BHP-Billiton	2,875	3,518	3,815	4,024	3,612	3,507	1,721	778	4,697	4161
Woodside Petroleum	59	124	127	198	264	361	391	425	1,179	954
Caltex Australia	31	68	101	34	37	36	108	120	49	-165
ORICA	148	188	257	358	295	334	271	212	189	-129
APN news and Media	19	26	31	35	35	44	48	79	90	76
News Corporation	580	1,071	1,236	1,284	1,147	1,225	1,719	1,505	1,383	1376
John Fairfax	25	105	153	190	128	98	140	171	216	144
Coca Cola	106	125	150	191	167	314	265	220	240	397
Southcorp	219	218	196	196	212	221	238	260	264	270
Orbital	30	9	- 3	- 3	- 70	- 115	66	3	10	21
James Hardie	26	21	42	- 18	81	58	95	111	189	90
Lend Lease	176	229	240	259	244	298	343	424	606	182
MIRVAC	12	2	11	24	29	39	50	118	131	139
Leighton Holdings	37	67	46	70	87	121	136	149	161	153
Coles Myer	614	593	599	641	487	511	561	617	652	434
Goodman Fielder	155	151	153	139	141	161	174	135	155	137
Foodland Associated	32	54	68	71	85	104	110	116	111	105
AMCOR	362	414	370	640	546	626	638	667	434	306
Mayne Nickless	143	152	165	156	112	147	174	133	98	182
ERG Australia Ltd	2	6	10	14	5	- 48	12	17	28	5
Brambles Industries	268	239	219	259	279	313	345	380	402	170
National Australia Bank	1,213	1,745	2,372	2,499	2,577	2,756	3,095	4,168	3,118	3010
Australia and New Zealand Bank	847	597	1,085	1,304	1,343	1,367	1,431	1,775	2,237	2105
WESTPAC	- 1,512	506	891	1,219	1,368	1,590	1,715	1,768	2,043	2068
Commonwealth Bank	616	872	955	1,337	1,496	1,510	1,589	1,773	2,837	2576
Stockland Trust Group	70	76	82	83	81	80	84	90	109	167

TABLE A2:3: Assets Real Dollars (Millions): Portfolio B

COMPANY NAME	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Portman Mining Ltd	44	47	45	96	152	187	207	136	138	145
MIM Holdings LTD	5,258	5,438	5,102	3,820	3,433	4,037	5,406	5,053	5,485	6,305
Kidston Goldmines LTD	141	131	121	120	117	88	75	58	37	29
Southern Pacific Petroleum	57	57	54	60	65	105	105	124	125	103
GWA International Ltd	310	349	364	425	418	510	540	659	648	610
Futuris Corporation Ltd	207	280	314	334	376	1,109	1,244	1,346	1,466	1,543
Sunraysia Television Ltd	93	93	94	92	94	95	100	98	95	92
Prime Television	181	185	182	178	171	241	501	532	404	384
Coventry Group	143	153	176	190	198	190	182	225	212	193
Pacific Dunlop Ltd	5,577	5,950	6,109	6,109	5,008	4,649	4,441	4,285	4,078	2,630
Lion Nathan Ltd	3,597	3,718	3,600	3,334	3,150	3,068	3,224	3,342	2,731	2,643
Pacifica Group Ltd	278	425	426	437	444	672	825	809	884	675
Boral Ltd/ Origin Energy Ltd	4,078	4,415	5,081	5,249	5,104	5,265	4,920	5,651	4,895	5,166
Lang Corporation Ltd	151	163	177	159	148	486	431	419	605	966
Villa World	51	56	86	82	64	77	84	99	143	140
Coal and Allied Industries	698	688	597	603	544	477	529	703	806	1,921
Woolworths Ltd	2,177	1,989	2,166	2,567	2,613	2,962	3,395	3,861	3,863	3,845
Fosters group	7,602	6,799	5,710	5,395	4,259	4,110	3,674	4,030	4,091	6,997
Harvey Norman Holdings	136	171	236	328	357	428	542	685	928	1,045
Greens food Ltd	50	56	71	83	79	76	75	73	108	103
Spotless group	224	250	252	273	263	273	355	372	670	954
Brickworks Ltd	285	288	283	276	270	269	273	404	412	416
AUSDOC Group Ltd	47	38	49	66	79	72	210	235	250	225
ARGO Investments Ltd	503	557	599	557	627	852	916	1,020	1,049	1,154
St. George Bank Ltd	8,717	10,862	14,398	15,433	16,335	37,456	36,792	36,960	39,783	38,430
Metway/ Suncorp Metway	2,842	3,952	4,960	5,681	5,978	16,534	17,809	17,639	21,026	22,436
BT Global Asset Management Ltd	43	49	47	42	50	57	67	29	36	24
Bendigo Building Society/	1,094	1,230	1,405	1,476	1,635	2,186	2,636	3,452	3,940	5,281

TABLE A2:4: Earnings Real Dollars (Millions): Portfolio B

COMPANY NAME	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Portman Mining Ltd	13.25	1.49	-1.66	-1.58	-0.78	18.65	16.88	3.71	2.49	20.11
MIM Holdings LTD	135.88	116.97	39.22	-8.08	56.11	58.60	85.20	0.90	166.48	103.25
Kidston Goldmines LTD	13.46	17.37	14.16	10.31	0.95	-19.02	-1.78	-2.49	8.14	24.28
Southern Pacific Petroleum	-0.10	0.19	-2.02	-0.40	0.46	1.26	-1.28	-2.27	-11.63	-22.27
GWA International Ltd	18.13	32.21	40.29	41.54	40.71	35.01	47.36	53.81	59.82	47.59
Futuris Corporation Ltd	8.18	16.74	24.14	36.53	35.43	51.19	64.59	71.00	88.18	79.13
Sunraysia Television Ltd	5.00	5.43	5.43	4.67	7.02	8.01	10.53	11.08	12.10	8.74
Prime Television	0.50	6.85	10.07	13.27	17.89	19.41	15.32	-9.95	3.96	3.30
Coventry Group	14.74	17.55	18.38	17.58	12.47	13.39	11.25	13.50	10.12	9.98
Pacific Dunlop Ltd	295.62	354.93	420.05	335.11	222.12	220.98	187.70	210.76	154.21	751.59
Lion Nathan Ltd	101.21	118.63	189.95	20.30	318.70	276.81	287.86	292.28	162.23	226.25
Pacifica Group Ltd	14.92	20.79	26.79	29.98	28.59	36.08	31.88	43.70	44.72	22.64
Boral Ltd/ Origin Energy Ltd	259.14	327.54	384.70	389.30	209.46	225.33	242.90	267.91	185.58	282.22
Lang Corporation Ltd	2.91	5.68	7.39	3.96	3.45	11.05	-4.97	38.74	63.18	72.26
Villa World	9.57	18.24	20.61	14.89	6.36	8.16	14.46	9.75	8.76	-4.87
Coal and Allied Industries	68.01	48.17	19.73	61.95	0.42	-16.48	116.16	80.82	85.54	248.09
Woolworths Ltd	233.74	255.17	266.21	299.91	303.79	338.99	393.52	405.50	476.18	524.58
Fosters group	246.41	257.83	279.35	322.48	254.59	279.88	351.95	431.03	469.69	502.42
Harvey Norman Holdings	13.39	21.23	28.22	42.86	40.23	48.16	74.96	112.35	139.45	123.27
Greens food Ltd	2.77	4.92	5.58	1.31	1.42	3.51	2.56	4.97	6.65	3.02
Spotless group	28.90	24.52	19.16	26.19	27.11	32.57	41.66	53.76	53.64	43.66
Brickworks Ltd	27.77	25.38	24.51	25.02	14.25	12.82	19.56	38.59	42.73	48.93
AUSDOC Group Ltd	0.54	5.67	7.30	6.15	6.55	8.94	16.94	17.22	13.10	10.06
ARGO Investments Ltd	17.21	26.80	28.81	31.01	34.50	37.40	38.05	44.92	47.60	53.70
St. George Bank Ltd	76.06	113.45	166.19	190.59	222.20	320.62	408.15	427.75	457.10	500.00
Metway/ Suncorp Metway	33.43	45.52	68.44	63.50	65.14	202.00	244.39	284.07	408.98	386.54
BT Global Asset Management Ltd	4.93	9.39	4.62	1.82	1.71	11.08	16.42	-0.66	13.40	-4.70
Bendigo Building Society/	9.33	11.30	12.92	15.89	18.54	14.81	18.34	24.28	38.38	41.61

Appendix 3: Economic Sub Indexes: Portfolios A and B

TABLE A3:1: Economic Sub Index Portfolio A 1992-1996

	Economic	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**
	Index	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**
	1992	*1993*	*1993*	**1993**	*1994*	*1994*	**1994**	*1995*	*1995*	**1995**	*1996*	*1996*	**1996**
1	**100**	*97*	*138*	**118**	*130*	*125*	**128**	*107*	*123*	**115**	*115*	*121*	**118**
2	**100**	*102*	*80*	**91**	*121*	*55*	**88**	*144*	*124*	**134**	*158*	*125*	**142**
3	**100**	*110*	*111*	**111**	*114*	*116*	**115**	*121*	*116*	**118**	*135*	*93*	**114**
4	**100**	*103*	*207*	**155**	*95*	*227*	**161**	*93*	*361*	**227**	*85*	*526*	**306**
5	**100**	*97*	*224*	**161**	*97*	*334*	**215**	*53*	*207*	**130**	*47*	*251*	**149**
6	**100**	*99*	*129*	**114**	*99*	*177*	**138**	*106*	*229*	**167**	*109*	*183*	**146**
7	**100**	*111*	*124*	**118**	*200*	*82*	**141**	*212*	*88*	**150**	*230*	*80*	**155**
8	**100**	*103*	*179*	**141**	*100*	*213*	**157**	*108*	*204*	**156**	*106*	*186*	**146**
9	**100**	*99*	*421*	**260**	*110*	*551*	**330**	*119*	*636*	**377**	*122*	*415*	**269**
10	**100**	*126*	*94*	**110**	*137*	*103*	**120**	*191*	*94*	**143**	*240*	*66*	**153**
11	**100**	*108*	*92*	**100**	*99*	*90*	**95**	*110*	*81*	**96**	*121*	*80*	**100**
12	**100**	*102*	*29*	**65**	*100*	*-10*	**45**	*105*	*-11*	**47**	*82*	*-279*	**-98**
13	**100**	*101*	*81*	**91**	*105*	*156*	**130**	*117*	*-61*	**28**	*95*	*329*	**212**
14	**100**	*117*	*111*	**114**	*117*	*116*	**117**	*128*	*115*	**121**	*125*	*111*	**118**
15	**100**	*101*	*14*	**58**	*98*	*90*	**94**	*121*	*167*	**144**	*121*	*197*	**159**
16	**100**	*113*	*161*	**137**	*117*	*108*	**112**	*129*	*149*	**139**	*146*	*163*	**155**
17	**100**	*108*	*90*	**99**	*117*	*83*	**100**	*108*	*97*	**102**	*112*	*71*	**91**
18	**100**	*106*	*92*	**99**	*100*	*98*	**99**	*92*	*97*	**95**	*80*	*114*	**97**
19	**100**	*185*	*92*	**138**	*350*	*61*	**206**	*374*	*59*	**217**	*422*	*63*	**243**
20	**100**	*114*	*100*	**107**	*127*	*80*	**104**	*153*	*116*	**134**	*145*	*104*	**124**
21	**100**	*109*	*97*	**103**	*104*	*96*	**100**	*116*	*90*	**103**	*116*	*63*	**90**
22	**100**	*186*	*151*	**169**	*350*	*145*	**248**	*422*	*164*	**293**	*495*	*47*	**271**
23	**100**	*103*	*87*	**95**	*87*	*94*	**91**	*97*	*100*	**98**	*85*	*123*	**104**
24	**100**	*113*	*127*	**120**	*119*	*141*	**130**	*135*	*129*	**132**	*153*	*120*	**136**
25	**100**	*101*	*70*	**85**	*100*	*128*	**114**	*105*	*147*	**126**	*114*	*139*	**127**
26	**100**	*93*	*-36*	**29**	*82*	*-72*	**5**	*90*	*-90*	**0**	*99*	*-91*	**4**
27	**100**	*102*	*139*	**120**	*100*	*154*	**127**	*106*	*204*	**155**	*112*	*217*	**165**
28	**100**	*109*	*101*	**105**	*112*	*105*	**108**	*111*	*108*	**109**	*115*	*101*	**108**

TABLE A3:2: Economic Sub Index Portfolio A: 1997-2001

	Gross	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**
	Sub Index	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**
	1997	*1997*	**1997**	*1998*	*1998*	**1998**	*1999*	*1999*	**1999**	*2000*	*2000*	**2000**	*2001*	*2001*	**2001**
1	*135*	*101*	**118**	*173*	*75*	**124**	*173*	*58*	**115**	*180*	*68*	**124**	*180*	*45*	**112**
2	*171*	*62*	**117**	*196*	*23*	**110**	*196*	*51*	**124**	*223*	*151*	**187**	*203*	*46*	**124**
3	*139*	*88*	**113**	*118*	*43*	**80**	*118*	*23*	**70**	*107*	*153*	**130**	*100*	*144*	**122**
4	*96*	*639*	**368**	*132*	*541*	**336**	*132*	*549*	**340**	*161*	*1247*	**704**	*156*	*1044*	**600**
5	*143*	*81*	**112**	*145*	*257*	**201**	*145*	*265*	**205**	*151*	*103*	**127**	*123*	*-428*	**-153**
6	*112*	*202*	**157**	*132*	*133*	**133**	*132*	*109*	**120**	*131*	*98*	**114**	*129*	*-68*	**30**
7	*265*	*88*	**176**	*389*	*92*	**241**	*389*	*108*	**248**	*397*	*120*	**258**	*874*	*46*	**460**
8	*141*	*150*	**145**	*181*	*160*	**171**	*181*	*143*	**162**	*215*	*111*	**163**	*263*	*90*	**177**
9	*117*	*331*	**224**	*113*	*487*	**300**	*113*	*602*	**357**	*112*	*763*	**438**	*112*	*511*	**312**
10	*369*	*80*	**224**	*338*	*76*	**207**	*338*	*61*	**200**	*330*	*68*	**199**	*225*	*166*	**195**
11	*124*	*81*	**103**	*137*	*80*	**108**	*137*	*87*	**112**	*144*	*83*	**114**	*175*	*70*	**123**
12	*59*	*-646*	**-294**	*41*	*395*	**218**	*41*	*24*	**32**	*33*	*102*	**68**	*18*	*384*	**201**
13	*106*	*212*	**159**	*83*	*334*	**209**	*83*	*517*	**300**	*91*	*807*	**449**	*97*	*357*	**227**
14	*163*	*104*	**134**	*251*	*86*	**169**	*251*	*96*	**174**	*368*	*94*	**231**	*290*	*36*	**163**
15	*138*	*233*	**186**	*638*	*244*	**441**	*638*	*154*	**396**	*685*	*159*	**422**	*681*	*170*	**426**
16	*166*	*198*	**182**	*159*	*221*	**190**	*159*	*256*	**208**	*171*	*258*	**214**	*191*	*219*	**205**
17	*104*	*80*	**92**	*118*	*82*	**100**	*118*	*85*	**102**	*122*	*87*	**105**	*117*	*60*	**89**
18	*63*	*164*	**113**	*83*	*156*	**119**	*83*	*104*	**94**	*79*	*127*	**103**	*74*	*118*	**96**
19	*380*	*86*	**233**	*385*	*92*	**239**	*385*	*94*	**240**	*343*	*102*	**222**	*336*	*98*	**217**
20	*144*	*120*	**132**	*129*	*120*	**124**	*129*	*143*	**136**	*98*	*122*	**110**	*131*	*64*	**98**
21	*123*	*81*	**102**	*97*	*123*	**110**	*97*	*97*	**97**	*94*	*54*	**74**	*119*	*107*	**113**
22	*514*	*-461*	**27**	*772*	*86*	**429**	*772*	*110*	**441**	*1170*	*120*	**645**	*1118*	*21*	**570**
23	*89*	*132*	**110**	*110*	*115*	**113**	*110*	*129*	**120**	*128*	*117*	**123**	*135*	*47*	**91**
24	*175*	*104*	**140**	*218*	*116*	**167**	*218*	*117*	**167**	*288*	*82*	**185**	*296*	*84*	**190**
25	*122*	*132*	**127**	*130*	*128*	**129**	*130*	*161*	**146**	*147*	*180*	**163**	*149*	*167*	**158**
26	*96*	*-110*	**-7**	*111*	*-103*	**4**	*111*	*-105*	**3**	*130*	*-104*	**13**	*139*	*-98*	**20**
27	*121*	*202*	**162**	*138*	*196*	**167**	*138*	*209*	**173**	*213*	*217*	**215**	*212*	*198*	**205**
28	*131*	*87*	**109**	*154*	*88*	**121**	*154*	*84*	**119**	*198*	*79*	**138**	*375*	*64*	**220**

TABLE A3:3 Economic Sub Index Portfolio B: 1992-1996

	Economic	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**
	Index	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**
	1992	*1993*	*1993*	**1993**	*1994*	*1994*	**1994**	*1995*	*1995*	**1995**	*1996*	*1996*	**1996**
1	**100**	*106*	*11*	**58**	*104*	*-12*	**46**	*219*	*-5*	**107**	*348*	*-2*	**173**
2	**100**	*103*	*83*	**93**	*97*	*30*	**63**	*73*	*-8*	**32**	*65*	*63*	**64**
3	**100**	*93*	*139*	**116**	*85*	*123*	**104**	*85*	*90*	**88**	*83*	*8*	**46**
4	**100**	*100*	*-190*	**-45**	*95*	*2105*	**1100**	*106*	*372*	**239**	*115*	*-397*	**-141**
5	**100**	*113*	*158*	**135**	*118*	*189*	**153**	*137*	*167*	**152**	*135*	*166*	**151**
6	**100**	*135*	*151*	**143**	*151*	*195*	**173**	*161*	*277*	**219**	*182*	*238*	**210**
7	**100**	*100*	*109*	**104**	*101*	*108*	**104**	*99*	*94*	**97**	*101*	*139*	**120**
8	**100**	*102*	*1342*	**722**	*100*	*2009*	**1054**	*98*	*2708*	**1403**	*94*	*3797*	**1945**
9	**100**	*107*	*111*	**109**	*123*	*101*	**112**	*133*	*90*	**111**	*138*	*61*	**100**
10	**100**	*107*	*113*	**110**	*110*	*130*	**120**	*110*	*103*	**107**	*90*	*84*	**87**
11	**100**	*103*	*113*	**108**	*100*	*187*	**144**	*93*	*22*	**57**	*88*	*360*	**224**
12	**100**	*153*	*91*	**122**	*153*	*117*	**135**	*157*	*128*	**142**	*160*	*120*	**140**
13	**100**	*108*	*117*	**113**	*125*	*119*	**122**	*129*	*117*	**123**	*125*	*65*	**95**
14	**100**	*107*	*182*	**145**	*117*	*217*	**167**	*105*	*129*	**117**	*98*	*121*	**110**
15	**100**	*110*	*173*	**142**	*170*	*127*	**148**	*162*	*96*	**129**	*127*	*52*	**90**
16	**100**	*99*	*72*	**85**	*86*	*34*	**60**	*86*	*105*	**96**	*78*	*1*	**39**
17	**100**	*91*	*120*	**105**	*99*	*114*	**107**	*118*	*109*	**113**	*120*	*108*	**114**
18	**100**	*89*	*117*	**103**	*75*	*151*	**113**	*71*	*184*	**128**	*56*	*184*	**120**
19	**100**	*125*	*126*	**126**	*173*	*122*	**147**	*240*	*133*	**187**	*262*	*115*	**188**
20	**100**	*113*	*89*	**101**	*143*	*18*	**80**	*167*	*20*	**94**	*160*	*52*	**106**
21	**100**	*112*	*76*	**94**	*113*	*59*	**86**	*122*	*74*	**98**	*118*	*80*	**99**
22	**100**	*101*	*91*	**96**	*99*	*89*	**94**	*97*	*93*	**95**	*95*	*54*	**74**
23	**100**	*80*	*1320*	**700**	*105*	*1289*	**697**	*141*	*808*	**475**	*167*	*727*	**447**
24	**100**	*111*	*141*	**126**	*119*	*141*	**130**	*111*	*163*	**137**	*125*	*161*	**143**
25	**100**	*125*	*120*	**122**	*165*	*132*	**149**	*177*	*142*	**159**	*187*	*156*	**172**
26	**100**	*139*	*98*	**118**	*175*	*117*	**146**	*200*	*95*	**147**	*210*	*93*	**151**
27	**100**	*116*	*164*	**140**	*111*	*85*	**98**	*99*	*37*	**68**	*118*	*29*	**74**
28	**100**	*112*	*108*	**110**	*128*	*108*	**118**	*135*	*126*	**131**	*149*	*133*	**141**

TABLE A3:4 Economic Sub Index Portfolio B: 1997-2001

	Gross	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**	*Gross*	*Ratio*	**Economic**
	Sub Index	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**	*Sub Index*	*Sub Index*	**Index**
	1997	*1997*	**1997**	*1998*	*1998*	**1998**	*1999*	*1999*	**1999**	*2000*	*2000*	**2000**	*2001*	*2001*	**2001**
1	*428*	*33*	**230**	*472*	*27*	**250**	*311*	*9*	**160**	*316*	*6*	**161**	*332*	*46*	**189**
2	*77*	*56*	**66**	*103*	*61*	**82**	*96*	*1*	**48**	*104*	*117*	**111**	*120*	*63*	**92**
3	*62*	*-227*	**-83**	*53*	*-25*	**14**	*41*	*-45*	**-2**	*26*	*234*	**130**	*21*	*876*	**448**
4	*186*	*-671*	**-242**	*185*	*682*	**434**	*219*	*1022*	**621**	*221*	*5179*	**2700**	*182*	*12044*	**6113**
5	*165*	*117*	**141**	*174*	*150*	**162**	*213*	*140*	**176**	*209*	*158*	**183**	*197*	*133*	**165**
6	*535*	*117*	**326**	*600*	*132*	**366**	*649*	*134*	**392**	*708*	*152*	**430**	*745*	*130*	**437**
7	*102*	*157*	**130**	*107*	*196*	**152**	*105*	*210*	**158**	*102*	*237*	**170**	*99*	*176*	**138**
8	*133*	*2928*	**1531**	*276*	*1110*	**693**	*293*	*-679*	**-193**	*223*	*356*	**289**	*212*	*312*	**262**
9	*133*	*68*	**101**	*127*	*60*	**94**	*158*	*58*	**108**	*149*	*46*	**97**	*135*	*50*	**93**
10	*83*	*90*	**87**	*80*	*80*	**80**	*77*	*93*	**85**	*73*	*71*	**72**	*47*	*539*	**293**
11	*85*	*321*	**203**	*90*	*317*	**203**	*93*	*311*	**202**	*76*	*211*	**144**	*74*	*304*	**189**
12	*242*	*100*	**171**	*297*	*72*	**184**	*291*	*101*	**196**	*318*	*94*	**206**	*243*	*62*	**153**
13	*129*	*67*	**98**	*121*	*78*	**99**	*139*	*75*	**107**	*120*	*60*	**90**	*127*	*86*	**106**
14	*321*	*118*	**220**	*285*	*-60*	**113**	*277*	*482*	**379**	*400*	*544*	**472**	*639*	*389*	**514**
15	*152*	*56*	**104**	*166*	*91*	**128**	*195*	*52*	**124**	*281*	*33*	**157**	*276*	*-18*	**129**
16	*68*	*-35*	**16**	*76*	*225*	**151**	*101*	*118*	**109**	*116*	*109*	**112**	*275*	*133*	**204**
17	*136*	*107*	**121**	*156*	*108*	**132**	*177*	*98*	**138**	*177*	*115*	**146**	*177*	*127*	**152**
18	*54*	*210*	**132**	*48*	*296*	**172**	*53*	*330*	**192**	*54*	*354*	**204**	*92*	*222*	**157**
19	*314*	*115*	**214**	*398*	*141*	**269**	*503*	*167*	**335**	*681*	*153*	**417**	*766*	*120*	**443**
20	*154*	*39*	**96**	*151*	*78*	**115**	*146*	*70*	**108**	*218*	*33*	**126**	*207*	*33*	**120**
21	*122*	*92*	**107**	*159*	*91*	**125**	*166*	*112*	**139**	*299*	*62*	**181**	*427*	*35*	**231**
22	*94*	*49*	**72**	*96*	*74*	**85**	*142*	*98*	**120**	*144*	*107*	**125**	*146*	*121*	**133**
23	*153*	*1087*	**620**	*447*	*705*	**576**	*501*	*639*	**570**	*532*	*458*	**495**	*478*	*391*	**435**
24	*169*	*128*	**149**	*182*	*121*	**152**	*203*	*129*	**166**	*208*	*133*	**171**	*229*	*136*	**183**
25	*430*	*98*	**264**	*422*	*127*	**275**	*424*	*133*	**278**	*456*	*132*	**294**	*441*	*149*	**295**
26	*582*	*104*	**343**	*627*	*117*	**372**	*621*	*137*	**379**	*740*	*165*	**453**	*789*	*146*	**468**
27	*134*	*167*	**151**	*157*	*212*	**185**	*69*	*-19*	**25**	*85*	*321*	**203**	*57*	*-168*	**-55**
28	*200*	*79*	**140**	*241*	*82*	161	*315*	*82*	**199**	*360*	*114*	**237**	*483*	*92*	287

Appendix 4: T Test of Difference: Assets: Portfolios A and B

TABLE A4:1 :T Test of Difference: Assets: Portfolios A and B

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Hypothesized Difference	0	0	0	0	0	0	0	0	0	0
Level of Significance	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Population 1 Sample										
Sample Mean (millions)	17778.12	18504.25	18634.91	20811.29	23521.21	25927.98	29855.56	30170.86	38666.66	42295.67
Sample Size	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Sample Stnd. Dev. (millions)	35190.64	36318.70	36385.01	40979.08	47191.00	52019.51	61302.08	62162.52	83317.16	90768.93
Population 2 Sample										
Sample Size	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Sample Stnd. Dev. (millions)	2663.33	2960.87	3526.95	3786.38	4008.90	9020.45	8980.45	9104.98	10204.43	10716.35
Population 1 Sample Degrees of Freedom	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Population 2 Sample Degrees of Freedom	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Total Degrees of Freedom	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
t-Test Statistic	**2.41**	**2.42**	**2.40**	**2.40**	**2.38**	**2.23**	**2.22**	**2.20**	**2.16**	**2.16**
Two-Tailed Test										
Lower Critical Value	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00
Upper Critical Value	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
p-Value	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**	**0.03**	**0.03**	**0.04**	**0.03**
	reject null hypothesis	**reject null hypothesis**	**reject null hypothesis**	**reject null hypothesis**	**reject null hypothesis**	**reject null hypothesis**	**reject null hypothesis**	**reject null hypothesis**	**reject null hypothesis**	**reject null hypothesis**

TABLE A5:1 :T Test of Difference: Earnings: Portfolios A and B

Appendix 5: T Test of Difference: Earnings: Portfolios A and B

TABLE A5:1 :T Test of Difference: Earnings: Portfolios A and B

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Hypothesized Difference	0	0	0	0	0	0	0	0	0	0
Level of Significance	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Population 1 Sample										
Sample Mean (Millions)	289.18	447.75	542.30	644.63	656.82	692.34	678.40	722.39	1010.25	910.39
Sample Size	28	28	28	28	28	28	28	28	28	28
Standard Deviation (Millions)	723.08	782.38	920.18	1019.76	1012.55	1041.96	914.39	1088.15	1445.23	1441.43
Population 2 Sample										
Sample Mean (Millions)	63.42	73.94	83.93	81.20	82.64	97.06	118.18	127.33	142.99	193.83
Sample Size	28	28	28	28	28	28	28	28	28	28
Standard Deviation (Millions)	95.94	111.38	132.48	133.22	121.18	136.29	155.51	173.50	189.14	270.84
Population 1 Sample Degrees of Freedom	27	27	27	27	27	27	27	27	27	27
Population 2 Sample Degrees of Freedom	27	27	27	27	27	27	27	27	27	27
Total Degrees of Freedom	54	54	54	54	54	54	54	54	54	54
t-Test Statistic	1.64	2.50	2.61	2.90	2.98	3.00	3.20	2.86	3.15	2.59
Two-Tailed Test										
Lower Critical Value	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00
Upper Critical Value	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
p-Value	0.11	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01
	Do Not Reject Null Hypothesis	**Reject the Null Hypothesis**	**Reject the Null Hypothesis**	**Reject the Null Hypothesis**	**Reject the Null Hypothesis**	**Reject the Null Hypothesis**	**Reject the Null Hypothesis**	**Reject the Null Hypothesis**	**Reject the Null Hypothesis**	**Reject the Null Hypothesis**

Appendix 6: T Test of Difference: Earnings/Assets Ratio: Portfolios A and B

TABLE A6:1 :T Test of Difference: Earnings/Assets Ratio: Portfolios A and B

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Hypothesized Difference	0	0	0	0	0	0	0	0	0	0
Level of Significance	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Population 1 Sample										
Sample Mean	0.06	0.06	0.06	0.07	0.06	0.04	0.07	0.07	0.08	0.06
Sample Size	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Sample Standard Deviation	0.04	0.04	0.04	0.04	0.06	0.11	0.05	0.05	0.06	0.07
Population 2 Sample										
Sample Mean	0.07	0.08	0.07	0.06	0.05	0.05	0.07	0.07	0.07	0.08
Sample Size	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Sample Standard Deviation	0.07	0.07	0.06	0.05	0.04	0.07	0.07	0.07	0.08	0.18
Population 1 Sample Degrees of Freedom	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Population 2 Sample Degrees of Freedom	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Total Degrees of Freedom	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
Pooled Variance	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02
Difference in Sample Means	-0.01	-0.02	0.00	0.01	0.00	-0.01	0.00	0.00	0.01	-0.02
t-Test Statistic	-0.81	-1.07	-0.27	0.48	0.31	-0.38	0.07	0.07	0.32	-0.45
Two-Tailed Test										
Lower Critical Value	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00
Upper Critical Value	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
p-Value	0.42	0.29	0.79	0.63	0.76	0.71	0.94	0.94	0.75	0.65
	Do Not Reject Null Hypothesis	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**

Appendix 7: T Test of Difference: Economic Sub Index: Portfolios A and B

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TABLE A7:1 :T Test of Difference: Economic Sub Index: Portfolios A and B

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Hypothesized Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Level of Significance	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Population 1 Sample									
Sample Mean	114.72	129.21	137.81	139.36	127.28	180.66	178.59	215.63	192.52
Sample Size	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Sample Standard Deviation	40.55	60.49	72.37	77.16	105.14	97.34	104.99	164.38	157.54
Population 2 Sample									
Sample Mean	150.08	206.14	180.38	188.63	196.66	207.88	189.87	306.26	441.91
Sample Size	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Sample Standard Deviation	159.42	266.34	247.99	350.06	294.12	151.98	164.46	476.60	1100.11
Population 1 Sample Degrees of Freedom	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Population 2 Sample Degrees of Freedom	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Total Degrees of Freedom	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
Pooled Variance	13528.74	37297.27	33369.34	64246.85	48781.64	16285.95	19035.01	127084.32	617530.43
Difference in Sample Means	-35.36	-76.93	-42.57	-49.27	-69.38	-27.22	-11.28	-90.63	-249.39
***t*-Test Statistic**	-1.14	-1.49	-0.87	-0.73	-1.18	-0.80	-0.31	-0.95	-1.19
Two-Tailed Test									
Lower Critical Value	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00
Upper Critical Value	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
***p*-Value**	0.26	0.14	0.39	0.47	0.24	0.43	0.76	0.35	0.24
	Do Not Reject Null Hypothesis	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**	**Do Not Reject Null Hypothesis**

Appendix 8: Firm A Data: Nominal and Real

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TABLE A8:1 : Firm ‘A’ Data: Nominal and Real

	95-96	96-97	97-98	98-99	99-00	00-01
	NOMINAL actual	**NOMINAL actual**	**NOMINAL actual**	**NOMINAL actual**	**NOMINAL actual**	**NOMINAL actual**
Assets	6,803,600,000	7,669,900,000	9,048,600,000	8,916,200,000	10,371,200,000	10,012,300,000
Earnings	525,900,000	344,000,000	111,200,000	325,800,000	1,123,600,000	327,600,000
Employ (actual = staff nos)	4,945	3,860	3,408	3,414	3,483	3,047
CO_2 (actual = tonnes)	1,784,644	1,776,274	1,822,827	2,076,484	2,755,324	2,990,000
	NOMINAL $	**NOMINAL $**	**NOMINAL $**	**NOMINAL $**	**NOMINAL $**	**NOMINAL $**
Assets	6,803,600,000	7,669,900,000	9,048,600,000	8,916,200,000	10,371,200,000	10,012,300,000
Earnings	525,900,000	344,000,000	111,200,000	325,800,000	1,123,600,000	327,600,000
Employ	183,623,674	148,312,008	136,332,269	140,034,086	149,239,584	136,230,151
CO_2	53,539,320	53,288,220	54,684,810	62,294,520	82,659,720	89,700,000
	REAL $	**REAL $**	**REAL $**	**REAL $**	**REAL $**	**REAL $**
Assets	5,731,760,741	6,375,644,223	7,521,695,761	7,320,361,248	8,316,920,609	7,573,600,605
Earnings	443,049,705	285,951,787	92,435,578	267,487,685	901,042,502	247,806,354
Employ	154,695,597	123,285,127	113,326,907	114,970,514	119,678,897	103,048,526
CO_2	53,539,320	53,288,220	54,684,810	62,294,520	82,659,720	89,700,000

Appendix 9: Firm B Data: Nominal and Real

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TABLE A9:1 :Firm B Data: Nominal and Real

Years	**94-95**	**95-96**	**96-97**	**97-98**	**98-99**	**99-00**	**00-01**
	NOMINAL actual	**NOMINAL actual**	**NOMINAL actual**	**NOMINAL actual**	**NOMINAL actual**	**NOMINAL actual**	**NOMINAL actual**
Assets	4351300000.00	4075000000.00	4857000000.00	6504000000.00	6154300000.00	6840400000.00	8335500000.00
Earnings	-9200000.00	66600000.00	70500000.00	102500000.00	1100000.00	207600000.00	348300000.00
Employ (actual = staff nos.)	8176.00	8011.00	8429.00	8152.00	7934.00	8308.00	8391.00
CO_2(actual = tonnes)	1847000	2055000.00	2331928.00	2262550.00	3147800.00	2905500.00	4343847.00
	NOMINAL $	**NOMINAL $**	**NOMINAL $**	**NOMINAL $**	**NOMINAL $**	**NOMINAL $**	**NOMINAL $**
Assets	4351300000.00	4075000000.00	4857000000.00	6504000000.00	6154300000.00	6840400000.00	8335500000.00
Earnings	-9200000.00	66600000.00	70500000.00	102500000.00	1100000.00	207600000.00	348300000.00
Employ	292079424.00	297474065.20	323865781.20	326109347.20	325433638.40	355981184.00	375158253.60
CO_2	55410000.00	61650000.00	69957840.00	67876500.00	94434000.00	87165000.00	130315410.00
	REAL $	**REAL $**	**REAL $**	**REAL $**	**REAL $**	**REAL $**	**REAL $**
Assets	3820280948.20	3433024431.34	4037406483.79	5406483790.52	5052791461.41	5485485164.39	6305219364.60
Earnings	-8077260.76	56107834.88	58603491.27	85203657.52	903119.87	166479550.92	263464447.81
Employ	256434964.00	250609995.96	269215113.22	271080089.11	267186895.24	285470075.38	283780827.23
CO_2	55410000.00	61650000.00	69957840.00	67876500.00	94434000.00	87165000.00	130315410.00

Appendix 10: General Conversion Information: Firms

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TABLE A10:1 :General Conversion Information for Firms

	GENERAL CONVERSION INFORMATION							
Year	**Inflation Index**	**AWE ($per week)**	**CO_2 ($ per Tonne)**					
94-95	113.9	687	30					
95-96	118.7	714.1	30					
96-97	120.3	738.9	30					
97-98	120.3	769.3	30					
98-99	121.8	788.8	30					
99-00	124.7	824	30					
00-01	132.2	859.8	30					
Inflation =	**Based on Australian Bureau of Statistics CPI Index for 1994- 2001**							
AWE =	**Based on Australian Bureau of Statistics Average Weekly Earnings 1994- 2001**							
CO_2 =	**Based on mid- range estimate of the value of emission credits**							

Appendix 11: Sub Indexes for Firms A and B: 1995-2001

TABLE A11:1 :Sub Indexes for Firms A and B: 1995-2001

	Absolute (B)	**Absolute (A)**	**Ratio(B)**	**Ratio (A)**	**Econ Sub Index (B)**	**Econ Sub Index (A)**
95/6	100.00	*100.00*	100.00	*100.00*	**100.00**	***100.00***
96/7	117.60	*111.23*	88.81	*58.02*	**103.21**	***84.63***
97/8	157.48	*131.23*	96.43	*15.90*	**126.96**	***73.56***
98/9	147.18	*127.72*	1.09	*47.27*	**74.14**	***87.49***
99/0	159.79	*145.10*	185.69	*140.16*	**172.74**	***142.63***
00/1	183.66	*132.13*	255.67	*42.33*	**219.67**	***87.23***
	Absolute (B)	**Absolute (A)**	**Ratio(B)**	**Ratio(A)**	**Social Sub Index (B)**	**Social Sub Index (A)**
95/6	100.00	*100.00*	100.00	*100.00*	**100.00**	***100.00***
96/7	107.42	*79.70*	91.34	*71.65*	**99.38**	***75.67***
97/8	108.17	*73.26*	68.68	*55.82*	**88.43**	***64.54***
98/9	106.61	*74.32*	72.44	*58.19*	**89.53**	***66.26***
99/0	113.91	*77.36*	71.29	*53.32*	**92.60**	***65.34***
00/1	113.24	*66.61*	61.65	*50.41*	**87.45**	***58.51***
	Absolute (B)	**Absolute (A)**	**Ratio(B)**	**Ratio (A)**	**Environ Sub Index (B)**	**Environ Sub Index (A)**
95/6	100.00	*100.00*	100.00	*100.00*	**100.00**	***100.00***
96/7	88.12	*100.47*	103.64	*111.76*	**95.88**	***106.11***
97/8	90.83	*97.91*	143.04	*128.48*	**116.93**	***113.19***
98/9	65.28	*85.95*	96.09	*109.77*	**80.68**	***97.86***
99/0	70.73	*64.77*	113.01	*93.98*	**91.87**	***79.38***
00/1	47.31	*59.69*	86.89	*78.87*	**67.10**	***69.28***

Appendix 12: Events Summary: Environmental: Firms A and B

Appendix 12: Events Summary: Environmental: Firms A & B

YEARS	FIRM A	FIRM B
95-96	1. Published Environment Progress Report. 2. Conducted environmental audits at 13 sites.	1. Incorporated environmental impact assessments into the feasibility studies of all of its major projects 2. One of the few companies operating in Queensland which was able to apply for and be granted full licences in respect of its mining operations at the time that the relevant provisions of the new Environmental Protection Act came into force
96-97	1. Prosecuted for emissions resulting in excessive sulphur dioxide levels over Kalgoorlie-Boulder 2. Created a central register of Australian environmental obligations to improve compliance monitoring and make it easier to track licence renewals 3. Participating in the Federal Government's Greenhouse Challenge program.	1. Joined Australia's Greenhouse Challenge. 2. The Company was instrumental in devising the Australian Minerals Industry Code of Environmental Management which it adopted. 3. Taken an active role in developing increased reporting on mining to the community. 4. Committed to the Australian Minerals Industry's Code for Environmental Management and the Australian Government's Greenhouse Challenge during 1996/97.
97-98	1. Our leadership in public environment reporting was recognised by peers with several national awards	1. Issued its first Community Environmental Report. 2. Environmental Management Policy was reviewed and restated.

Appendix 12: Events Summary: Environmental: Firms A & B

98-99	1. Developing company-wide environmental standards and auditing our operations was a key focus. 2. Environmental Management System is consistent with the international management standard (ISO 14001). It reflects the requirements of the Australian Minerals Industry Code for Environmental Management to which we are a signatory. We are committed to fully implementing the system across our Organisation by December 2000. 3. Developed 14 environmental performance standards against which we audit our performance to ensure the environment is protected, particularly where legislation is inadequate.	1. Environmental management is becoming fully integrated as a core technical mining discipline, fundamental to the way MIM does business. Detailed site specific environmental reviews and audits were undertaken for all of MIM's Australian operations. 2. Published its first Annual Environmental Report
99-00	1. Highlighted satellite data showing a slight atmospheric cooling of the earth's surface, contrary to claims of global warming, in an effort to balance the debate. 2. United Nation's Environment Program rating of our reporting as being seventh best in the world, after reviewing over two hundred reports from all industries. We were the only Australian resource company in the top fifty. 3. Our inclusion in the Dow Jones Sustainability Index, where we are assessed as having a minimum sustainability risk and being optimally placed to take advantage of sustainability opportunities.	1. Won Australia's major mining environment award with the 1999 Australian Minerals and Energy Environment Foundation Environmental Excellence 2. Award for a large project being given for our internally Drained Rehabilitation method which is practised at Oakey Creek and Newlands. 3. We improved our public reporting with the publication of our second group Annual Environmental Report, for the 1999 financial year, including details of specific targets and objectives for environmental performance for the year ending 30 June 2000.

Appendix 12: Events Summary: Environmental: Firms A & B

00-01	1. We continued to record environmental non-compliance incidents using five levels, ranked by the severity of any environmental law or licence condition breach. We reported 132 new incidents for the year, 72 less than during 2000. The decrease reflects work undertaken at sites to improve their environmental management practices. At year end, there were 20 non-compliance incidents still to be rectified, compared with 41 incidents at the end of 2000. 2. Improved water efficiency at our Olympic Dam and St Ives Gold operations contributed to a 5.2 per cent reduction in water consumption, from 1.077 kilolitres for every tonne of ore treated in 1998, to 1.021 kilolitres in 2001. 3. Energy use has reduced by four per cent, from 672 mega joules for every tonne of ore treated in 1998, to 645 mega joules in 2001. However, we did not meet our energy reduction target of 11.5 per cent, principally due to changes in mining practice at Leinster Nickel Operations and Agnew Gold Operation, where we developed major open-cut mines. Increased energy consumption at the Kalgoorlie Nickel Smelter was also a factor. 4. Carbon dioxide emissions increased to 87 kilograms for every tonne of ore treated, from 80 kilograms in 1998. This 8.8 per cent increase is mainly due to a change in the way the government requires us to calculate emissions. Changes at our operations, primarily increased production at Olympic Dam, accounted for three per cent of the increase.	1. Environmental considerations are now routinely integrated into the running of all MIM's exploration, mining and processing activities. 2. Environmental practice is built around each site developing an EMS and the auditing of the environmental performance of each site. 3. Compliance status is reported monthly and detailed compliance registers are being developed at each site. 4. Provided emissions data for the National Pollutant Inventory established by the Federal and State Governments. 5. Recommitted to the revised voluntary Australian Minerals Industry Code for Environmental Management that binds companies to continual improvement in environmental performance. 6. Recommitted to the Greenhouse Challenge, a joint voluntary programme between the Australian Federal and State Governments and industry to abate greenhouse gas emissions.

Appendix 13: Events Summary: Social: Firms A and B

Appendix 13: Events Summary: Social: Firms A and B

YEARS	FIRM A	FIRM B
95-96	1. Four fatalities occurred 2. The Lost Time Injury Frequency Rate was 10.6 per million hours worked, a 3% improvement on the previous year: The combined Lost Time and Medically Treated Injury Frequency Rate improved 32% to 38.3 per million hours worked. 3. Implemented the Indigenous Peoples' Policy. 4. Assisted the local Philippine Bla'an people to document their ancestral domain claims. 5. Introduced an employee assistance program. 6. Continued development of performance management systems.	1. Developed the safety system as part of a strategy to integrate safety, quality and environmental standards which can be handled by a single audit system. 2. Employed 233 apprentices with a significantly increased intake effected at our X operations in 1996. 3. Extensive technical training of trades and operating employees continued throughout the group. 4. Targeted graduate recruitment systems were established and a structured graduate career path program was re introduced incorporating relocation across the group to maximise experience.

Appendix 13: Events Summary: Social: Firms A and B

96-97	1. Lost Time Injury Frequency Rate fell by 35% to 6.9 per million hours worked, against a target rate of less than 7. 2. The combined Lost Time and Medically Treated Injury Frequency Rate fell by 20% to 30.7 per million hours worked. 3. Developing an international human resources framework to manage issues arising from the Company's globalisation specific remuneration guidelines. 4. Introducing a company-wide fitness for work standard. This standard addresses issues such as substance abuse, fatigue and personal stress. It includes processes for managing these issues.	1. Recruitment of staff has been centralised, maximising effectiveness and reducing costs. It is planned to extend this shared services concept to the human resources support and services functions 2. Work continues in 1997 to integrate our human resources information system into the wider business and to continue development of the performance management and employee development reporting aspects of the system. 3. Established a Human Resources Planning Committee comprising the entire Executive General Management Team, which meets regularly to assess future human resources needs, agree promotional moves and consider succession planning. 4. During 1996/97, the Company employed 187 apprentices and the technical training of trades and operating employees totalled more than 16 000 days during the 12 month period. 5. Three employees were fatally injured at X operations, one at X, one in the decommissioning of the X refinery, and two at the X joint venture. 6. Lost Time Injury Frequency Rates results described as being 'patchy'

Appendix 13: Events Summary: Social: Firms A and B

97-98	1. Lost Time Injury Frequency Rate reduced 27 per cent to 4.3 incidents per million hours worked. 2. In 1998, all employees were required to attend Code of Conduct information sessions 3. Developing and publishing 20 standards and procedures for high-risk areas. 4. Corporate staff numbers were reduced by around 25 per cent. 5. We extended the use of attitude surveys to measure employee sentiment and opinion, enabling key issues to be identified and prioritised.	1. Group employee numbers (excluding major project contractors) fell from 8 688 to 8 195, most of the reductions occurring by natural attrition. 2. Human Resources support and service functions between X, X, X and X were rationalised. As a result, a central salary administration shared service was established. 3. 175 apprentices were employed in the group; the technical training of trades and operating employees totalled more than 18 000 days. 4. After two years' introduction, the safety system has been fully incorporated into the management systems of every operation and location and is being applied uniformly throughout the business. Fully documented standards have been prepared for each operation and performance is being measured against these standards. 5. The first cycle of annual external audits of the application of the safety system at operations was completed with encouraging results. 6. The safety system is being developed further to integrate with other risk management strategies, including business audit, environmental management and insurance underwriting requirements. 7. A set of core training courses was developed by in-house safety and training professionals with the involvement of the operations staff, and distributed for customising to suit specific approaches

Appendix 13: Events Summary: Social: Firms A and B

98-99	1. Our Lost Time Injury Frequency Rate reduced by 44 per cent to 2.4 injuries per million hours worked, from 4.3 in 1998. 2. One fatality 3. Commissioned an external and independent review into our safety management	1. Two fatal accidents during the year 2. Undertook a major review of Equal Employment Opportunity and Elimination of Harassment compliance against Firm B policy for all Australian sites. 3. A consistent process is being used across the group to identify and prioritise safety and health risks during the implementation phase. 4. Disabling injury frequency rate (DIFR), now established as the key performance indicator for the group, records the effect of accidents more accurately than the lost time injury frequency rate (LTIFR). (LTIFR statistics are still kept for external reporting purposes and benchmarking within the Australian mining industry.

Appendix 13: Events Summary: Social: Firms A and B

99-00	1. As part of our annual reporting for 2000, we are publishing our first public safety and health report, and our combined community and environment report. These reports contain detailed information on our policies, activities and performance; and are available at our website, or by contacting us. 2. Only engage contractors who share our safety values, and will actively support them in achieving an incident- and injury-free performance. 3. no fatalities 4. Our lost time injury frequency rate increased, from 2.4 injuries per million hours worked in 1999 to 3.1 in 2000, compared to our target of 2.2.. 5. The majority of the twenty Major Hazard Standards have been implemented at our sites and we expect t0 complete this task by December 2001.	1. We are doing more of the work in our operations with our own employees. The changes are leading to increases in productivity. 2. Major initiative to develop leadership skills. Hundreds of employees, largely supervisors and superintendents, are participating in the programme designed to improve their own performances and create a supportive "coaching culture" in which they accept responsibility for developing the skills and leadership attributes of their teams. This programme will be made available throughout the company. 3. Three fatal accidents during the year. 4. The continued application of *the safety system,* a group-wide systematic approach to safety, was accompanied by a 5% improvement in overall safety performance as measured by disabling injury frequency rate.

Appendix 13: Events Summary: Social: Firms A and B

00-01	1. Two fatalities 2. Lost-time injury frequency rate averaged 2.8 injuries for every million hours worked by employees and contractors. Rate is substantially lower than the last published total Australian metalliferous mining average of nine. 3. Implemented Take Time - Take Charge, an environment, health and safety culture and behaviour program, at all sites. This program empowers employees to manage safety and environmental hazards as they work. 4. We deployed a company-wide incident reporting and action tracking information system early in 2002. 5. Conducted 13,638 random tests on individuals across our Australian sites, of which 255 indicated the presence of alcohol or drugs unrelated to prescription or over-the-counter medicines. This is a two-thirds reduction since the program began in 1997.	1. The high and increasing rate of internal appointments to management jobs highlights the effectiveness of the firm's development initiatives for employees. Company employees accepted 78% of managerial positions filled during the year, the balance of the appointees being externally recruited. **2.** Two fatal accidents 3. Disabling injury frequency rate fell 8%

Appendix 14: Five Industries: Data (Nominal)

TABLE A14:1 : Five Industries: Data Nominal

AGRICULTURE, FORESTRY AND FISHING					
Employment	no.	344,061	339,678	348,873	346,058
Earnings before interest and tax	$m	4,915	6,142	5,599	6,274
Operating profit before tax	$m	3,331	4,388	3,754	4,561
Total assets	$m	126,208	137,083	145,236	146,663
Emissions	Gg	6,518	6,737	6,988	7,188
MINING					
Employment	no.	82,202	85,060	85,601	78,395
Earnings before interest and tax	$m	7,524	8,457	9,372	8,518
Operating profit before tax	$m	6,040	6,866	7,563	6,784
Total Assets	$m	75,247	75,857	85,292	91,012
Emissions	Gg	12,295	13,271	14,596	15,136
MANUFACTURING					
Employment	no.	983,196	1,000,471	1,005,959	997,953
Earnings before interest and tax	$m	18,719	17,024	16,416	17,423
Operating profit before tax	$m	16,031	13,693	13,072	13,601
Total assets	$m	164,832	178,842	183,948	192,180
Emissions	Gg	55,665	56,603	55,437	57,166
ELECTRICITY, GAS AND WATER SUPPLY					
Employment	no.	66,801	59,962	54,623	49,953
Earnings before interest and tax	$m	7,175	6,920	7,689	8,248
Operating profit before tax	$m	3,762	3,465	4,212	4,800
Total assets	$m	106,224	111,574	115,576	122,371
Emissions	Gg	141,773	147,531	152,889	168,845
CONSTRUCTION					
Employment	no.	305,715	325,672	355,542	393,381
Earnings before interest and tax	$m	3,877	3,066	3,872	3,728
Operating profit before tax	$m	3,287	2,316	3,152	3,144
Total assets	$m	23,567	24,846	28,138	32,189
Emissions	Gg	4,582	4,809	4,819	4,958

Appendix 15: Five Industries: Data (Real)

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TABLE A15:1 : Five Industries: Data Real

Years		**94-95**	**95-96**	**96-97**	**97-98**
AGRICULTURE FORRESTRY AND FISHING					
Assets	$m	110806	115487	120728	121914
Earnings	$m	4315	5174	4654	5215
Employ	$	10791251241	10626226714	11142707817	11507536001
CO_2	$	19554000	20211000	20964000	21564000
MINING					
Assets	$m	66064	63906	70899	75654
Earnings	$m	6606	7125	7791	7081
Employ	$	2578212685	2660951973	2734023361	2606884640
CO_2	$	36885000	39813000	43788000	45408000
MANUFACTURING					
Assets	$m	144716	150667	152908	159751
Earnings	$m	16435	14342	13646	14483
Employ	$	30837308081	31297969450	32129477527	33185131031
CO_2	$	166995000	169809000	166311000	171498000
ELECTRICITY GAS AND WATER SUPPLY					
Assets	$m	93261	93997	96073	101722
Earnings	$m	6299	5830	6392	6856
Employ	$	2095170258	1875805340	1744612306	1661097116
CO_2	$	425319000	442593000	458667000	506535000
CONSTRUCTION					
Assets	$m	20691	20932	23390	26757
Earnings	$m	3404	2583	3219	3099
Employ	$	9588553696	10188073724	11355710023	13081177200
CO_2	$	13746000	14427000	14457000	14874000

Appendix 16: General Conversion Information: Industry

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TABLE A16:1 : General Conversion Information: Industry

		GENERAL CONVERSION INFORMATION				
Years	**Inflation Index**	**AWE($per week)**	**CO2($per 100 tonnes)**			
94-95	113.90	687.00	3000			
95-96	118.70	714.10	3000			
96-97	120.30	738.90	3000			
97-98	120.30	769.30	3000			
Inflation Index =	**Based on Australian Bureau of Statistics CPI Index for 1994- 2001**					
AWE =	**Based on Australian Bureau of Statistics Average Weekly Earnings 1994- 2001**					
CO_2 =	**Based on mid- range estimate of the value of emission credits**					

Appendix 17: ISDI (including Sub Indexes): Five Industries: 1994-1998

TABLE A17: 1 ISDI (including Sub Indexes): Five Industries: 1994-1998

	ECON INDEX	SOCIAL INDEX	ENVIRO INDEX	ISDI
94-5	100.00	100.00	100.00	100.00
95-6	109.64	96.48	98.79	101.64
96-7	103.97	99.01	97.45	100.15
97-8	109.94	101.78	95.22	102.31
MINING				
	ECON INDEX	**SOCIAL INDEX**	**ENVIRO INDEX**	**ISDI**
94-5	100.00	100.00	100.00	100.00
95-6	104.12	104.95	91.13	100.07
96-7	108.61	102.43	87.32	99.45
97-8	104.06	94.70	87.13	95.30
MANUFACTURING				
	ECON INDEX	**SOCIAL INDEX**	**ENVIRO INDEX**	**ISDI**
94-5	100.00	100.00	100.00	100.00
95-6	93.97	99.49	100.36	97.94
96-7	92.12	101.40	103.25	98.92
97-8	95.11	102.55	102.43	100.03
ELECTRICITY, GAS & WATER SUPPLY				
	ECON INDEX	**SOCIAL INDEX**	**ENVIRO INDEX**	**ISDI**
94-5	100.00	100.00	100.00	100.00
95-6	96.31	89.18	96.48	93.99
96-7	100.75	82.05	94.13	92.31
97-8	104.43	75.99	87.78	89.40
CONSTRUCTION				
	ECON INDEX	**SOCIAL INDEX**	**ENVIRO INDEX**	**ISDI**
94-5	100.00	100.00	100.00	100.00
95-6	88.09	105.64	95.83	96.52
96-7	98.35	111.60	101.28	103.74
97-8	99.86	120.96	105.96	108.93